

Theories, methods, practices, and fields of digital social research

Edited by

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Theories, methods, practices, and fields of digital social research

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Editorial: Theories, methods, practices, and fields of digital social research

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Editorial on the Research Topic

Theories, methods, practices, and fields of digital social research

The digital nuances of contemporary societies are becoming thicker and thicker as technology is progressively pervading every aspect of our social life; just think of the way in which many, if not most, social actions and social relationships, both formal and informal, are mediated and experienced through digital devices. This occurrence has an impact on the very concept of digital social research, which, according to some authors, might even be a redundant expression. In fact, as [Pink \(2019\)](#) wittily pointed out, because the digital, social, and material aspects of our worlds are now inextricably linked, social research is currently almost always digital in both its subject matter and methodology, as our research strategies and interactions are, even if only indirectly, connected to digital platforms, and practices.

Obviously, the theoretical question of new social formations, phenomena, and practices arising through internet access is different and separated from the question of methods to carry out social research using ICT (Information and communication technology). However, these two themes co-occur and need to converge in the recognition of the digital not only as a topic of social research but especially as a way of transforming social research both in terms of topics and in terms of methods.

Even though there is still no solid set of shared definitions and concepts in the social science community regarding the social study of the digital, in our opinion it is worthwhile to consider digital social research as a disciplinary field in its own right. The swirling yet gradual evolution of digital technologies is causing, among other consequences, a constant and potentially unlimited production of information on every human practice and activity experienced through the Internet.

The last decade has seen deep changes in the way people use new Internet-related technologies to manage their private data. People have moved from secretly exchanging small amounts of anonymised data to sharing huge volumes of personal data that can be traced at any time, thus blurring the boundaries between what is public and what is private. This data is commonly defined as “Digital traces,” i.e., the footprints we leave behind on a daily basis by surfing the Internet, acting and interacting online with other people or with social networking platforms ([Hinds and Joinson, 2018](#); [Keusch and Kreuter, 2022](#)). Digital traces are a heterogeneous set: from the information we share on social platforms (likes, comments, tweets, etc.) to the websites we visit or the products we search for on

the ecommerce platforms. These types of information are also recognized as “Big Data,” and, according to some scholars (Lewis, 2015; Molteni and Airolidi, 2018), are naturalistic data, being them “found” and spontaneously generated by users and not requested or provoked by researchers. According to Kitchin, this epistemological vision of Big Data applied to the social sciences act as a discursive rhetorical device orienting research practices toward a mere empiricism in which theories progressively lose their relevance (Kitchin, 2014) in favor of data. Similarly, Fuchs (2019) believes that a digital positivism has emerged from this view, which risks influencing digital social research with the idea that theoretical reflection is no more than a mere ornament, reduced to a sterile list of superficial definitions of key concepts. However, this alleged total shift from theory-driven to data-driven knowledge making is not sustainable from a theoretical and methodological point of view. On the one hand, digital social research must not be reduced to a branch of data science, on the other hand, of course, it cannot ignore it either (Veltri, 2019), but must look at data from a critical perspective. Every social scientist knows that ‘data’ is only such if there is a conceptual framework in which it is collected, analyzed and interpreted (De Martino et al., 2020, 2021). The likes, the comments, the tweets, the click views, are not inherently meaningful. Data are analyzed through specific lenses that influence their interpretation. Even the algorithms used to collect and analyse digital data are intrinsically linked to a specific theory and/or method (Giuffrida et al., 2016). Therefore, digital social research should pay more attention to a systematic and critical application of social theories and ethics when it deals with the study of digital society and its peculiar phenomena, dynamics, and practices (Fuchs, 2019).

We could say that digital social research instead that a new empiricism calls for hermeneutics and interpretation at different levels of the research process. At the level of goal setting, the ever-changing nature of digital society and the impact of the digital on mainstream sociological concepts such as identity, community, relationships, and capitals and so on, imposes appropriate research questions.

Research questions are crucial in social research in general, both digital and not. Without them, the collection of information is impossible or meaningless since everything would appear important (Miles and Huberman, 1984). Thus, digital social research cannot be limited to a mere analytic process, a purely computational and data analysis approach. Also at the level of data collection and due to the non-neutrality of algorithms the role of human interpretation becomes significant also in data mining for example in selecting attributes, features and categories for data collection. At the level of data analysis, technological interpretation of affordances (the socio-technical architectures of media such as likes, tags, shares, and hashtags) and their role in structuring the digital actions and interactions is essential for making sense of the results. Although the interpretive role is more evident in qualitative analysis such as narrative analysis or digital ethnography and it involves making sense of intertextual, trans-medial, multimodal and interdiscursive narratives, it is also crucial in computational analysis where the equivalence between correlation and causation is frequent. Big data based correlation is not sufficient to understand

social phenomena (correlation is not causation) (Delli Paoli and Masullo, 2022).

The digital society is an ever-changing and rapidly evolving research object; therefore, there is the need for theoretical and methodological frameworks that may help us to understand how new technologies interact with people in the social daily life. At first, when the majority of social scientists were convinced that studying digital practices no longer meant moving away from reality, the social sciences made an effort to adapt traditional methods to research digital contexts. Subsequently, this effort was aimed at developing new methodological tools designed specifically to study the web.

However, neither reworking traditional techniques nor the development of new digital tools could be considered the only valid and reliable way to do digital social research. In the former case, traditional social research methods and techniques may prove to be unsuitable for the study of certain digital practices or contexts (e.g., the study of online communities or social media-related phenomena). However, new methodological tools, with a clear digital nature, may often turn out to be extemporaneous attempts, destined to become obsolete in a very short period of time (Addeo and D’Auria, 2022). Moreover, digital social research frameworks should take into account the possibility that new technologies not only change, even radically, during our experience with them, but that over time the ways in which they ‘intelligently’ interact with us, learn from or with us in the course of our dealings with them, and make decisions will increase and intensify (Pink, 2019).

At the current stage of the epistemological development of the social sciences, it is difficult to find conceptual and operational definitions of the key concepts in the digital social research field that are shared by the majority of the social science scientific community. This is not necessarily a bad thing for social science, if we consider that this *in fieri* state of the art could pave the way for challenging digital positivism while promoting critical digital research practices. Social scientists should ‘only’ be fully aware that the knowledge drawn from the use of digital and all the web-related technologies is always fuzzy, revisable and highly prone to obsolescence due to the continuous flourishing of online social practices and the creative ways in which individuals’ online activities are embedded in data. Digital social research should therefore also be critical, marked by transdisciplinarity and intersectionality; it should aim to understand, and eventually interiorise, how digital technologies are conceptualized and studied in other disciplines and outside academia. Digital social researchers should conceptualize but also and above all practice the processes through which technology is designed, understood, and implemented in social life (Fuchs, 2019; Pink, 2019).

This research topic explores the challenges and advantages as well as the pitfalls and problems of the digital, conceived here both as an object of research and as a methodological tool, and offers epistemological and methodological insights and examples of what it means to do digital social research. The Research Topic collects articles from academics and scholars belonging to different research fields (e.g., sociology, education, and political science) conducting innovative research on several compelling social science Research Topics, which demonstrates both the increasing relevance of digital

in daily life as well as the use of digital media tools to address social research questions. The essays collected are significant examples of empirical social science research performed in the digital era, through a wide range of methodological approaches, some original and others more traditional, in the context of digital technology.

The digital society is constantly changing, in line with the rapid evolution of technologies that are redefining its practices. Unfortunately, the spread of technology does not travel at the same speed both between different countries and within the same country, and this is mainly due to the so-called digital divide, understood as inequality in access to and use of new digital technologies (Hilbert, 2015; Van Deursen and Van Dijk, 2019). Drawing from research that have successfully measured the Digital Capital in UK (Ragnedda et al., 2019), Addeo et al. propose a research path to detect and validate this concept in the Italian context. The results show that the operationalisation of Digital Capital works also in Italy, thus legitimizing the idea it could be conceived as an independent capital. Laskar offers an in-depth analysis of the digital divide in India, showing how socio-economic factors, especially urban-rural differences, are a key determinant of digital inequalities.

The emergence of new digital entities, such as the metaverse, and the risks associated with them require an effort of understanding that Pascali fully succeeds in making, highlighting the urgency of rethinking traditional forms of preventive and repressive measures to counter deviant and illegal drifts in digital spaces. A well-researched digital practice on which there is no agreement by the scientific community is online propaganda. Nerino effectively proposes the use of Druckman's Generalizing Persuasion Framework to address this gap, thereby emphasizing the role of cultural and cognitive sociology. Health is one of the sectors that is benefiting most from the digital revolution. Lenzi and Iazzetta disclose how the use of social media could increase knowledge about diabetes and obesity, suggesting and motivating targeted public health strategies.

The relevance of the Health field for the development of digital social research is also evident from the fact that the digitisation of society has undoubtedly been accelerated by the pandemic crisis. This process had a huge epistemological and methodological impact on the social research: COVID-19 upturned the social research inertia as regard digital methodological innovations (Velotti et al., 2021). The problem caused by the pandemic crisis are still being experienced in all sectors from Health to Policy, from Economy to Education; COVID-19 aftermath will be felt for a long time to come. That it is why several papers in this Research Topic deals directly or indirectly with COVID-19 related subjects.

In Italy, one of the strongest consequences of the pandemic has been the acceleration of distance learning practices by schools and universities. Two papers are dedicated to this Research Topic: Lo Presti provides an argued assessment of the social impact of the Distance Learning (DaD) within the framework of the Positive Thinking Evaluation; Faggiano and Fasanella reflect on future scenarios for learning offered not only by common Distance Learning tools but also by the adoption of VR in educational contexts.

The COVID-19 pandemic has also exacerbated the issue of continuous infodemic of fake news and (mis)information to such

an extent that it has become a major cause of public concern; not least because misinformation has been both cause and effect of institutional mismanagement of the pandemic crisis (Ruiu, 2021). One of the piece de resistance of disinformation practices has been the vaccination campaign. Murero wittily discusses how the manipulation tactic called Coordinated inauthentic behavior (CIB), using a mix of authentic, fake and duplicate accounts on social media, massively misled the online debate on COVID-19 vaccination. Pilati et al. analyse, from a worldwide perspective, the relationship between the Infodemic Risk Index and the epidemic wave, finding a decrease in misinformation on Twitter as the number of COVID-19 confirmed cases increases. During the pandemic crisis, Twitter became a kind of "official" social media used by health and government institutions to disseminate information on COVID. Gozzo and D'Agata explore how Twitter helped build a digital community based on a shared digital culture that contributed to the spread of ontological forms of security. Taddei et al. examine the contributions of digital social research to develop E-Health and Telemedicine in Southern Italy in a post-COVID-19 scenario, identifying those issues that need to be addressed in order to reduce the existing gaps and inequalities. As highlighted by some authors (Velotti et al., 2021) COVID-19 crisis paradoxically has been a noteworthy prospect for social science study to pursue innovative methodology. Vaccaro et al. illustrate the strengths and the weakness of a qualitative method, the SONAR-global Vulnerability/Resilience Assessment, for defining and analyzing vulnerabilities during the COVID-19 pandemics. An innovative spatial analysis methods was developed and implemented by Lenzi and Truglia in order to analyse the territorial spillover of COVID-19 infections in Rome proving how useful digital methods could be when studying rapidly changing phenomenon as the spread of a viral infection on an urban scale. Using a combination of traditional (Factor Analysis and Cluster Analysis) and innovative (Topic Modeling) techniques, Acampa et al. investigate the narratives on the pandemic and vaccines on social media platform.

Digital social research requires a robust and epistemologically grounded methodological apparatus, which is why many contributions in this Research Topic aim at addressing methodological questions. Drawing on this, the paper from De-Groot et al. is of great relevance as it fills an important gap in current scientific research: by combining web-analytics with quantitative and qualitative research methods, it develops a ground-breaking framework for monitoring the citizen science landscape, the CS Track. On the same wavelength, Martini discusses from a sociological perspective the advantages of adopting a quintuple helix model to predict possible future digital scenarios and their consequences from economic, social, and technological perspectives. Poliandri et al. critically review different approaches to conducting online focus groups, subsequently porpoising an online focus group protocol, used as part of a research project carried out Italy, that overcomes the limitations previously highlighted. In their study about the Italian digital diaspora in China, Moffa and Di Gregorio offer a timely methodological account of the advantages and disadvantages of using messaging and social media apps as tools for qualitative research. Starting from sound methodological premises, Caroleo et al. assess

the impact of SEO techniques on the way information on political issues circulates and influences public debate and opinion.

The Cambridge Analytica case led to a data policy shift, the so-called “APICocalypse,” that dramatically shaped the digital research methods, greatly limiting social researchers’ access to digital data. Based on the results of a survey on Italian researchers, Trezza critically reflects on the way these restrictions have altered, positively but mostly negatively, current social research practices and suggests social research to make a self-reflexive effort to diversify research platforms and to act ethically with user data.

La Rocca and Boccia Artieri offer two valuable contributions reflecting on the use of hashtags in social research: the first paper provides a thorough review of this area of research, outlining the features of what can be called hashtag research. The second contribution develops an innovative interpretive proposal of the hashtag as a relational social form, thus formalizing a model to analyze the changeable meaning of the hashtags (La Rocca and Boccia Artieri b).

One of the methodological approaches that has been able to adapt best to the digital revolution has been the ethnographic approach, and two papers in this Research Topic reflect excellently on its current developments. Padricelli and Punziano starting with an overview of the evolution of ethnographic studies in the social sciences, propose a conceptual analysis that traces the main pillars of the current development of the ethnographic method and identifies its possible future directions. Masullo and Coppola focus specifically on the digital evolution of the ethnographic method, offering a careful examination of the advantages and disadvantages of this method through a practical case study of a web community of Italian asexual people.

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Developing a framework for investigating citizen science through a combination of web analytics and social science methods—The CS Track perspective

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Over the past decade, Citizen Science (CS) has shown great potential to transform the power of the crowd into knowledge of societal value. Many projects and initiatives have produced high quality scientific results by mobilizing peoples' interest in science to volunteer for the public good. Few studies have attempted to map citizen science as a field, and assess its impact on science, society and ways to sustain its future practice. To better understand CS activities and characteristics, CS Track employs an analytics and analysis framework for monitoring the citizen science landscape. Within this framework, CS Track collates and processes information from project websites, platforms and social media and generates insights on key issues of concern to the CS community, such as participation patterns or impact on science learning. In this paper, we present the operationalization of the CS Track framework and its three-level analysis approach (micro-meso-macro) for applying analytics techniques to external data sources. We present three case studies investigating the CS landscape using these analytical levels and discuss the strengths and limitations of combining web-analytics with quantitative and qualitative research methods. This framework aims to complement existing methods for evaluating CS, address gaps in current observations of the citizen science landscape and integrate findings from multiple studies and methodologies. Through this work, CS Track intends to contribute to the creation of a measurement and evaluation scheme for CS and improve our understanding about the potential of analytics for the evaluation of CS.

KEYWORDS

web-based analytics, social science analysis, citizen science, social networks analysis, content analysis

Introduction

Citizen Science (CS) is a growing phenomenon within scientific research, in which lay or non-scientists volunteer in scientific research activities. Well-known CS activities include butterfly counts, birdwatching, and monitoring air and water quality. Such projects have demonstrated the “power of the crowd” in delivering scientific, policy and social impact (Shirk et al., 2012; Turrini et al., 2018). The vast potential of CS has been demonstrated extensively in large scale projects which are mediated through online communities or apps that can accommodate many volunteers. Projects such as “Galaxy Zoo” which asks participants to visually classify pictures of galaxies, are quite successful regarding their scientific outcome (Golumbic et al., 2019). Apart from a high number of publications, the results are valuable for further research, for example the exploration of “Hanny’s Voorwerp” in Galaxy Zoo (Lintott et al., 2009).

There is growing interest in the advancement of collaborative and co-creative projects which involve more responsibility on the part of the citizen scientists who are involved. In fact, a recent study conducted across 125 European-based projects found the roles citizen scientists undertook in the projects were predominantly those of collaborators (Moczek et al., 2021). Such approaches are increasingly chosen when attention is required from both local actors and communities in order to solve place-based problems and deliver community outcomes (Gunnell et al., 2021; Manzoni et al., 2021).

The growth of CS is apparent by the increasing number of projects on CS platforms such as Zooniverse, eu-citizen.science¹ or scistarter². Scistarter alone lists over 1,600 and the numbers are growing. CS growth is also reflected by the number of academic publications which have risen exponentially over the last two decades (Pelacho et al., 2021). Such publications include scientific findings derived from CS data, in addition to research on project design, infrastructure, benefits for participants, and more (Kullenberg and Kasperowski, 2016).

While several studies have attempted to map citizen science (e.g., Roy et al., 2012; Kullenberg and Kasperowski, 2016; Hecker et al., 2018), these are few and far between. Furthermore, despite the vast work that is currently taking place within CS projects and activities, there is still a lack of knowledge about the impact of these projects and activities on society and how to integrate CS into new policies. More information is needed about citizen engagement, appropriate research methodologies, and the contribution of CS to policy-making.

The CS track project

The CS Track³ project aims to broaden our knowledge about CS from an “observer” perspective by combining web-analytics with quantitative and qualitative methods from social science practices. CS Track involves nine partners from seven countries with backgrounds in social and educational studies, computer science and data analytics, as well as research into CS. Such an approach strengthens the findings, provides more comprehensive data, increased validity, and ultimately enhances our understanding of the state of CS. Methods utilized by CS Track comprise literature reviews, content analysis (including web and social media content), exploring discourse related to CS in social networks and carrying out surveys and interviews with key stakeholders in the field.

CS Track has created a database of more than 4,500 CS projects. Although the database essentially comprises information on individual projects, the harvesting of project information used 56 global CS platforms as starting points, which enabled a partially automated approach using web crawling techniques. This database serves as a resource for our explorations, using descriptors and analytic methods to build a coherent understanding of CS based on big data exploration. The database structure is deliberately flexible and can be adjusted to incorporate emerging analysis results. CS Track has also conducted an online survey collecting subjective perceptions of participation and engagement of CS stakeholders with over 1,000 respondents. In some cases, CS Track utilizes interviews and content analysis methods. CS Track also shares its results with the wider CS community through an eMagazine, providing summaries of main findings and other outputs.

Levels of analytics and analysis in CS track

It is a specificity of the CS Track project that it gains insight in CS practices by applying computational analytics techniques to existing websites and social media channels that contain manifestations of CS activities. Relevant computational techniques include data and text mining, semantic analyses (esp. “Explicit Semantic Analysis” or ESA, cf. Gabrilovich and Markovitch, 2007) as well as Social Network Analysis or SNA (Wasserman and Faust, 1994). The sources of primary information to be processed by analytics are human-created content in the form of natural language and formal texts. Some of this information, such as short descriptions of CS projects, is directly available in the CS Track database. Additional information can be gained by harvesting from CS platforms and project websites. Here, again, the database serves as an entry point providing

1 EU-Citizen Science. Available online at: <https://eu-citizen.science/> (accessed 15 December, 2021).

2 Scistarter, Arizona State University. Available online at: <https://scistarter.org/> (accessed 15 December, 2021).

3 CS Track European project. Available online at: <http://cstrack.eu>.

indexical information such as names, acronyms, and web links. Techniques of Named Entity Recognition (NER) allow for extracting information on persons, institutions, geographical locations, etc. from given texts (Nadeau and Sekine, 2007). This information can be useful to locate connections between projects and other institutions or support anonymization of personal information.

Given CS Track's observer perspective on a broad range of projects, there is no direct access to the internal processes and documents of individual CS projects, beyond their manifestations in project websites. Still, there is content information on websites that is even partly represented in the CS Track database (especially project descriptions). Interactions between project members can be retrieved from project-related forums and wiki pages, even in standardized form on platforms such as Zooniverse or SciStarter. This allows for building and analyzing network models from which influential actors or structural characteristics (e.g., hierarchical or reciprocal relationships) can be inferred. It also means that information about project content and activity can be captured. Depending on the level, the potential of applying analytic techniques to external data sources differs in the degree of automation that can be achieved. In this regard, we distinguish three different levels with specific characteristics:

- (1) *Micro level applications*: Based on small samples using human judgement in the filtering and selection such as the analysis of communication and collaboration in project web forums for example, the analysis of the "Chimp & See" project on the Zooniverse platform which provided detailed insights in participation and role-taking between scientists and volunteers (Amarasinghe et al., 2021).
- (2) *Meso level applications*: Here, we work with a predefined set of projects that allow for standardized, homogeneous data processing. The sampling (e.g., all projects from a particular platform) can be done through a simple filter applied to the CS Track database. For such a given sample, semantic analyses such as the identification of research areas or SDGs can be performed automatically.
- (3) *Macro level applications*: Here, we harvest information from an open space that goes beyond the projects captured in the CS Track database. This allows for identifying special connections and trends related to the interplay between CS activities and a broader public. Such interactions take place in different social media of which the Twitter "blogosphere" is particularly suited as a source of analysis since it provides rich textual information with high potential for systematic search and retrieval (Mazumdar and Thakker, 2020). Network models can be built on the basis of different relations such as retweeting or following. Structural network analysis can be combined with content analysis of tweets.

Case studies

The following case studies illustrate how these three levels of analytics are implemented in CS Track. Each includes a description of the methodologies used and insights that have emerged as a result. In-depth descriptions of each have been or are intended to be published elsewhere.

Micro level: CS response to COVID-19 challenges

The COVID-19 pandemic has challenged scientists, researchers, and industries to rapidly divert their research to better understand the COVID-19 virus spread, biology and health implications in addition to identifying medical solutions and cures. One of the avenues utilized for this cause was CS.

In a micro level study, which involved a sample of CS projects, chosen by explicit criteria, we examined the power of CS to respond to emerging health challenges, through the example of the COVID-19 pandemic [see full report by Turbe et al. (2022)]. Twenty-Five CS projects were identified as conducting COVID-19 research, by searching the CS Track database and exploring COVID-19 dedicated projects lists produced by citizen science associations and research institutes globally (e.g., <https://www.citizenscience.org/covid-19>; <https://www.wilsoncenter.org/blog-post/citizen-science-and-covid-19-power-distanced-crowd>).

Content analysis of projects' websites revealed projects focused on three main domains, namely tracking the spread of the pandemic in the population, investigating the influence of COVID-19 on people's wellbeing, and investigating the COVID-19 virus biology (see Figure 1). Citizen scientists' tasks centered around responding to an online survey, self-tracking data from a wearable device and distributed computing. Overall projects were widely accessible, targeting a broad audience, and requiring no special skills. Most projects required at least a moderate degree of effort from participants, asking a few types of questions, and many required frequent contributions at regular intervals.

Meso level: Identification of research areas for CS projects

Recent studies indicate that environmental sciences are a predominant research topic in the citizen science landscape (Follett and Strezov, 2015; Moczek et al., 2021). However, many of these analyses associate each project with only one main research area (Follett and Strezov, 2015; Lukyanenko et al., 2020), neglecting the multi-disciplinary nature of many projects. In a meso level study, which included a sample of all CS

projects listed on the Zooniverse platform ($n = 218$), we have investigated the multi-disciplinarity nature of projects through an assessment of research areas within a subset of projects in the CS Track database.

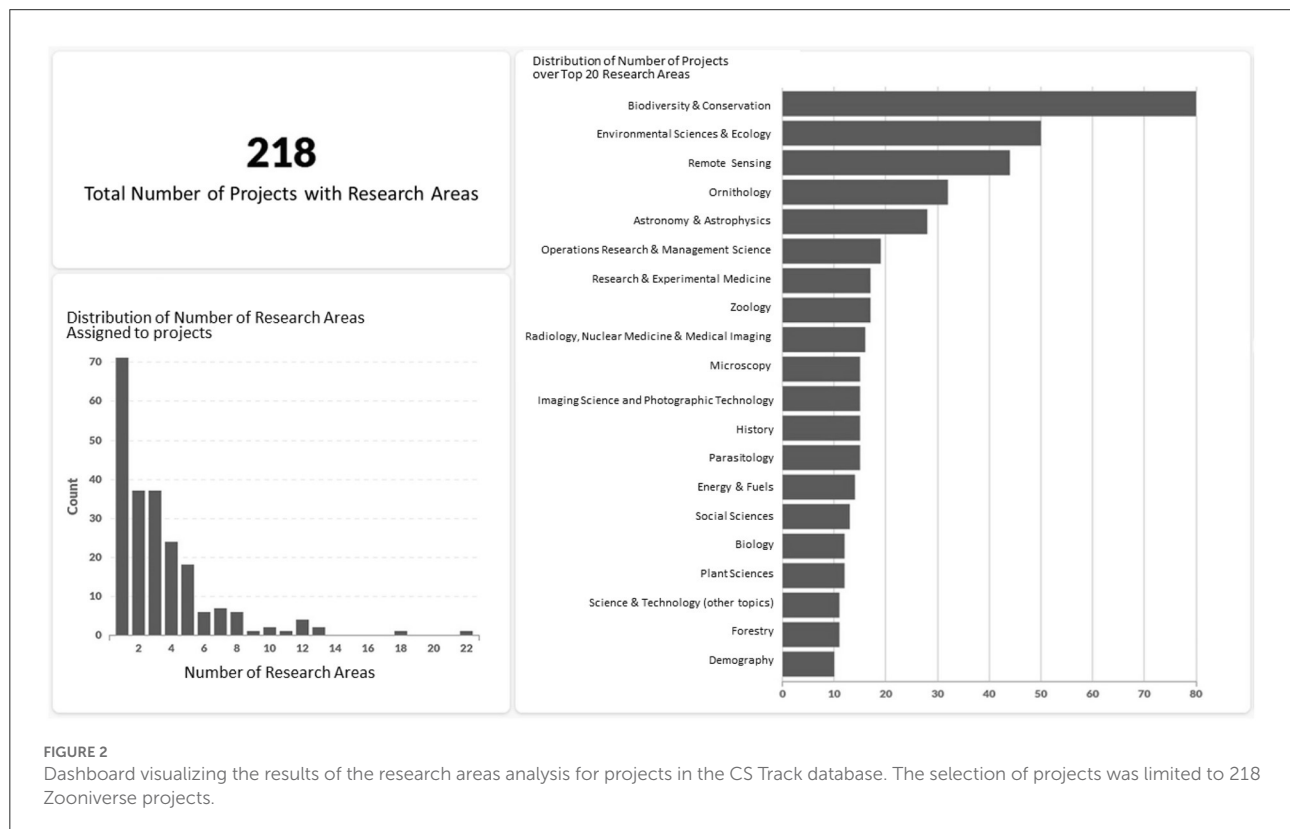
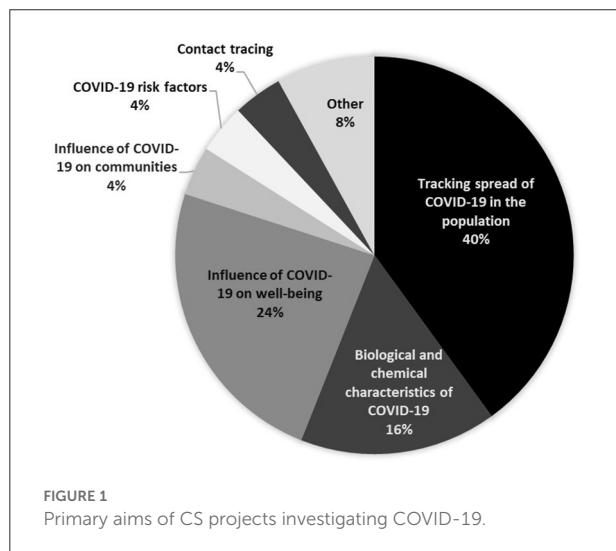
To assign research areas to projects we relied on the ESA approach of semantic analysis (Gabrilovich and Markovitch, 2007). ESA combines statistical models with semantic

background knowledge taken from Wikipedia pages. Every research area has a corresponding Wikipedia article in this model, which allows for the comparison of terms or documents regarding their semantic relation. By computing the similarities of project descriptions to research areas, it was possible to assign research areas to projects.

Figure 2 shows a combined diagram of the results from this analysis based on 218 project descriptions taken from the Zooniverse platform. Notably, 147 of these projects (67.4%) have more than one associated research area. The average number of associated research areas is 3.34 and 11 projects have associations to 10 or more research areas. This shows that multi or inter-disciplinarity is a prevailing characteristic of CS projects.

Macro level: CS on twitter

Following the macro level paradigm, Twitter data were used in a recent analysis of discussions related to climate change. Here, machine learning techniques for detecting sentiments were applied to tweets originating from within and outside the CS community. The analysis was based on the BERT approach (Devlin et al., 2018) using the multilingual uncased pretrained model, to cope with the presence of multiple languages in our dataset.



The data from within the CS community were extracted from a collection that had been created by [Roldán-Álvarez et al. \(2021\)](#), originally to detect connections that characterize the relation of CS activities to Sustainable Development Goals (SDGs). From this dataset, we extracted tweets about climate change by custom filtering using terms such as “sdg13,” “climate action,” “climate change,” or “climate justice.” This resulted in a dataset of 26,000 original tweets and 95,000 retweets. Using a corresponding search query, Tweets about climate change originating from outside the CS community were retrieved from the Twitter space. This resulted in 71,000 additional original tweets. For the sentiment analysis, a cropped version of the T4SA reference dataset ([Vadicamo et al., 2017](#)) with the same number of tweets labeled as negative, neutral, and positive was used as a training dataset.

The analysis of the original tweets (excluding retweets) revealed sentiments were mainly neutral within (92.9%) and outside (76.7%) the CS community. The ratio between positive and negative tweets was 1.8 (predominantly positive) within, and 0.89 (more or less balanced) outside. While these differences are less pronounced than we would expect from recent reports ([Marlow et al., 2021](#); [Moernaut et al., 2022](#)), they still indicate that the climate change debate is less polarized within the CS community.

Discussion and conclusions

Data analytics methodologies are widely used in research across scientific disciplines to assess and analyze current domain-related practices and scientific activities. For these purposes, big volumes of input data can be found in domain-specific archives but also in general web and social media sources. The contribution of CS projects and activities to generating and providing such data collections has been characterized by [Poisson et al. \(2020\)](#) for the area of geographic information systems and by [Tang et al. \(2017\)](#) for environmental big data. However, few efforts have been made to facilitate such approaches for analyzing the CS landscape as a whole, broadening our knowledge on the scope and state of CS to date. This is the perspective taken by the CS Track project.

A specific focus on scientific publications allows for using well-understood “scientometric” methods applied to available corpora of publication data. [Kullenberg and Kasperowski \(2016\)](#) have used a scientometric approach to identify the subjects or “focal points” of CS research activities, whereas, [Pelacho et al. \(2021\)](#) analyze co-publication networks to characterize and compare collaborations in the CS community in an international perspective. This enables the CS landscape to be addressed as a whole yet is limited to publication databases as data input and addresses only specific issues about CS. CS Track widens the scope by including data from different web and social media sources that capture external manifestations of CS activities.

The different levels of analysis introduced above are associated with typical data sources, including the CS Track database with project-related attributes and metadata, forum and wiki data available on CS platforms such as Zooniverse or SciStarter as well as the open blogosphere of Twitter. Among the data and metadata found in the database, are project descriptions or documentations that were usually written by authors themselves involved in these projects in leading roles. These meso-level descriptions account for expectations and goals “behind” these projects. Text-analytic methods, including sophisticated machine learning techniques, allow these descriptions to be associated with motivational factors or skill requirements. However, these analyses cannot reveal the individual motivation or learning gains of volunteers participating in these projects. A similar discrepancy occurs with the analytics of micro-level data from forums and webpages: These data allow for following general trajectories that may indicate “personal growth” (measured, e.g., in terms of increasing network centrality) or assess the distribution of tasks between professional scientists and volunteers in the discourse. However, they do not directly give us an account of subjective perceptions like feeling satisfied or rewarded by this work. To address the individual and subjective level, the analytics results have to be complemented with data from interviews or questionnaires from project participants or other contributors. The full analysis perspective in CS Track includes this integration (also called “triangulation”) as a current focus for the project.

Although micro level analyses like those based on participation data from forums and talk pages allow for identifying individual contributors, we would not use these for individual profiling in adherence to privacy-related ethical principles (cf. [Cooper et al., 2021](#)). Accordingly, our units of analysis are single projects, i.e., we characterize projects by certain participation patterns and make comparisons between projects on that basis. Results that rely on meso level content analyses such as the assignment of research areas (cf. Case 2) are also naturally related to projects or groups of projects. The scope of the Twitter-based macro level analysis is usually broader: Case 3 shows how the “climate of discourse” can be comparatively assessed between large sets of contributions within and outside the CS community as manifested in the Twitter blogosphere. A plausible explanation is that the context of the community discourse itself, which is more science-oriented within CS, induces a different tone or style.

An example for an analysis that integrates evidence from different sources comes from the COVID-19 study (Case 1). Following the analysis of web content, interviews have been conducted with key projects to complement the data and better understand projects’ experiences researching COVID-19. This provided valuable information about project design, characteristics, and motivations in addition to reflections of project leaders on what actions have been successful and what

can be improved in the future design and development of CS projects (Turbe et al., 2022). Ultimately, using mixed methods of analytics and social science provides methodological richness, allowing for the triangulation of data. That is a systematic comparison of data obtained from different sources and research perspectives which provides a coherent, validated, and holistic perspective of the CS landscape. This approach allows us to deepen our understanding about the main topics and concepts which are communicated over the web and characterize CS and the different ways it is perceived and approached by people who lead or take part in CS activities.

The CS Track framework aims to complement existing methods for evaluating CS, address gaps in current observations of the citizen science landscape and integrate findings from multiple studies and methodologies. The work done in this project so far and reported briefly above, should be seen as pioneering in its efforts to use mixed analytic and social science methods along with the triangulation of results from different sources, to achieve a broad picture of social phenomena related to the case of CS. Future work is expected to concentrate on refining the measurement and evaluation scheme for CS and summarize results of our analysis to provide further recommendations for best practices and policies for the CS community.

Data availability statement

The datasets presented in this article are not readily available because restrictions apply to the original data under the GDPR regulation. The datasets will be made available on request.

Author contributions

FM has contributed the macro-level case study. SR has been responsible for contributing to the article where it relates to the scientific communication aspect and for input in terms of text editing and language. YG was responsible for structuring of the paper, describing the study background, CS Track context and future directions. She has also contributed the micro-level case study together with RD-G. RD-G has been responsible for the

organization of the writing and the design of the concept of the article. She was in charge of the work distribution amongst the partners. She is the first author and the corresponding author. She has contributed the micro-level case study together with YG. UH has been responsible for specifying and describing the technical basis of the analytics approach and has contributed the meso-level case study.

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Conflict of interest

Author SR was employed by company ATiT.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Territorial spillover of COVID-19 infections in Rome during the “second wave”

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The study investigates the spread of the effects of COVID in 2019 in the city of Rome, focusing on the socio-economic factors that affect the incidence of the virus in the 155 urban areas (UAs) of the city. The units of analysis of this study are the UAs. The survey emphasizes the weight of spatial contiguity between the 155 UAs. For this purpose, the spatial data model analyses the spillover between contiguous units of analysis, distinguishing direct and indirect spatial effects. Digital geocoding of the collected data has been performed to create a geodatabase (GDB) that allows the statistical information to be turned into geographic layers. Geographic layers represent information layers that can be overlapped with each other on the map of Rome. The database allowed the variables to be handled with spatial analysis methods. This emphasizes the usefulness of digital analysis methods for the study of such a complex and rapidly changing phenomenon as the spread of SARS-CoV-19 infection on an urban scale.

KEYWORDS

spatial data models, COVID-19, urban health, β -convergence, socio-demographic effects

Introduction

A COVID-19 pandemic is an abnormal event, not fitting in the series of *usual* catastrophic events (natural disasters, conventional or non-conventional wars, etc.). First of all, it seems that, differently from the case of other catastrophic events, there is complete adherence between the meaning of the adjectives that describe this event and their empirical references. For instance, terms such as “global” or “world” have been used to label various tragic events including the two world wars, which, as a matter of fact, were not global in the sense of spatial extension.

The uniqueness of the present time, with the interruption of the monotonous, but reassuring, daily habits, seems to escape the focus of the studies on safety/unsafety in big cities. Suddenly, the frequently mentioned *liquid modernity* (Bauman, 2000) seems to have solidified and the social distancing, rather than weakening the importance of physical contact among people, proves that it is irreplaceable.

Obviously, since the pandemic is affecting our life in all its individual and collective dimensions, is relevant for different fields of study: from medicine to philosophy, epidemiology to sociology, and statistics to law. For instance, the interchange among these disciplines can be noticed in the overlapping of idioms and words that sometimes from being metaphors turn into real *discourses* on the government of life (Foucault, 2001). We owe the use and conceptualization of terms such as biopolitics and biopower to Foucault. In his view, a turning point in the evolution of the tools for the management of power is essentially marked by the techniques for the subjugation of human bodies through specific disciplinary devices (prisons, barracks, colleges, etc.).

In this way emerged the idea of the “microphysics of power” that collects and organizes the *laws* for the *treatment* of “naked life” or “sacred life,” to which G. Agamben devoted relevant studies (Agamben, 1995). A life that connects the biological dimension with the political one and that now, with the current crisis, is at the center of the political and philosophical debate¹. Based on this perspective, it can be argued that the management of the pandemic can only be biopolitical. However, it has to be taken into account that under this term gather different formulations can be essentially divided into two groups. The first one is more markedly pessimistic or, as U. Eco described it, “apocalyptic” in which the now irreversible and pervasive aspects of the techniques of control and command are emphasized. The other one is more “optimistic,” where the life, the *bios*, seems to overflow the political dimension (Esposito, 2010). The reference to biopolitics is central, and the focus is placed in particular on the biopolitics approach with regard to two concepts: anomie and immunity.

By leveraging on these two concepts, an attempt has been made, if not to completely uncover, at least to open a crack from which to look at the socio-political and epidemiological interactions triggered by the COVID-19 pandemic. Interactions that bring to light terms, theories, and *knowledge* that have been systematized in the 70s of the XX century, but whose speculative layers date back to more ancient times.

At the same time, from an empirical point of view, the space-time dynamics of the spread of infections were analyzed, to seek to identify spatial continuity and discontinuity as well as time differences that characterize the “territorialization” process (Deleuze and Guattari, 1980) of the epidemic in the city of Rome. In addition, attention was paid to three segments of the population—a central element in Foucault’s reflections

on biopolitics²—which are the old-age index, the density of the population under 15 years of age, and the incidence of foreigners.

In conclusion, it has to be remarked that the *trait-d’union* between the two sections of this article is that common analytical dimension: the city.

Materials and methods

Space-time and demographic aspects of the spread of infections among the urban areas of Rome

Although the COVID-19 pandemic is much less lethal than other events of the same kind, it bursts into the XXI century and interrupts sociability—which no social substitute can replace—and imposes physical confinement and social distancing exactly as in past eras, thus eliminating relations between people, between people and places and even between places. The very short time within which the city, while remaining inhabited, emptied itself of social life, has been impressive. This experience certainly raises the awareness of the possibility that society itself can dissolve as well as of the potential speed of such dissolution.

Therefore, the duration and the speed of change appear to be the most distinctive characteristics of pandemics.

With regard to the first aspect, it is clear that with a prolonged duration of the “state of exception” the “shared values” and social cohesion weaken. There is no doubt that the effects of the pandemic, primarily the economic ones, affect different social strata in different ways, increasing inequalities³ and therefore the loss of trust in the institutions.

With regard to the second aspect, it is immediately evident that the speed of the spread of the virus corresponds to an equally sudden dismantling of social life. A dismantling that appears to be a sort of a strategic retreat aimed at cutting the supplies to the virus. Also in the case of the spread of COVID-19, as in all battles, the fighting concerns the defense of the territory.

In this study, rather than just the search for correlations between socio-demographic variables and infections—correlations that are nevertheless taken into consideration in the proposed models—an attempt has been made to focus the attention on the space-time dynamics of the spread of the virus and in particular, to take up the metaphor of the invasion, on the speed of its diffusion in the territory of Rome. In other words, the variable under investigation is not the effect of

1 The theories of Agamben (2020) on the “health dictatorship” are certainly more complex than those reported by the mass media and, in particular, those disseminated on social networks. The strong and harsh reactions that they provoked, perhaps, are mainly due to the fact that Agamben’s reflections provided support and reinforced the theories of the so-called “negationist front” in which the role of the far right neo-fascist origin is by no means marginal.

2 The shift of attention from the centrality of the territory to the population is the basis for the theory of the pastoral power which will be discussed in the following pages.

3 An interesting book (see the bibliography hereunder), by the group of #mapparoma (<https://www.mapparoma.info/>), is devoted to the study of inequalities in the city of Rome.

the change produced by the pandemic, but the speed of this change. Therefore, in this sense, the speed of diffusion can be understood as an indirect indicator of the timing of a social change in an urban context.

For this purpose, it is thus necessary to resort to models of spatial auto-regression, in which the growth of infections at time t_1 , in a certain Urban Area (UA), is related both to the level of infections at time t_0 in the same UA and to the infections in the neighboring UA. The autoregressive aspect is hence informing us of the space–time dynamics, while the other socio-demographic and geographical indicators in the model have mainly the function of control variables.

Given the lack of individual data on the infections, it has been resorted to the analysis of aggregate data by UA. These territorial units by size, population, density, number of structural facilities, and so on, exceed by far the size of many Italian cities. Therefore, in this sense, Rome can be considered as a *city of cities* (Cipollini and Truglia, 2015).

From an operational point of view, the speed of diffusion can be reported by the rate of variation in the incidence of infections in the UAs. On the other hand, from a methodological point of view, it is possible to use β -convergence econometric models with spatial effects. As it will be explained more in detail below, it is a specific and diverse family of models for the treatment of space–time data that had been first used for the study of economic imbalances between different geographical areas (Taufel et al., 2016) and which, subsequently, had also been used in the socio-demographic and electoral fields (Truglia, 2019).

The data used in the research have been subject to a (digital) geocoding which allowed to generate variables that could deal with spatial analysis methods. This emphasizes the usefulness of digital analysis methods for the study of such a complex and rapidly changing phenomenon as the spread of SARS-CoV-19 infection on an urban scale.

The second section is divided into three parts. The first reports the basic data, their transformations, and a brief overview of the β -convergence model. The second is devoted to the description of the methodology of spatial regression models, highlighting their peculiarities. The third shows the results of the analysis.

Basic information and re-coding

The data on the COVID-19 cases are collected by the Lazio Region—Epidemiology Department and refer to different periods of time between April 7, 2019 and November 2, 2020 (the latest data available at the time this study began).

For the purpose of the analysis undertaken below, in addition to the data on infections, it has been necessary to update to 2019 the information regarding the resident population, the

population above 64 years and under 15 years old and the foreign population.

The data collected by the Municipality of Rome with the support of the Italian National Institute of Statistics (ISTAT) have been geocoded so that it has been possible to build a geodatabase that allowed to turn the statistical information into geographic layer. Each of these geographic layers amounts to an information layer that can be overlapped with the others on the map of Rome. This has allowed employing of statistical spatial analysis tools. The following indexes are calculated from the data on infections and those on the population:

- *incidence of infections* on October 5 and November 2 for each UA:

$$I_{(5,10)i} = \frac{N^{\circ} \text{Infections on October 5 in the } i\text{-th UA}}{\text{Population}} \times 10.000 \text{ ab.};$$

$$I_{(2,11)i} = \frac{N^{\circ} \text{Infections on November 2 in the } i\text{-th UA}}{\text{Population}} \times 10.000 \text{ ab.}$$

- *natural logarithm of the rate of variation in the incidence of infections* in the two periods of time considered (TVI) for each UA:

$$\begin{aligned} TVI_i &= \ln \left(\frac{I_{(5,10)i}}{I_{(2,11)i}} \right) \\ &= \ln \left(\frac{N^{\circ} \text{infections on October 5 in the } i\text{-th UA}}{N^{\circ} \text{infections on November 2 in the } i\text{-th UA}} \right). \end{aligned}$$

- *natural logarithm of the incidence of infections* as of October 5 (I_c), which for each UA is as follows:

$$I_{ci} = \ln[I_{(5,10)i}].$$

The other indexes, calculated for each UA, for which it is redundant to provide a statistical formulation and to which the role of explanatory variables is assigned are as follows:

- *The old-age index* (IV_i). The effects of the COVID-19 infection can be particularly serious, with dramatic consequences, among the elderly who are the most fragile part of the population. For this reason, it is certainly important to investigate the relationship between the growth of infections and the levels of IV in the different UAs;
- *The percentage of foreigners in the population* (ST_i). Although it was not possible to distinguish this variable by type of nationality, it seemed useful to include it in the analysis as it takes into account specific lifestyles connected to urban coexistence;

- *The population <15 years old per km²* (D_i). Among children from 0 to 15 years old, the number of asymptomatic people is significantly higher than in other demographic groups (Ismail et al., 2020). This peculiarity makes these individuals considerably effective carriers in the transmission of the virus in particular to the older generations; and
- *Infections as of November 2 per km²* (C_i). This is a context indicator entrusted with the task of highlighting the weight of the “community” on the countermeasures to contain the epidemic.

If not required by the statistical formulation, these indexes will be hereinafter referred to without subscript.

Furthermore, two geographical divisions have been recoded as *dummy* variables concerning, respectively, the localization of the UAs with respect to Gra (InGra/ExtraGra) and with respect to QSouth (QSouth/NoQSouth). The information on the geographical location of the UAs besides serving as control variables can also be a sort of a “container” of information on the socio-cultural and urban characteristics of the territory of Rome. A long tradition of studies has reported and formalized both from an empirical and theoretical point of view, the structural elements that characterize these areas of knowledge. For instance, consider the *diffuse city* and the *dense city* in which the extra-Gra and intra-Gra UAs respectively fall, or the UAs that form the part of Rome that extends in the QSouth between Eur and Ostia.

Review and description of the data distribution

COVID-19 officially arrived in Italy on January 30, 2020, with the hospitalization of two Chinese tourists at the Spallanzani Hospital in Rome. Thus, it has been the capital, to begin with the interventions and health procedures for the treatment and containment of the pandemic in Italy. From January 30 to May 4, the cases of COVID-19 in the capital were 2,441. On June 4, 1 month after the end of the lockdown, the infections increased by 458 units and therefore stood at 2,899 (+185 compared to May 4). In the 3 summer months, the infected people increased by 2,639 units and stood at 5,538 (+126.9% compared to May 4). Starting from this date, we have witnessed a steady increase of cases which on October 5 reached the number of 8,612 (+252.8% compared to May 4) and on October 19 they exceeded 10 thousand, reaching a total amount of 11,711 infections (+379.8% compared to May 4). From this date, a strong acceleration has been registered, as highlighted by the change in the angle of inclination of the broken line (Figures 1A,B). On November 2,

the total number of cases was 20,012 (+719.8% again compared to May 5).

From a territorial point of view, as of May 5, the UAs without infections were 20 (12 of which were non-residential), on October 5 they were reduced to 15 (of which 12 were non-residential), on November 2 the UAs in which no infections were reported were only two (both are non-residential). As of November 2, the 10 UAs with the highest number of infected were Torre Angela (691), Centocelle (497), Primavalle (436), Don Bosco (424), Tuscolano sud (369), Torpignattara (355), Gordiani (353), Trieste (343), Borghesiana (342), Gianicolense (323), and Esquilino (312) (Figure 2).

The geography of the pandemic shows a strong concentration of UAs with a high density of infections within the Gra (Figure 2). In fact, 20% of the UAs with the highest values are located in this territorial division (from 78 to 200 infections per km²).

With reference to the population, as of October 5, only one UA (Omo) has an incidence greater than 100 infections per 10 thousand inhabitants. A little less than a month later, on November 2, the UAs that exceed that threshold are 19, of which 12 are residential (Figure 2). Considering only the latter UA, from the data published on October 5, it appears that only Casetta Mistica has 0 infections and only the Omo UA has an I_c higher than 100. For the rest of the UAs, this number varies between 39.5 (Gregna) and 84.1 (Grotta rossa Ovest).

Considering only the residential UAs by incidence rate (a number of infections per 10 thousand residents), the most exposed, with increases of at least 150%, are Grotta Rossa Ovest, Casetta Mistica, Appia Antica Nord, and Omo. While the highest TVI ($\geq 300\%$) are Santa Palomba, Navigatori, S. Maria di Galeria, Prima Porta, Barcaccia, Appia Antica Nord, Lucrezia Romana, Aeroporto dell'Urbe, and Tor Cervara (Figure 2).

With reference to the distribution of the other variables, the respective box plot (Figure 3) shows the following:

- A strong symmetry of the old-age index. In 50% of the UAs for every 10 children/young people affected there are at least 15 elderly people affected. The proportion is 10–30 in 25% of the UAs, the mean (M) and the coefficient of variation (C_v) are equal to 1.58 and 0.50, respectively;
- A marked right asymmetry in the density distribution of the foreign population. In 50% of the UAs, the percentage of foreigners is over 13.3%. There are nine UAs with a stronger presence of foreigners (at least 30%), and in three of them (Appia Antica Sud, Casetta Mistica, and Tor San Giovanni) the percentage is higher than 50% ($M = 15.5$; $C_v = 0.65$);
- A strong right asymmetry in the density distribution of the population under 15 years old. In 50% of the UAs, the value of this reference is greater than 556 inhabitants per km². The UAs with the highest density of children/young people are six (Marconi, Gordiani, Don Bosco, Eroi, Tor

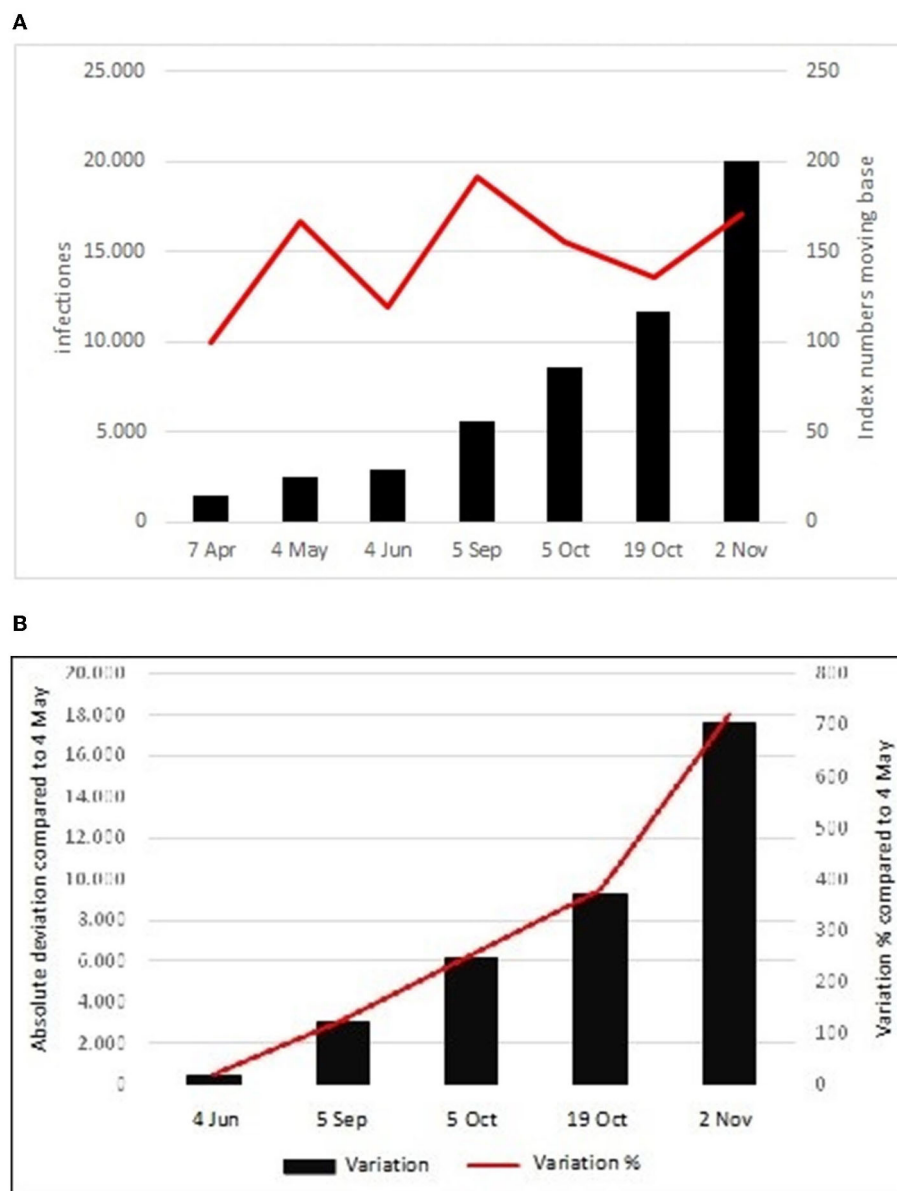


FIGURE 1
(A) Absolute values and index numbers with a moving base. (B) Absolute and percentage variation compared to the 4/5.

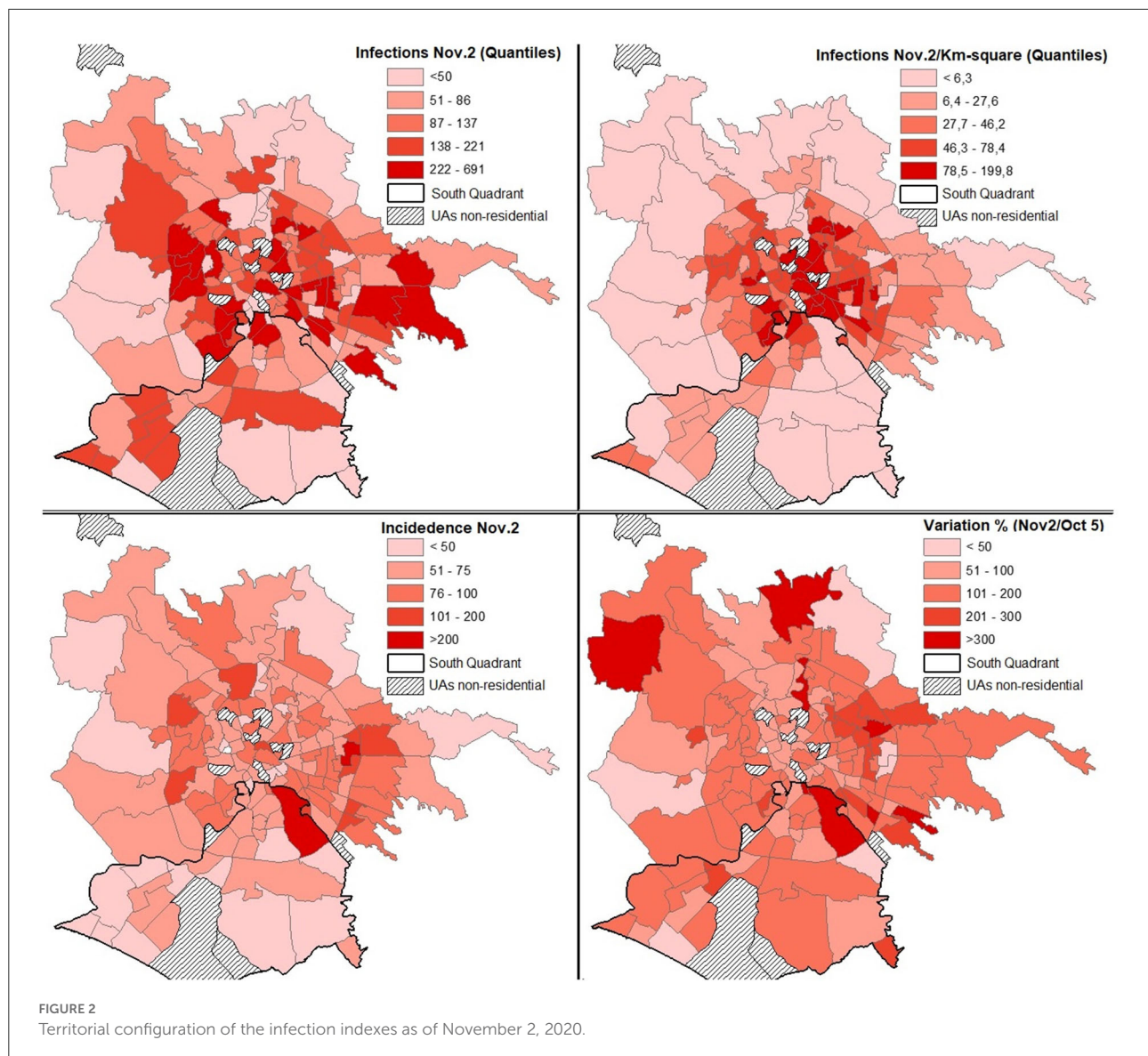
Pignattara, Trieste). The mean and the CV are equal to 726,7 and 0,94, respectively; and

- A marked asymmetry in the density of infections reported as of October 5. In 50% of the UAs, there are at least 34 infections per km^2 . In four UAs, the value of this reference is greater than 75 infections per km^2 ($M = 46.3$; $Cv = 0.93$).

The distributions of incidence (I_c) and the rate of variation in incidence (TVI) are compared in the graphs presented in Figure 4 and which represent the starting point for the analysis developed in the following pages. The UAs with the lowest

I_c values are Tor Cervara, S. Maria di Galeria and Aeroporto dell'Urbe. The highest ones are Grottarossa Ovest and Omo. As regards the distribution of TVI, the UAs with the highest values, which are located above the “mustache” are Prima Porta, S. Maria di Galeria, Barcaccia, Aeroporto dell'Urbe, Appia Antica Nord, Lucrezia Romana, and Tor Cervara. Therefore, these are UAs that as of October 5 had low levels of I_{c_i} .

The point cloud shows an inverse relationship between these two variables, whereby the TVI is higher in the UAs that had low I_c levels on October 5. This trend, therefore, signals the presence of territorial convergence.



Urban balances and imbalances of COVID-19 infections: The β -convergence model

Among the different procedures for the analysis of territorial convergence (for which reference is made in the bibliography), in this study the β -convergence criterion was used in its simplest version and taking into account the transformations of the values into natural logarithms, has this function:

$$TVI_i = \beta_0 + \beta_1 I_{ci} + \varepsilon_i.$$

The β -convergence model, therefore, reports whether in a certain period of time the territorial gaps, in relation to a specific aspect, increase or decrease; in this second case, there

is territorial convergence with negative β_1 , while the speed of convergence is a function of this parameter (Arbia, 2005):

$$\beta_1 = -(1 - e^{-bt})$$

from which it is derived as,

$$b = \frac{\ln(1 + \beta_1)}{t}$$

where t is the length of the time period considered.

It should be emphasized that the term convergence does not mean a trend of the TVI toward the same level, but the achievement of a steady state that is specific for each UA (Alexiadis, 2010).

The trend of the point cloud seen in the scatterplot of Figure 4 shows a linear and a quadratic component that

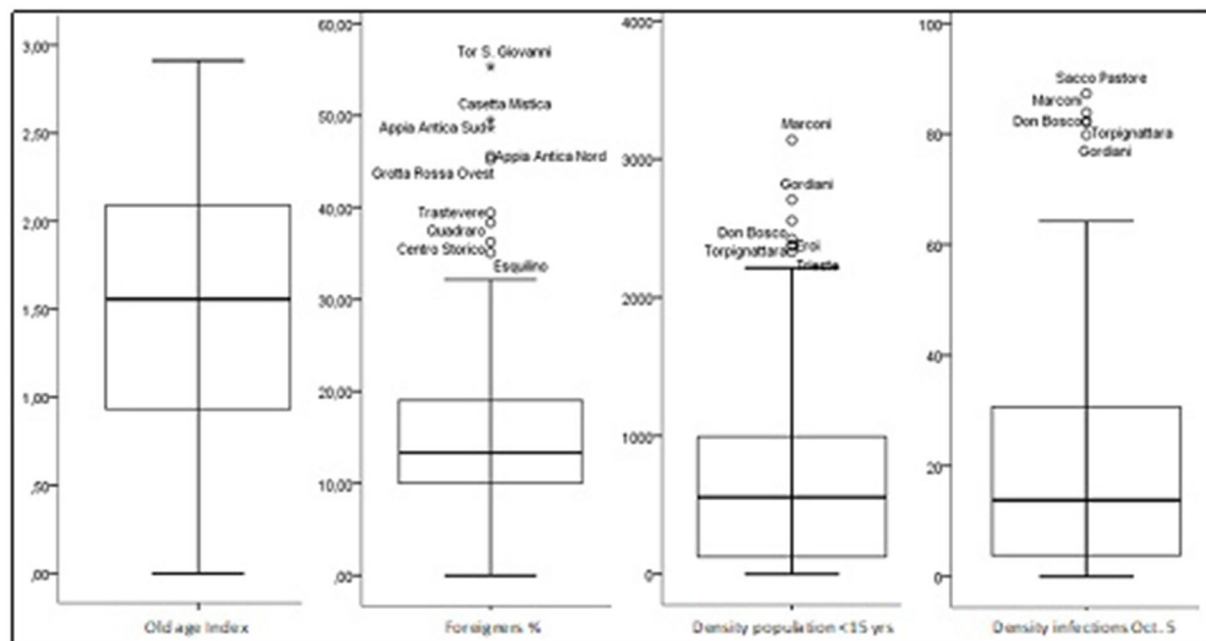


FIGURE 3
Characteristics of the territorial distribution of the explanatory variables.

intercepts the variability due both to the UAs that are arranged in the upper section of the ordinate axis and to the single UA (Omo) which is located beyond the minimum point and for which there is no convergence.

In addition to the first-degree function, the parameters of a quadratic regression model were then estimated. In summary, the results report the parameter estimates (p -value < 0.01) of the quadratic linear regression model:

$$TVI_i = 2,35 - 0,33Ic_i + \varepsilon_i \quad R^2 = 0,39 \quad (1)$$

$$TVI_i = 4,31 - 1,44Ic_i + 0,15Ic_i^2 + \varepsilon_i \quad R^2 = 0,47 \quad (2)$$

The variance reproduced by the model [2] is almost 10 percentage points higher than that of the model [1]. This increase is probably due to the better representation capacity of the UAs that are arranged both along the upper section of the ordinate axis (UAs with the highest increases in the growth rate) and, at the same time, of the UAs with values of Ic higher than 4.42 (minimum point) which represents a threshold beyond which there is no longer convergence.

Over the period of time considered, which goes from October 5 to November 2, 2020, in just under a month, the number of infections went from 8,612 to 20,012 (+132.4%), the speed of convergence for the two models is equal to 0.12 and 5.3% daily, respectively.

Econometric models for the analysis of spatial effects: Methodological aspects

Due to the “nature” of the analyzed phenomenon, a central role is played by the spatial links between the units of analysis. Therefore, it seems necessary to use specific procedures capable of considering the structure of the connections between the units of analysis (Guliyev, 2020).

In the cases investigated in this study, the mechanisms of the spatial spread of the COVID-19 pandemic are operationalized within an appropriate spatial regression model. A systematization of the models that adopt the econometric approach for the processing of spatial data is included in the works of Elhorst (2010) which are based on the methodologies developed by Anselin (1988) and Manski (1993). In a very simplified way, the spatial effects can be traced back to three types of interactions:

- Endogenous: the variation of the dependent variable (TVI) within an area depends on the change in the nearby areas;
- Exogenous: the variation of the dependent variable (TVI) within an area depends on the characteristics of the nearby areas; and
- Spatial autocorrelation: the change within an area of the dependent variable (TVI) depends on non-random factors, unobservable, or omitted variables in the nearby areas.

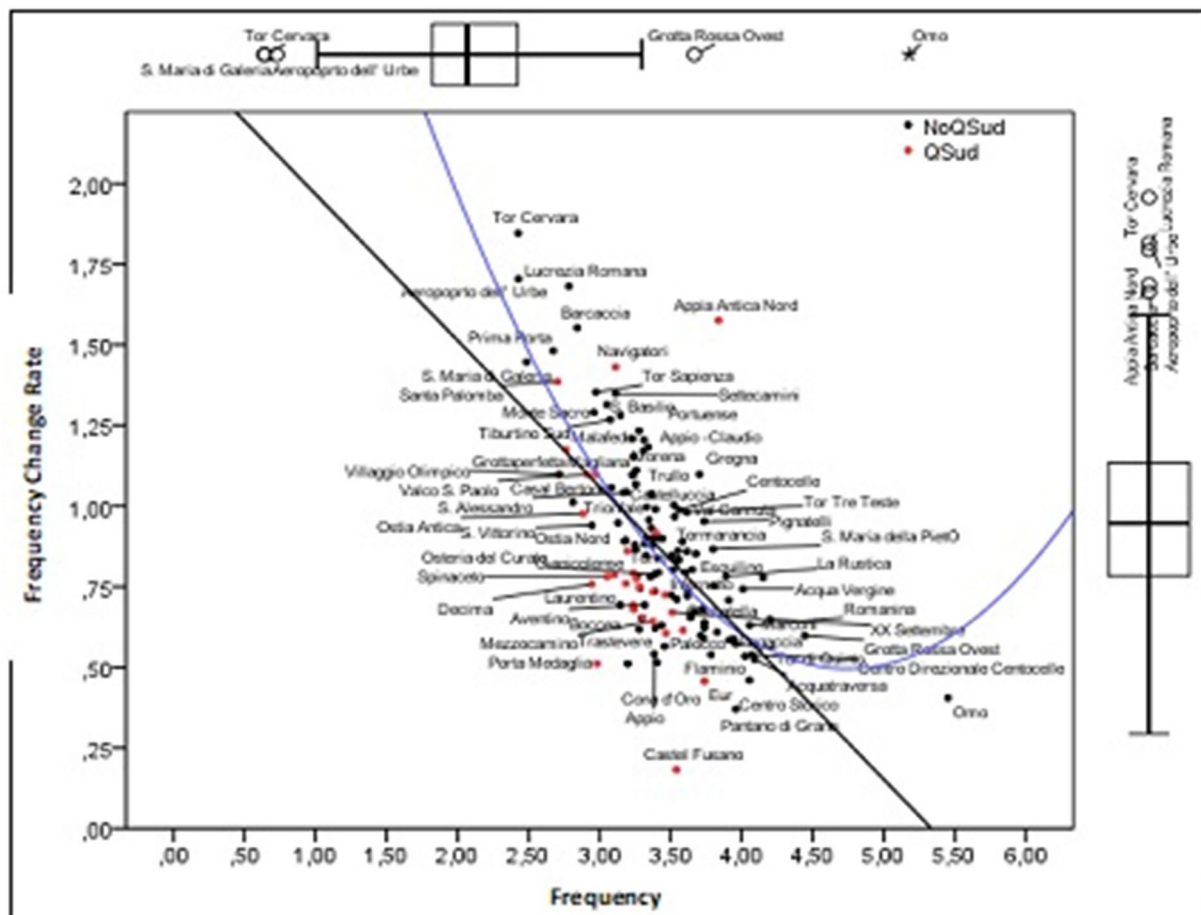


FIGURE 4
Univariate and bivariate features of the distribution of IC and TVI.

These three effects can be methodically organized in a general spatial regression model that can be formulated in the following way:

$$\begin{aligned} \mathbf{y} &= \rho \mathbf{W} \mathbf{y} + \mathbf{X} \boldsymbol{\beta} + \mathbf{W} \boldsymbol{\delta} + \mathbf{u} \quad \text{with } |\rho| < 1 \\ \mathbf{u} &= \lambda \mathbf{W} \mathbf{u} + \varepsilon \quad \text{with } |\lambda| < 1. \end{aligned} \quad (3)$$

where:

- $\mathbf{y}$ is the vector ($n \times 1$) is the dependent variable (TVI);
- $\mathbf{X}$ is the matrix ($n \times k$) of the explanatory variables;
- $\mathbf{u}$ is a vector ($n \times 1$) of regression residuals or errors due also to the presence of variables not explicit in the model;
- $\mathbf{W}$ indicates a matrix ($n \times n$) in which the spatial structure of the units of analysis is organized based on a neighborhood criterion. For these analyzes, the criterion of the physical proximity of the units of analysis was adopted. So, two UAs are contiguous if they share at least one section of their boundary. The elements w_{ij} of the matrix $\mathbf{W}$ are

equal to 1 or 0 depending on whether the i -th unit is contiguous or not to the j -th unit⁴;

- $\mathbf{W} \mathbf{y}$, $\mathbf{W} \mathbf{X}$, and $\mathbf{W} \mathbf{u}$ are, therefore, three matrices ($n \times n$) that represent the spatial lag of the dependent variable, the explanatory variables, and the term of error;
- ρ is the parameter associated with the spatial delay of the dependent variable and reports the endogenous effects of spatial interaction (*Spillover*). Therefore, it is an auto-regression parameter that measures the effects of the spatial delay on the same dependent variable;
- $\boldsymbol{\beta}$ is a vector ($k \times 1$) of regression parameters that report the influence of the explanatory variables on the dependent variable in the i -th UA;
- $\boldsymbol{\delta}$ is a vector ($k \times 1$) that contains the parameters that measure the effects of the spatial delay of the explanatory

4 Among the different criteria (distance between centers of gravity, k-closest, etc.) that of physical proximity is the one that maximizes the spatial autocorrelation of the rate of variation.

variables (*Spinoff*). That is, the influence on the dependent variable in the i -th UA produced by varying the explanatory variables in the neighboring UA; and

- λ is the scale associated with the spatial delay of the regression error. It is, therefore, a measure of the autocorrelation of the error due to the omission of explanatory variables.

The formulation of the general model, therefore, depends on the rejection/acceptance of the null hypothesis on the value of each of these parameters. In a very simplified way, the spatial effects can be treated in autoregressive terms, thus using the *lag* of the dependent variable (Wy), or in terms of autocorrelation, through the error *lag* (Wu). In the first case, there is a Spatial Autoregressive Model (SAR), in the second a spatial error model (SEM). Finally, it is possible to treat both the delay error and the dependent variable (SARMA) at the same time.

The general model can be formulated in a single expression in the following manner (Florax and Folmer, 1992):

$$y = \rho WY + X\beta - WX\delta + (I - \lambda W)^{-1}u \quad (4)$$

which with a few simple steps can be written in the following way:

$$y = (I - \rho W)^{-1} (I\beta + W\delta) X + (I - \lambda W)^{-1}u. \quad (5)$$

This formulation makes it possible to clarify the mathematical, and therefore interpretative, peculiarity of the regression parameters associated with the explanatory variables and their spatial delay.

Unlike what happens in OLS models, the relationship of dependence between the dependent variable and each independent variable (marginal effects) is not indicated by the usual coefficients β_r , but from the s_{ij} elements that make up the matrix S (Le Sage and Pace, 2009):

$$S = \begin{bmatrix} s_{11} & \cdots & s_{1n} \\ \vdots & \ddots & \vdots \\ s_{1n} & \cdots & s_{nn} \end{bmatrix} \text{ with } s_{ij} = (I - \rho W)^{-1} (I\beta_k + W\delta_k).$$

The information contained in the matrix S takes into account the peculiarity of the analysis of the spatial series compared to the temporal ones. For the latter, in fact, the dependent variable at time t is related only to the same variable reported at time $t-1$ and the interaction is unidirectional (time t cannot affect time $t-1$). In spatial models, the relationship is multidirectional, in the sense that the variation of y_i influences and is influenced by the variations that occur in the nearby units.

In other words, the infections in a given UA(a) can produce variations of the infections in the neighboring UAs which, in turn, can affect the variation of infections in the same UA(a).

The spatial effects, organized in the matrix S , are therefore of three types:

- Direct (EI): impact of the explanatory variables on the y_i in the same unit area. These effects are indicated by the coefficients s_{ij} that are arranged on the diagonal of the matrix ($i=j$), thus from the trace of the matrix $\text{tr}(S)$. So by dividing $\text{tr}(S)$ by the number of units (n) we obtain the direct average effects (EMD);
- Indirect (ED): impact on the variable y_i in the i -th due to the variation of the explanatory variables in the zones close to it. These effects are given by the sum of the elements s_{ij} outside the main diagonal of the matrix ($i \neq j$). By dividing this sum by the number of zones we obtain the indirect average effects (EMI); and
- Total (ET): impact of all s_{ij} elements ($ET = EI + ED$). Also in this case, the total average impact (IMT) is obtained from the division by the number of units, which can be interpreted in two different ways: i) effects produced by the i -th zone on all the others (sum of the elements of the i -th row of matrix S); ii) effects produced on the i -th zone by all the other zones (sum of the elements of the j -th column of the matrix S).

The process of identifying the most suitable model to study spatial effects is divided into several steps which, in a very schematic way, can be summarized as follows:

1. OLS model estimate;
2. test (Anselin, 1988) on the spatial independence of the residues and based on the results choice of the SEM or SAR model;
3. assessment of the parameters with the maximum-likelihood (ML) method;
4. test for the inclusion of exogenous variables in the model both in direct and delayed form; and
5. analysis of the suitability of the model to the data.

By setting $\rho = \lambda = \delta = 0$, therefore eliminating the variables, from the model [3] we obtain the following multiple regression:

$$y = \rho WY + X\beta \quad (6)$$

where the matrix X contains the explanatory variables.

The estimates of the OLS parameters represent the first step for the analysis of the spatial effects and are shown in Table 1 together with those of the SDM.

Starting from the OLS model, the analysis is carried out to verify the presence or absence of spatial dependence of the residuals and to identify the most appropriate procedure for their statistical analysis.

The Moran index, which registers the presence of spatial autocorrelation on the residues produced by the OLS model, is approximately 0.15 and is statistically significant (p -value = 0.0025). The outcomes of the diagnostic tests point in favor of an autoregressive model with the spatial delay of the dependent variable (SAR). In fact, although the LM-error and LM-lag tests

TABLE 1 Figures and tests for the identification of the model.

Test	Figure	Df	p-value
Moran	0.158		0.0025
LM-error	8.780	1	0.0030
LM-lag	10.02	1	0.0015
RLM-error	1.028	1	0.3107
RLM-lag	2.269	1	0.1319
SARMA	11.051	2	0.0040

are both significant, the latter is associated with a higher test statistic and therefore a lower *p*-value.

Furthermore, the tests carried out on the external variables recommend this information to be entered both in the direct form and as a spatial delay.

The choice of an autoregressive model, which also incorporates this information, is also supported by the rejection of the null hypothesis of the *Common Factor Test* (*likelihood ratio* = −403.18; *df* = 7, *p*-value = 0.000)⁵.

The econometric model that best lends itself to the treatment of the spatial dimension of TVI, therefore, is the *Spatial Durbin Model* (SDM) which can be formulated as follows:

$$y = \rho W y + \beta X + \delta W X + u \quad \text{with} \quad |\rho| < 1.$$

Results

Effects of the socio-spatial interactions on the spread of COVID-19

The estimate (ML) of the parameters of the SDM model together with those of the OLS estimates are also reported in Table 2, which is divided into two sections. In the first section, in dark gray, there are the estimates of the regression parameters β_k which report the non-spatial effects of the explanatory variables on the dependent variable. In the second section, in light gray, the parameters that account for the spatial effects (Spillover and Spinoff) are organized.

The main differences between the two models concern [6] and [7], the significance of the parameter associated with the

geographical repetition InGra/ExtraGra, and the percentage of foreigners who are no longer significant in the SDM. For the other parameters the following considerations can be made as follows:

- Compared to the OLS model, the parameter associated with the IC remains negative and with lower values, indicating, as already mentioned above, the presence of territorial convergence reported by all models. This is stronger in the SDM in which the daily convergence rate is equal to 3.2%.
- The parameter associated with the quadratic term that reports the non-linear effects between I_c and TVI remains positive. For values of I_c^2 lower than 7.72, this increase is very limited, while it increases noticeably for values above this threshold;
- Even in the SDM, the relationship between the old-age index and the TVI remains negative. The latter is on average lower in the UAs with a higher prevalence of elderly people;
- The percentage of the foreign population is still not significant, even though the *p*-value has dropped considerably compared to the OLS estimates. Although the parameter associated with this variable is not significant, it seems interesting to underline the positive relationship between the increase in the percentage of the foreign population and the rate of variation;
- The density of infections as of November 2 and the density of the population under the age of 15 years, albeit with very low values of the regression coefficient, have a statistically significant influence on the TVI which increases as the first indicator increases and decreases in the UAs with a high density of children and young people; and
- In the UAs of the QSouth the levels of the TVI are lower than in the rest of the city. While the division InGra/ExtraGra has significant effects only in the OLS model (in the UAs within the Gra the TVI are higher).

The significant spatial effects are as follows:

- *Spillover*: The variable of autoregression ρ , just below 0.30 in fact indicates the presence of spatial dependence between the units of analysis. In other words, increases/decreases in the TVI in the *i*-th UA are also attributable to the variations of the same variable in the neighboring UAs.
- *Spinoff* relating to: *i*) the old-age index (WIV_i). The UAs with a high presence of elderly people negatively affect the TVI of the neighboring UAs (containment effect); *ii*) the percentage of foreigners (WSt_i). UAs with low TVI are close to UAs with high percentages of foreigners. Therefore, it would seem that the UAs with a high rate of foreigners curb the growth of infections in the neighboring areas; *iii*) the

⁵ As noted by Anselin (1988), the SEM is equivalent to a special form of SAR also known as the Durbin spatial model which is derived by transforming the dependent and explanatory variables: $(Y - \lambda WY) \sim (X - \lambda WX)$; so, we have $Y = \lambda WY + X\beta - \lambda WX\beta + \xi$. This model is derived from the more general one: $Y = \lambda WY + X\beta + WX\gamma$. The common factor test verifies the null hypothesis $H_0: \gamma = -\lambda\beta$; the rejection of the null hypothesis implies the rejection of the SEM specification in favor of a broader model with spatially delayed explanations.

TABLE 2 Estimates of the parameters of the OLS and SDM model.

		OLS				SDM			
		Estimate	Er. St.	t	Pr(> t)	Estimate	Er. St.	t	Pr(> t)
β_k	Constant	4.281	0.408	10.505	0.0000	2.813	0.927	3.036	0.0024
	Incidence (I_{ci})	−1.285	0.228	−5.640	0.0000	−1.389	0.193	−7.185	0.0000
	Incidence ² (I_{ci}^2)	0.119	0.032	3.757	0.0003	0.130	0.027	4.874	0.0000
	Old-age index (IV_i)	−0.087	0.027	−3.225	0.0016	−0.068	0.027	−2.488	0.0129
	Foreigners % (St_i)	0.000	0.001	0.269	0.7884	0.002	0.001	1.531	0.1258
	Infections on November 2 per km ² (C_i)	0.005	0.001	4.994	0.0000	0.004	0.001	4.940	0.0000
	Density < 15 years (D_i)	−0.000	0.000	−4.885	0.0000	−0.000	0.000	−4.775	0.0000
	Qsouth vs. No Qsouth ($QSouth_i$)	−0.076	0.029	−2.580	0.0110	0.164	0.058	2.842	0.0045
	InGra vs. ExtraGra (Gra_i)	0.114	0.034	3.332	0.0011	0.014	0.041	0.341	0.7330
ρ	Lag-growth rate ($WTVI_i$)					0.287	0.111	2.576	0.0010
δ_k	Lag-Incidence (WIC_i)					0.652	0.420	1.551	0.1209
	Lag-Incidence ² (WIC_i^2)					−0.064	0.057	−1.118	0.2636
	Lag-old-age index (WIV_i)					−0.091	0.054	−1.695	0.0901
	Lag-Foreigners % (WSt_i)					−0.007	0.003	−2.714	0.0067
	Lag-Infections on November 2 per km ² (WC_i)					0.000	0.002	−0.113	0.9102
	Lag-Density < 15 years (WD_i)					0.000	0.000	0.216	0.8290
	Lag-QSouth ($WQSouth_i$)					−0.245	0.065	−3.774	0.0002
	Lag-InGra ($WGra_i$)					0.196	0.068	2.857	0.0043

two geographical partitions (lag-InGra and lag-QSouth)⁶. The TVI decreases with the increase in the proportion of the UAs of the QSouth neighboring the i -th UA and, conversely, increases with the increase of the intra-Gra UAs neighboring the i -th UA.

Finally, it seems interesting to note that the spatial delay of the incidence (WIC_{1i}), although not significant (the p -value is just over 10%), can, however, give some indications on the spatial mechanisms of the transmission of infections. It would seem, in fact, that the increase in the incidence in

TABLE 3 Breakdown of the spatial effects.

Index	Impact		
	Direct	Indirect	Total
Incidence (I_{ci})	−1.3728***	0.3395	−1.0333°
Incidence ² (I_{ci}^2)	0.1286***	−0.0353	0.0934
Old-age index (IV_i)	−0.0748**	−0.1482*	−0.2230**
Foreigners % (St_i)	0.0016	−0.0092**	−0.0076*
Infections on November 2 per km ² (C_i)	0.0041***	0.0013	0.0054*
Density < 15 yrs (D_i)	−0.0003***	−0.0001	−0.0003°
Sign.	0.001***; 0.01**; 0.05*; 0.10°		

The number of * indicates the levels of statistical significance.

the UAs produces an increase in the rate of variation in the neighboring UAs.

Before concluding this section, it is necessary to come to some methodological considerations, in substantive terms, on the interpretation of the regression coefficients β_k associated with the explanatory variables which, as already explained above, can have direct, indirect, and total impacts on the dependent variable (Table 3).

The statistically significant impacts of the I_c are direct and total ones and both negative, which implies that if the I_c increases by 1% in the i -th UA, the TVI decreases by 0.14% in the same UA. The same considerations apply to the total impact

⁶ In order to give a correct interpretation to the effects of these variables, it is necessary to make a brief clarification. Both subdivisions are calculated with two binary variables which can, as already remarked, assume values equal to 1 or 0 depending on whether the UA belongs, or not, to a territorial partition. Therefore, the effects of the spatial delay, which is given by the average assumed by the variable being analyzed in the UA neighboring the i -th UA, can be explained as follows:

$$Wx_i = \frac{\sum_j w_{ij}x_j}{n}$$

This figure is nothing more than the proportion of UA contiguous to the i -th UA, for which Wx_i can only assume values between 0 and 1. Therefore, the spatial delay is nothing more than an average of these values which is hence the proportion of UA neighboring the i -th UA belonging to the same territorial partition.

that highlights the presence of negative global interaction: an increase of 1% of the Ic in all the other UAs produces a decrease of 1.03% of the TVI in the *i*-th UA.

Therefore, by following this outline it is possible to interpret the marginal effects of the different variables both with respect to the type of impact and with respect to the relationship (positive or negative) that each of them has on the rate of variation of the infections. In particular:

- In quadratic terms only the direct impact is significant and is in a positive relationship with the TVI;
- The impacts of the IV are all significant and positive. Therefore, an increase in this index in the *i*-th UA, or in the neighboring UA, produces a decrease in the TVI in the *i*-th UA;
- The foreigners have a negative, but not significant, direct impact, while the indirect impacts are negative and significant: the TVI in the *i*-th UA decreases with the increase in the percentage of foreigners in the neighboring UAs and, in general, in all UAs of the city;
- The impacts of the number of infections per km² (C) are all positive, but only the direct and total ones are significant. As the density increases in the UAs neighboring to the *i*-th UA and in all the UAs, there is an increase in the TVI in the *i*-th UA; and
- The impacts of the density of the population under the age of 15 years (D) on TVI are all negative and significant.

It is worth remembering that the basic hypothesis of spatial regression models is that the units of analysis are not independent of each other, so it is not correct to estimate their parameters with the OLS method, as in traditional regression models. This method, in the case of spatial dependence, produces inconsistent estimates. For this reason, it is necessary to resort to other methods, including that of ML. Therefore, it follows that the R² index is not suitable for assessing the suitability of spatial regression models whose parameters are calculated with different criteria than the OLS.

Therefore, in this case, the suitability of the model is evaluated by comparing the figures of AIC, of the log-likelihood (LogLik) calculated for the different models (Table 4).

The AIC for the MDS is getting lower and lower. Conversely, the LogLik values are higher. The differences between these figures are statistically significant; therefore, the SDM model is the one that best fits the data.

Territorial and socio-demographic aspects of the spread of COVID-19

As already mentioned, the socio-demographic indexes in the econometric model play the role of variables and control.

TABLE 4 Figures on the suitability.

	df	AIC	LogLik	L-Ratio	p-value
OLS	10	−165.91	92.955		
SDM	19	−193.86	115.931	45.952	0.0000
SEM	12	196.77	−86.384		
SDM	19	−193.86	115.931	404.63	0.0000
SAR	11	−172.74	97.372		
SDM	19	−193.86	115.931	37.119	0.0000

However, the dramatic impact of the pandemic crisis on the elderly and the steady incidence of asymptomatic cases among children and young people suggested that a study should be dedicated to these two aspects. For this purpose, the first element of evaluation concerns the structure of the territorial configuration of the distribution of the three indexes (TVI, IV, and D) which was investigated with the Moran index (Moran, 1950). Having ascertained the presence of spatial autocorrelation, the (high/low) levels of TVI were associated with the (high/low) levels of the old-age index and with those of the density of the population under 15 years old, calculated based on the respective average values.

The intensity of the autocorrelation⁷ is higher for the IV (0.380) and followed by the index D (0.371) and TVI (0.211). These values are statistically significant (*p-value* = 0.01) and indicate the presence of a territorial aggregation process. In other words, contiguous UAs tend to have the same values on each of the three indexes.

The second step concerns the territorial configuration of the combinations between TVI and IV (Figure 5A) and between TVI and D (Figure 5B) whose colors reflect the following combinations:

⁷ The Moran index reports whether and to what extent neighboring territorial units are similar/different in relation to the intensity of a certain phenomenon and can be formulated in this way (Truglia, 2011):

$$I = \frac{n \sum_i \sum_j (x_i - M)(x_j - M)w_{ij}}{\sum_i \sum_j w_{ij} \sum_i (x_i - M)^2}$$

where

- x_i and x_j are the intensities of the examined variable (in this case TVI, IV, and D) in the *i*-th zone and the *j*-zones close to it;
- M is the arithmetic mean of the variable;
- w_{ij} is the element of the contiguity matrix W ; and
- n the number of territorial units.

In general, the index I varies between -1 and 1 . In the first case, there is negative autocorrelation, contiguous areas have different values of the variable x_i , while non-contiguous areas have similar values of x_i . In the second case, on the contrary, there is a positive autocorrelation for which contiguous areas report similar values of the variable under study. In the case of the absence of autocorrelation, the index value is equal to $-1/n-1$.

- blue → UAs with low TVI and low IV or D values;
- light blue → UAs with low TVI and high IV or D;
- orange → UAs with high TVI and low IV or D; and
- red → UAs with TVI and IV or D high.

The territorial configurations of TVI-IV and TVI-D are very similar. Excluding Martignano, of the 154 UAs, 119 have the same properties on the two combinations (diagonal of Table 5).

There are 39 UAs with high levels of TVI-IV and, with the exception of Spinaceto, they are all located within the GRA mainly between the center and the periphery of the ring QEast and QSouth.

The UAs with high level of TVI and low level of IV are 32 and comprise mainly the UAs of the extra-ring periphery of the QEast and the QSouth.

The areas with high levels of TVI and IV are 39 and, with the exception of Spinaceto, all are located within the GRA. Of these UAs, eight are located in the QSouth (Appia Antica Nord, Grottaperfetta, Laurentino, Navigatori, Spinaceto, Tor Marancia, Tre fontane, and Valco San Paolo) and 20 in the QEast.

The UAs with low levels of these two indexes are 40 and are arranged from South to North between Castelporziano and Cesano.

The UAs with low-TVI and high-IV levels are 40 and form a large cluster including the central western intra-Gra UAs.

The territorial configuration based on the combination of TVI-IV levels largely mirrors that of TVI-D, with the exception of 35 UAs and those that regard, in a more consistent way, the low-low levels, those that increase by eight units, those that regard the UAs of the intra-Gra and QWest periphery, those extra-GRA of the QNorth and high-high which decrease seven units that are located inside the GRA in the QEast and QSouth.

Discussion

While completing the chapters on home safety and road accidents, where we have tried to describe and highlight some aspects of lack of safety in UAs during the second modernity, other elements of lack of safety, those descending from the COVID-19 pandemic, broke into everyday life, upsetting it and bringing back fears and scenarios that seemed not possible to come to existence.

Among the contradictions that the socio-health crisis has highlighted, at least for the Western world, is certainly the one between public alarm and home safety. If on the one hand, on the public side, and in particular on the health side, the mass media show dramatic and, in many cases, tragic scenes, on the other hand, on the private side, time seems to be suspended in the *unsafe* comfort of the daily life.

In the case of the COVID-19 pandemic, the lack of safety is not triggered by the usual “threats” associated with the second

modernity but appears to be due to the very irruption of nature itself into the second modernity. A small virus was enough for the possibility of “naked life” to take a substance and reveal the fragility of society and the power of nature. Givone writes in *Metaphysics of the plague*: “One would think that the civilization, with its frames of values and disvalues, with its sophistication, its delights, and even its perversions, is nothing more than a false construction destined to collapse at the first encounter with the reality” (Givone, 2012; p.16).

The images of the empty streets and squares during the lockdown show the *bare city*, in which the grandeur of monuments and architecture reinforces the absence of man. Those images refer to the metaphysical squares of De Chirico's paintings, which in years of another virus, that of the warlike and racist ideas of fascism, infected the population and at the same time immunized it from the basic principles of freedom and equality.

In *Immunitas*, Esposito proposes a possible solution to the community-immunity antinomy, and seems to find it right within the functioning of the immune system and in particular in the “immunological tolerance.” He suggests an overlap between the language of medicine and that of politics, which thus shows deeper and more lasting bonds and biopolitical contiguities than previously thought. Esposito writes: “but perhaps it is precisely the figure of the implant – artificial as a prosthesis or natural as a fertilized egg in the mother's womb – to provide the most powerful evidence. The fact that it is precisely the genetic heterogeneity – and not the similarity – of the fetus that favors its acceptance by the woman's immune system means that this cannot be reduced to a simple function of rejection toward the stranger. But if anything, it should be interpreted as its internal sounding board, as the diaphragm through which the difference involves us, and passes through us, as such” (ivi, p. 18).

If this is the case, then immunization is both protection and denial of life and the fact that this second aspect has been given prominence, so to speak, is the consequence of a precise political choice that has put fear at the center of its discourse. First of all, fear of the different, fear of the new. Fear that the space of social relations is the premise of the return to the “state of nature” and therefore it should be harnessed and immunized. It is, therefore, a question of emphasizing the positive aspects of immunization starting with the development of a new semantics. For example, think of the term “body” used to indicate the *embodiment* of the state, of society, of a political apparatus. This translation seems to have lost its metaphorical character to acquire a more substantial and institutional one⁸. The consequence is that if the state is

⁸ The analogy, between the human body and that of the sovereign, forms the iconoclastic image of power, starting with the image on the cover of Leviathan. However, the genesis of this identification is older and, certainly, it already played a fundamental role in the political theology of Saint Paul which was aimed at founding a deep-rooted order, but

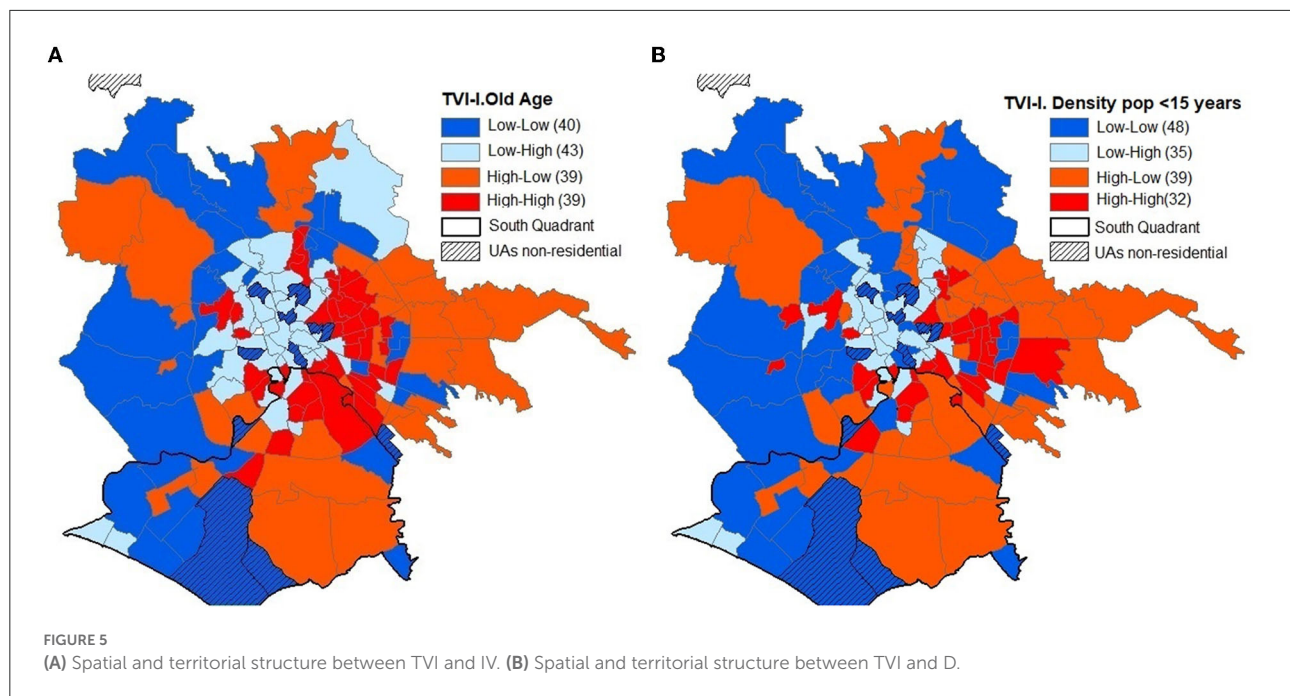


TABLE 5 Distribution of the UAs according to the combinations between the levels of TVI-D and TVI-IV.

TVI-Density pop <15yrs	TVI-IV old age				Total (TVI-D)
	Low-Low	Low-High	High-Low	High-High	
Low-Low	36	12			48
Low-High	4	31			35
High-Low			26	13	39
High-High			6	26	32
Total (TVI-IV)	40	43	32	39	154

a body, if the electorate is a body, if the society is a body, and so on, then it is possible to *cure* them using those specific methods and therapies to heal the body. In other words, the use of this language brings with it the immune logic of biopower as analyzed by Foucault.

The current socio-health crisis, with its political-legislative implications, allows us to *test* the effects of the pandemic on the social arrangements and gives us the opportunity to rethink and update our views of government mechanisms. As is the case with the virus, biopolitics is also subject to change and can be rethought by removing and *immunizing* it from

the *thanato-political* drift to bring it closer to the lands of *biopolitics*. In this changed horizon, then, biopolitics stands as a protection of the “law of the gift”⁹ which is the *nomos* of common life.

The countermeasures to contain the effects of the epidemic have eliminated social relations and transformed deeply rooted habits. However, as already mentioned, the most impressive aspect is the speed with which this change took place and which reveals how delicate, in their simplicity, the mechanisms of living in common are. At the same time, the duration of the pandemic underlines the irreversibility of this change. It is on these two aspects, speed and duration, that the empirical analysis of XXI century metropolis has been based.

capable of lasting on earth. On the relationship between the believer's body and the body of Christ, see Taubes (1993), translation into Italian 1997. On the other hand, Canetti, describes in three paragraphs *The grasping and incorporating*, *The hand*, and *On the psychology of eating*, the relationship between these parts or functions of the body and the organs of power (Canetti, 1960, pp. 243–269).

⁹ In this regard, think of the possibility of pooling vaccines against COVID-19 and the biopolitical implications of this choice.

From a statistical–methodological point of view, the possibility of using specific econometric models to investigate some space–time mechanisms that govern the dynamics of “territorialization” of the pandemic in the city of Rome was explored. The first of these dimensions, the spatial one, has been probed in terms of interaction between the UAs, an interaction which is assumed to be stronger the greater their territorial contiguity. The second aspect, the temporal one, is analyzed in terms of differentials in the growth rates of infections between two moments in time. Furthermore, some information relating to the demographic structure and the territorial partition of the metropolitan territory has been used.

Particular attention is devoted to the elderly population—the most vulnerable to the consequences of the infection—which seems to play a significant role to block, or at least contain, the growth of infections. While, on the contrary, the density of children–young people and that of infections per km² seem to show their significant role in the spreading of COVID-19.

Nevertheless, the most interesting information on spatial spillovers and the speed of infection between territorial units is given by the autoregressive effects of TVI and the temporal effects of the IC. In fact, it would seem that the increase in cases of infections in the analyzed period is not of an intensive type (increase in infections in the UAs where they were already high), but extensive.

The indirect and total impacts of the spatial delay of the explanatory variables show the presence of a territorial framework between the UAs which can be interpreted as the core of the spatial relationships between the various areas of the city, highlighting both the local and global ones. It is thanks to this framework that it is possible to explore the effects of the interaction between the epidemic (bio) and the city (society).

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <https://www.deplazio.net>.

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Author contributions

FRL and FGT contributed to conceptualization, investigation, and writing of original draft preparation. FGT contributed to methodology, formal analysis, and data curation. FRL contributed to supervision, visualization, and writing of review and editing. Both authors have read and agreed to the published version of the manuscript.

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Conflict of interest

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Research using hashtags: A meta-synthesis

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In the last 20 years, research using hashtags has grown considerably. The changes that occurred in the digital environment have influenced their diffusion and development. Today, there is considerable research on hashtags, their use, and on hashtag activism. Likewise, there is a growing interest in their descriptive measures and their metrics. This article aimed to provide a review of this area of research and studies to outline the traits of hashtag research, which are yet nascent. To achieve this, we used a meta-study to produce a meta-synthesis capable of bringing out similarities and differences in research using hashtags and identifying spaces for the generation of new knowledge.

KEYWORDS

hashtag research, hashtag studies, social media, meta-study, meta-synthesis

Introduction

How are hashtags used in social research? In which direction is the research using hashtags going? This article focuses on these questions, given that hashtag-driven research has grown significantly in recent years and in many fields.

Hashtags, as a research tool, are used in communication (e.g., [Bruns and Burgess, 2015](#)), psychology (e.g., [Reavley and Pilkington, 2014](#)), sociology (e.g., [Bruns et al., 2012](#)), political science (e.g., [Lynn et al., 2020](#)), computational social sciences (e.g., [Grčar et al., 2017](#)), as well as in the medical sciences (e.g., [Tavoschi et al., 2020](#)) and engineering (e.g., [Das and Dutta, 2021](#)). Hashtags are used to analyse topic-specific public debates that develop on social media. The research conducted using this tool is also indebted for the technical developments of the features of digital platforms ([Helmond, 2015](#); [Gillespie, 2018](#); [van Dijck et al., 2018](#); [van Dijck, 2021](#)) that allow you to scratch data and store information such as, for example, who initiated the conversation and through which hashtag. The hashtag was developed from the programming language C and was initially written as two separate words, hash and tag. However, from the time it was first known as a number sign, the pound symbol, or a tic-tac-toe board, its recently identification as the “hashtag” has changed language and communication for millions ([Pandell, 2017](#)). Though merely a label (tag) preceded by the hash sign (#), the hashtag has become more than just a tool for classifying the content of texts and images conveyed through the Internet and through social media. Its meaning, use, and relationship within the social context have undergone a transformation, evolving from a thematic collector—therefore a label that collects all the posts that feed the discussion—to an “ubiquitous sign” ([Burgess and Baym, 2020](#)), which produces consequences and effects inside and outside digital environments.

The evolution of the uses of hashtags can be classified based on different periods. In 2007 Chris Messina launched the hashtag within Twitter—a social media platform containing short texts and images—asking users “how do you feel about using # (pound) for groups” (Piatek, 2021). Messina’s post was not very successful. The same year, numerous fires broke out in San Diego in October; Natan Ritter—a web developer, who was traveling to San Diego and sighted the flames—started using #sandiegofire to monitor news sources for any information regarding it and then rapidly (every two-to-three minutes) posting information about the fire, road closures and neighbourhood’s evacuations on Twitter. In this way, the hashtag helped citizens follow the information and not to disperse it by activating a secondary information channel compared to TV ads (Weller et al., 2014) and to keep constantly updated about the evolution of the crisis. This event demonstrated the usefulness of hashtags for gathering information and creating a sense of community around an event.

In the same period, Vander Wal (2005, 2007) applied to hashtags the concept of folksonomy, a form of cataloging produced from users spontaneously and from below. That is, whereas taxonomies are hierarchical in their classification, folksonomies are created by users within the web to classify events and, at the same time, give them meaning. Folksonomies define situations in which members of a society create words and categories to describe the world in a way that is relevant to them (Neal, 2007). The folksonomies are a result of the users’ ability to alter and modify the structure of the conversations on social media from their own words and concepts, without restrictions to terms previously used or predefined by the systems.

With users, hashtags have begun to take on specific uses that are no longer limited to the simple cataloging of events; indeed, it has transformed into a means of associating one’s feelings with something that is igniting and concerns the community.

The changes in the usage and what users do with the hashtag has led to research on the changeability of the meanings of hashtags. Colleoni (2013) described them as empty signifiers that invite the ideological identification of a polysemic orientation; that is, it is like an empty jar with a coffee label, and in it, everyone puts their favorite type and brand of coffee. Papacharissi (2016) perfected this definition by considering them as signifiers that are open to definition, redefinition, and re-appropriation by people on social media. The author introduces the possibility of there being different interpretations of what coffee is, of how people can use it and what a generic coffee jar can contain. Hashtags also signify the emotional component users attach to events and affections (boyd, 2010), by expressing participation through expression of sentiment (Papacharissi, 2016). As Bernard (2019) summarizes, the hashtag is a lingua franca that, starting from the function of thematic aggregator (as in the case of the San Diego fires) develops a network of collateral meanings (La Rocca, 2020) produced by those who use them and insert their opinions, feelings, and point of views on specific events.

The study of what is linked to a hashtag, therefore, is of interest to social scientists because it can offer material that allows them to, for example, analyse public debates or reconstruct people’s perception of political, social and economic events.

Therefore, the increasing use of hashtags in research can be attributed to the ability of hashtags to share information—words, images, links, and more—hooking them to a continuous conversational flow and offering an observation point to those who want to analyse the evolution and perception of social topics. There are also considerable economic advantages in working with hashtags because they already aggregate the information; additionally, by extracting data through a computer, it is possible to extract them in a short time.

Hashtags have become an important development tool for social research and are now used in various fields. It should, therefore, be possible to reflect on how a hashtag or a chain of hashtags—several hashtags placed in sequence within a post—are used within social research to identify the traits of the nascent hashtag research. Based on these assumptions, we aim to answer the following research question:

[RQ] Through a literature review, is it possible to outline the traits of the nascent hashtag research?

To this end, we resort to a meta-study, specifically looking at the possibilities offered by meta-synthesis.

A reconstruction of research using hashtags

The aim of this study is to outline the traits of the nascent hashtag research through a review of studies that use hashtags for data collection and interpretation. The object of study is neither digital methods in research nor their possible alternatives (e.g., Marres and Gerlitz, 2016). We also did not focus on the algorithms or hashtag linguistic functions (e.g., Zappavigna, 2015). Our work tries to reconstruct how sector studies use hashtags in research and how they theorize them in these studies. We are trying to connect the different perspectives of using hashtags within social research, to examine similarities and differences, and if possible, at the end of this interpretative process try to find a framework for hashtags that can define the trends of current research. To do this we resort to the meta-synthesis approach by changing the application scenario, since has been used to analyse qualitative research. We resort to it because our intent is to arrive at the interpretation of a nascent, expanding and above all constantly changing phenomenon given the rapid evolution of technologies and meta-synthesis seems to be the most suitable approach to describe and explain the nuances, the interpretative, the paths followed by researchers, having as our ultimate goal to bring out new

insights. Our purpose is producing a meta-synthesis attempt to integrate results from a number of different but interrelated studies (Walsh and Downe, 2004). Ours is therefore research on research, which implies not only the analysis of primary research results but incorporates reflection on the perspectives and processes involved in those studies (Clarke et al., 2015). As Zimmer (2006) recalls, for Paterson et al. (2001) what is referred to generically as qualitative meta-synthesis is better designated as the meta-study of qualitative research. In Paterson et al. (2001) the meta-synthesis would be the last of six steps, where the first two “laying the groundwork” and “retrieval and assessment of primary research” represent organizational moments while from the third to the fifth we have “the three analytic steps of meta-study” (p. 109), that is: “meta-data analysis”, “meta-method”, and “metatheory”, concludes this process the “meta-synthesis” (p. 109) follows inductively from these three analytic steps through a “dynamic and iterative process of thinking, interpreting, creating, theorizing, and reflecting” (p. 112).

Ours is a synthesis of studies by different investigators in a related field. Within these studies we try to trace readjusting them from Paterson et al. (2001): the meta-theory, therefore the aspects related to the theoretical perspectives and the social media we are dealing with; the meta-method that requires to examine whether it is a theoretical or empirical study, the methodologies and methods adopted; meta-data analysis, which involves an analysis of the results or conclusions that the study reaches. For the identification of the pertinent documents we followed the indications of Barroso et al. (2003) and the research method called “berrypicking model” (Bates, 1989), so we recovered all the relevant studies in a field, not simply a sample of them, through a non-linear search method but starting from a theme broad “the hashtags” and gradually selecting the articles, the chapters that are most interesting for us and thus refining the terms of the search query. This allowed us to identify a priori two main flows: (1) hashtag studies and hashtag activism; and (2) studies that define hashtag indicators or metrics.

Appraisal of the first main stream

Scholars in the first stream consider the use and function of hashtags. This first stream of studies builds on and expands the concept of folksonomies that is the possibility for social media users to attribute meanings to events from below through hashtags. These are studies that focus mainly on Twitter because it is the first social media to introduce hashtags. Therefore, starting from these assumptions, two main sub-branches develop: the first is based on the concept of affordances, which refers to the properties of the environment that activate or offer potential action by an agent (Gibson, 1979); and the second looks at the social impact that a hashtag is able to generate and is represented by hashtag activism.

Regarding the first sub-branch we must remember that the social media like Twitter since they have appeared, have been the object of numerous studies and of various thematic in-depth analyses. There is their theorization as a connective media (van Dijck, 2013), they therefore intervene on the way of defining social bonds through forms of connection that mix social and socio-technical norms typical of online environments (van Dijck, 2013), creating a symbolic field and digital cultural practices that delimit specific ways of relating—often distinct from those offline—and which preside over new processes of signification of being together. Connective media (van Dijck, 2013) have become an almost uninterrupted presence in daily routines: they absorb a significant part of identity processes and social relationships; they give life to a common heritage of cultural and symbolic practices, rules, behavioral practices that contribute to settling “an accepted version of reality” and intersubjectively shared within the same communicative environment.

This is where that line of study comes in that analyzed the dimension of connections between users, identifying the tweets as a tool to provoke reactions in the audience (Marwick and boyd, 2010), and to generate ad hoc publics and that interact between them through the functionality of commenting on posts and proposing them again (retweeting); these effect are attributable to affordances that represent a relational approach to understanding how people interact with technology (Leonardi, 2013). Rathnayake and Suthers (2018) extensively analyzed affordances in digital environments—specifically Twitter—to argue that hashtags are affordances for “momentary connectedness”. According to Rathnayake and Suthers (2018), Twitter hashtags can be seen as affordances for two reasons: (1) the platform allows the creation of hashtags and (2) through hashtags different types of actions emerge. On this trail are placed the studies that analyse hashtags as tools for collective responses (Ross, 2020), expressions of solidarity (e.g., De Cock and Pizarro Pedraza, 2018), support for advocacy strategies (Saxton et al., 2015), strategies of inclusion oriented to create a joint sense of belonging in the community formed around it (Mulyadi and Fitriana, 2018), and strategies to drive television advertising and consequently commercial products (Arvidsson and Caliandro, 2015; Stathopoulou et al., 2017).

To the analysis of hashtag affordances by Rathnayake and Suthers (2018), we add a third reason: (3) the possibility of hashtags to change their original meaning thanks to retweets and quotations, knowing, however, that this happens for topical hashtags, that is, those for which there is an interest from an audience. The flow of conversation that is generated transforms hashtags into public speeches that are assembled through the multiple contributions of users. We can look at this as an evolution of what happened in 2007 with #sandiegofire, allowed by the interaction methods of social media and by the action of users who comment, reply, post messages and images, or other data,

actively participating in the evolution of media events or crises.

Thus, there are two types of events that generate a large number of reactions in hashtags: “media events” (from major sports and entertainment broadcasts to election-night political coverage) and “acute events” (from natural disasters to political unrest) (Bruns et al., 2016). In the first case, hashtags linked to official events are used to follow the expression of shared fandom in the context of a major, internationally televised annual media event, as in the case studied by Highfield et al. (2013) for Eurovision Song Contest, where researchers followed and analyzed the evolution of meanings for hashtags: #eurovision, #esc, and #sbseurovision. The second case could be represented by the studies on Queensland floods in 2010–2011 and Christchurch earthquakes (e.g., Bruns and Burgess, 2012, 2014; Bruns et al., 2012) and now for the Covid-19 pandemic (e.g., Boccia Artieri et al., 2021a,b; Kurten and Beullens, 2021; La Rocca and Greco, 2022). In this case, there is a prevailing idea that when crises or disastrous events emerge, hashtags are born with them, as a need felt by social media users to share information, follow news, and comment on them. They do this by using a unique collector, the hashtag, to ensure the flow of information. In this way, discursive assemblages (Rambukkana, 2015) are generated under the hashtags, which are the result of an interconnected network between multiple meanings that are gradually being built and the organizational network made up of media and their features. This process was spotted by Rambukkana (2015), who defines hashtags as generated from “nodes in the becoming of distributed discussions” (Rambukkana, 2015, p. 3). The studies that are placed within this field analyse the content of tweets, working on the analysis of the texts (e.g., Behzadidoost et al., 2021), therefore of the textual traces left by users as comments. Others begin to look at how a network of relationships is generated through hashtag streams (e.g., Pilar et al., 2021), then examine which actors and topics are the subject of public debate.

The second sub-branch appears as a direct consequence of the first, because Twitter hashtags are bottom-up user-proposed tagging conventions that embody user participation in the process of hashtag innovation as it pertains to information organization tasks (Chang, 2010) and, subsequently, the spreading of activism and participation in political and social themes (e.g., Sebeelo, 2021), the creation of counternarratives and counterpublics different from those spread by the mainstream (Jackson and Foucault Welles, 2015). These have also been related to the viral phenomenon of racialised hashtags (e.g., Sharma, 2012; Jackson, 2016), or feminist movements such as #MeToo (Dobrin, 2020) or LGBTQ+ movement (e.g., Duguay, 2016). This is hashtag activism, within which a hashtag becomes a flag under which the activists gather their protests. In these studies, the hashtag becomes the symbol and manifesto of a movement.

These are, therefore, forms of demonstration conveyed by hashtags that embody forms of social disaffection and that find expression within digital platforms (van Dijck et al., 2018), specifically in the Twittersphere. These forms fall within hashtag activism, which refers to demonstrative practices that allow to aid “ordinary people and those without access to traditional forms of power create compelling, unignorable narratives” (Jackson et al., 2020, p. 185).

The narrative agency in hashtag activism was analyzed by Yang (2016), who defined it as generated by a broader online activism, as the outcome of multiple individual actions, by multiple individuals, to link a social or political claim under a common word, phrase, or hashtag. The temporal unfolding of these messages, which are mutually connected in networked spaces, provides the shape and strength of a narrative agency. One can consider the form of discursive protests on social media in the use of #BlackLivesMatter, mostly in the United States, a hashtag that was generated in response to the acquittal of George Zimmerman in July 2013 in the fatal shooting death of African-American teen Trayvon Martin, which produced a protest movement both in the streets and on social media networks.

Recently Sebeelo (2021) working with the hashtags #ThisFlag (Zimbabwe) and #RhodesMustFall (South Africa) highlighted that social media has accentuated resistance in Africa and, although African continent still lags behind in smartphone ownership and internet connectivity compared to other regions of the world, there is enough evidence to suggest that online-based movements have produced a transformation in political engagement in Africa. Agency narrative can also be found in Dobrin’s study (2020) on #MeToo, which emerged in response to the many sexual harassment accusations involving high-profile Hollywood producer Harvey Weinstein and the numerous celebrities and others who spoke up about the abuse they experienced at the hands of the film mogul, leading him to be brought to justice. In #MeToo study, digital activism and the hashtag’s use are read for their cultural importance, emphasizing the symbolic role played by the hashtag in the emerging myth around the movement through its narrative use, shaped by its users (Dobrin, 2020). These uses demonstrate the “power of digital activism in shaping public discourse” (Yang, 2016, p. 13).

In hashtag studies and hashtag activism, the object of interest is topical hashtags, that is, those capable of generating a conversational flow in the digital environment. Bruns and Stieglitz (2012) argue that hashtags linked to a crisis event, or a television program are more likely to give rise to a sharing of information, which engages and disseminates other information conveyed by URLs, photos, and continuous retweets than hashtags with generic content and meaning (not topical hashtags, i.e. #job, #holidays). This leads Bruns and Burgess (2015, p. 21) to infer that “these distinctly divergent, stable patterns in user activities for these different hashtags use case points to the existence of different conceptualisations by users of

the hashtag community that they are seeking to address or participate in”.

Therefore, there is an awareness of the use of tools and a redefinition of operations that can be generated through the hashtag dissemination circuit. This awareness of use manifests through the creation of memory hashtags for particular events to which photos are attached and spread on platforms such as Instagram (Serafinelli, 2020). On Instagram, Twitter, and other platforms, the conscious use of hashtags and features has been established, developing the capacity for collective action.

Appraisal of the second main stream

This conscious use has generated a set of metrics to define user behavior. Hence, it is possible to divide the second strand into two sub-branches, the one that includes research that uses metrics to describe data flow within social media, as in descriptive statistics; and the other that considers strategies of inferential statistics to study user behaviors and then how to act to influence these behaviors, to satisfy these last purposes, however, it is necessary to identify ad hoc indicators for monitoring hashtags.

Within this second block, a dividing line is represented by the platformization process (Helmond, 2015), that has saturated every area of the web and in which institutional and non-institutional actors move, carrying out a new intermediation function; it is this new intermediation that structures the information and commercial flow through the use of users' behavioral data, subjecting them to the logic of algorithms.

What we are witnessing is, on the one hand, the rise of the platform as the dominant infrastructure and economic model of the web and, on the other, the convergence with social media, as platforms, in building an increasingly integrated ecosystem. To enable this process, the tech companies have operated on dynamics relating to decentralization in data production and re-centralization of data collection, aiming at: (a) making the external data “platform ready,” i.e., suitable for operation in the platform model—for example, with the use of the Facebook “Like” button for content on the web; (b) making internal data useful for third-party development—for example, the increasingly regulated use of API (Application Programming Interface), which allow you to access a portion of the platform data for your own purposes (Boccia Artieri et al., 2021c).

Therefore, the effect of platformization takes on de facto a political nature, since in making external data suitable for the platform, it gains greater control over how the contents appear when they are shared. The power and politics of platforms also extend beyond them, favoring certain protocol logics that adapt external contents to their own internal language (and priorities). Ultimately, we are faced with what Helmond (2015) defines as the “double logic of platformization”:

“This double logic is operationalized through platform-native objects such as APIs, social plugins, and the Open Graph, which connect the infrastructural model of the platform to its economic aims. These elements serve as prime devices for social media platforms to expand into the web and to create data channels—data pours—for collecting and formatting external web data to fit the underlying logic of the platform” (Helmond, 2015, p. 8).

In practice, the platforms provide a technological framework on which others are led to operate and the data produced by others becomes readable by the platforms that can use them in a useful way for their own economic model. Thus, we are witnessing a transition that is not only technological, but also social, economic and political and is based on the new tracking of behavioral data.

In the first period we found a network of descriptive measures for novelty in social media that is represented by topics trending on Twitter or other platforms as expressed by hashtags. These descriptive measures expand rapidly thanks to the functionality of the API, to which the first sub-branch is attached. The APIs allow you to download data-tweets, for example, keeping elements useful for analysis, such as: hashtags, tweets, re-tweets, mentions and other information from which it is possible to reconstruct the meanings and relationship networks. Here we also identify operational indications regarding how to work with tweets, mainly by Bruns and Stieglitz (2013). As scholars suggest (2013, p. 93) it's important to report the values for: the original tweets sent “tweets which are simply original statements, without mentioning other users”; the total number of retweets; and inside the RTs is useful to find the @replies sent, which constitute @mentions sent that are “tweets which contain “@user”, but no indication that the message is a retweet of an earlier post by user” and RT plus @mentions, which represent “tweets which are in the format “RT @user [original message]” or equivalent”. It is also important to indicate the total number of tweets making up the dataset and the presence of URLs that provide an “indication of the amount of external resources a user is introducing into, or retweeting from, the hashtag conversation”; another element is the geolocation.

Bruns and Stieglitz (2013), suggest three areas of metrics in the study of Twitter hashtag datasets: (1) user metrics, which include “metrics about a user's activities, and metrics about their visibility within the overall community of hashtag participants” (p. 97); (2) temporal metrics, which envisage a “a breakdown of the total dataset not by user, but by time” (p. 99); (3) combined metrics, which combine the use of temporal metrics with user and user percentile metrics to identify “differences between the activities of leading user groups and the more random contributions by less active users that have already been identified” (p. 101). The metrics were developed as a requirement in the social research sector and in the economic-business sector.

The use of descriptive measurement tools has established itself in the business sector because they enable companies to learn about their brand reputation or engagement around a product and service. The same is true for various metrics including awareness metrics, which provide information on current and potential audiences; engagement metrics, which show how much and how the public is interacting with the brand; conversion metrics, which measure the effectiveness of social media marketing actions; and customer metrics, which reflect how active customers think and feel about a brand (Shleyner, 2020). These metrics are an attempt to overcome vanity metrics, which as Rogers (2018, p. 450) explains, are “a critical term from business studies that demonizes analysts for a reliance on the brute counting of page views and likes as indicators of success in the hit and like economies (Ries, 2009; Gerlitz and Helmond, 2013)”.

To overcome vanity metrics, Rogers (2018) suggests “critical analytics”, linking this conceptualization, relating to metrics, to the changes in social media, which are no longer the same environment as 5 or 10 years ago. This is the starting point for the second sub-branch of this block of studies, which, as already indicated, marks the transition from social media to digital platforms. Roger considers whether metrics measure or prompt behavior. This question arises because, considering that the number of likes, page views, and shares appear on websites, social profiles, posts, and tweets, we must ask if this score fuels the desire for vanity. It nourishes the desire to achieve fame and success, to be a micro-celebrity, or to treat the audience as a “fan base” (Marwick and boyd, 2011; Senft, 2013). This pushes users to take action to increase the impact of these vanity metrics and, in turn, it feeds the desire to extract more information from “found objects”, things created for another purpose, and we can run into an inconvenience, which is to find ourselves with a lot of behavioral data, without any meaning associated with it (Fielding, 2019).

There are difficulties inherent in “what to measure” on social media to extract “what type of information”. Critical analytics address this difficulty by shifting the axis of interest from the studied vanity networks to the problem network, which emerges through hashtag activism. It is no coincidence that Rogers (2018) reports as an example #BlackLivesMatter on Twitter, where “unity is conceived as hashtag discipline, numbers as recognized contributors, and commitment as repeated participation” (2018, p. 455). Here, he explains social media as one space used to vent social problems. He also highlights that metrics should thus “measure the “otherwise engaged” or modes of engagement (other than those for vanity metrics), such as dominant voice, concern, commitment, positioning, and alignment” (2018, p. 467) in continuity with analytics activism (Karpf, 2017). In the wake of Rogers’ work (Rogers, 2013, 2018, 2019), the contribution of Omena et al. (2020), developed from a three-layered (3L) perspective, emphasizes the need to follow the evolution of the medium, communication technologies, their

own methods, and the consequent availability of digital data. The 3L perspective “serves as a form of “critical analytics” or “alt metrics” for social media research by locating issue networks and creating indicators that are alternatives to marketing-like measures” (Omena et al., 2020, p. 4). From this perspective, hashtag engagement is seen as “collectively formed actions mediated by technical interfaces” (Omena et al., 2020, pp. 4–5). The identified levels are as follows. The first is represented by differences between high visibility and ordinary hashtag usage culture, its related actors, and content. The second focuses on hashtag activity and repurposes hashtags by looking at how they can be embedded differently in social media databases. The third considers the images and texts related to hashtags.

In other words, the engagement of hashtags is described as a “grammaticised” action that moves toward descriptions of images and feelings or toward particular topics of discussion (or issues), which require a (minimum) collective level of commitment (Omena et al., 2020). Omena et al. (2020) developed a multidimensional approach that considers the hashtag an element—a prism—with many faces. However, their approach is at a procedural rather than conceptual level, and techniques are developed.

Discussion

This study aimed to produce a meta-synthesis of the existing studies on hashtag research [RQ], to highlight what has been overlooked and what new avenues can be examined to advance knowledge. Research using hashtags is a composite field of study, which required to adapt the classic meta-study procedures on it. To organize the salient elements that emerged from literature review, we can use some of the procedures identified there (Ronkainen et al., 2022). Thus, what emerged for the two lines of studies can be divided into the sub-branches of: theoretical perspectives and the social media (meta-theory); type of study (meta-method); analysis of results or conclusions (meta-data analysis) (see Table 1).

In Table 1, among the two blocks, the first represents the thematization of the role of the hashtag and the second, the search for a measurement of its impact. Both blocks were confronted with the techno-social changes that occurred over the years. Consequently, three orders of considerations can be produced.

The first consideration concerns the way in which scholars have viewed the hashtag within the two blocks. In the first stream of research on hashtag and activism hashtag, studies treated hashtags as social entities conveyed first from connective media and then from digital platforms. Following the technological changes of the web infrastructure, which moved from Internet-based to Web 2.0, and then to digital platforms, hashtags have similarly undergone a change in their spreadability (Jenkins et al., 2013). These structural changes

TABLE 1 Summary of the results of the meta-study.

		Key findings: meta-theory	Key findings: meta-method	Key findings: meta-data-analysis
First block	Hashtag studies	The media are identified as connective media and affordances are the conceptual framework that is most used to explain the actions of users especially on twitter	These are theoretical studies whose main objective is to theorize the changes in the meaning and use of hashtags	The main results consist in having identified an awareness of the use of hashtags by users within social media
	Hashtag activism	The Twittersphere enters the identification processes of digital platforms. Through the use of hashtags, those who do not have access to traditional forms of power have the ability to create compelling narratives that cannot be ignored outside digital environments. Online and offline merge within the platform society	These are theoretical and empirical studies that underline the role of hashtags as demonstrative forms of protest	The hashtag becomes a flag, the symbol and manifesto of a movement
Second block	Descriptive measures	The first operational indications are drawn on how to work with tweets considering its features	These are studies on metrics called vanity metrics	They are identified different areas of metrics in the study of twitter hashtag datasets: user metrics, temporal metrics, combined metrics
	Behavioral data	The connection process undergoes a metamorphosis, and we enter in the platformization. In addition to twitter, instagram is also studied	The metrics now become “critical analytics”, linking this conceptualization, relating to metrics, to the changes in social media, which are no longer the same environment as 5 or 10 years ago	Difficulties emerge with respect to “what to measure” on social media to extract “what type of information”. The works on alt-metrics and that of 31 perspective that serves as a form of “critical analytics” for social media research by locating issue networks and creating indicators that are alternatives to marketing-like measures

reflect the evolution of the source/environment characteristics (see Table 2).

In hashtag studies and activism, the hashtag is treated as a unit of meaning formed through a process of attribution of contributions/comments inserted by each user within the movement’s label. Thus, through the analysis, a researcher examining this hashtag category can reconstruct the meaning and sense attributed by others to what the hashtag represents. From this perspective, hashtag is a sensemaking practice (see Table 2). Here, a gap in the literature becomes apparent; that is, the reconstruction of the meaning of a hashtag—a “before” and an “after”, represented by the literal meaning of the label/event, and by its modification through reworking by users, respectively—is not considered.

In the second stream of studies, the hashtag became a tool for estimating the impact of and interest in an event or theme. Here, digital platforms represent the source/environment in which the hashtags spread. The hashtag is treated as a unit of sensemaking, formed through the generated buzz or level of engagement. Therefore, it becomes the effect produced by the interaction of many people. Through the analysis, a researcher can reconstruct the volume of interaction between users regarding a theme or

TABLE 2 The dimensions of hashtag analysis.

	Sense-making practice	Propagation-effect practice
Source	Connective media	Digital platforms
Content	Social entity	Tool entity for buzz or engagement
Process	Reconstruction of sense-making	Reconstruction of interest: buzz, engagement

an event of interest (see Table 2), estimating the propagation effect. For example, similar to a sound wave, a hashtag also spreads across platforms, with an alternation of compressions and rarefactions. These are detected by a receiver, such as a user, social researcher, and media outlet, as changes in pressure. Specifically, this propagation is estimated within the platforms. Here, a second lack emerges: if social media platforms are digital structures, and if the distinction between online and offline has collapsed, it is necessary to estimate the presence/absence of the propagation effect inside and outside digital environments.

The second consideration is closely related to the first and has already been introduced as a shortcoming. It is concerning

time and the interchange between social environments. Time comes into play when analyzing the development of extra and collateral meanings in the hashtag; consequently, we must deal with a before and an after. Time is also a social factor, a period in which user interaction develops. The importance of the time factor appears in the theoretical contribution of Faltesek (2015), who links the temporal question not only to the collection and interpretation of hashtags, but also to the historical-social time of the event that generated them. That is, instead of viewing the issue strictly through digital and research functions on social platforms, he anchors them to a cultural and social dimension. He begins by distinguishing *kairos*—“a time in between”, an indefinite period of time in which “something” special happens—and *chronos*, which refers to chronological and sequential time. In social media, *kairos* cannot be determined at the individual level represented by the posts (read or unread), or by the elements attached to hashtags, enabled by polysemic digital communication. Rather, it must be sought in the temporal (and social) context within which hashtag networks are generated and within which they are located. They operate by activating an audience, known as *ad hoc publics* (Bruns and Burgess, 2015), which follows a specific hashtag, shares it, and uses it in combination with other hashtags. Sharing produces a clamor, which can be linked exclusively to the digital environment or can come out of it; however, it can also enter it by virtue of something that has happened outside. Thus, it is important to consider how, where and when this propagation effect develops.

To estimate the timeframe, one can consider media hype the starting point. Vasterman (2004, 2005) explored this concept, defining it as “a media-generated, wall-to-wall news wave, triggered by one specific event and enlarged by the self-reinforcing processes within the news production of the media. During a media hype, the sharp rise in news stories is the result of making news, instead of reporting news events, and covering media-triggered social responses, instead of reporting developments that would have taken place without media interference” (2018, p. 20). Therefore, it is necessary to consider when the event contained in the hashtags began to be of interest to media outlets; consequently, it is necessary to estimate its coverage in the press, for example by identifying when it appears for the first time, how quickly it grows every day, and when it stops being of interest to the news media. This provides an overview of the life cycle of the news and the evolution of users’ interest. In addition to the media hype, it is necessary to check the number of tweets and posts that are produced in the same period, and examine if there is a correspondence between the two. According to Pang (2013), social media hype develops as a “netizen-generated hype that causes huge interest that is triggered by a key event and sustained by a self-reinforcing quality in its ability for users to engage in conversation” (p. 333). The introduction of these elements—of time or period, of storm or engagement, of interdependence

or lack of relationship between media and social media hype—builds a framework through which to interpret of the research results.

The third question concerns the emergence of nascent hashtag research based on the elements identified here. We can combine the sub-branches of the two main strands and obtain the conceptual space within which the current hashtag research moves (see Figure 1).

We identified two main branches of studies represented by studies, in which we deal with: 1) thematizing the hashtag. They are contained in the hashtag studies and hashtag activism labels, in which the hashtag is considered a social entity; 2) measuring the effects of hashtags. These are represented by the search for measures and parameters to describe and analyse them and subsequently, to identify behavioral data through the metrics connected to them. We can also consider how the respective sub-branches are connected to each other vertically and horizontally.

Along the vertical dimension of the hashtag as a social entity, hashtag studies are an essential prerequisite for the development of hashtag activism. Indeed, if hashtag is not viewed first as a subject capable of changing its meaning through the use and interaction between users, it cannot be considered a flag, a manifesto within which the social instances are collected. Conversely, hashtag as a tool to measure interest and impact testifies to the need to identify parameters for the description of its use, diffusion within social media and the effects that its spreadability are able to produce. Therefore, here, the indications that emerge from the appraisal of the studies suggest that all useful elements are identified to describe the volume and methods of dissemination, and subsequently—due to the transition from connective media to digital platforms—the need to identify metrics emerges, more specifically able to read user behavior.

Along the horizontal axis—which in Figure 1 is indicated by a bidirectional arrow—we identify the links between the conceptual dimension of the hashtag and its articulation in measures. There is a close link between how the hashtag is conceptualized and the development of relevant measurement tools. The hashtag as an entity that changes the meaning from post to post should explain how the space for discussion and sharing within which it moves is organized. Bruns and Stieglitz (2013) describe the features of Twitter and how to work with them, and simultaneously, the two scholars develop metrics to view who uses the hashtags, the organization of the datasets along a time dimension and the possibility of combining both metrics. Along the second horizontal axis we find the need to look at hashtags as social behaviors, which find their strength in being used by the community to express forms of protest. Here the alt-metrics of Rogers (2018) emerge and are inserted.

At this point we can argue that we have answered our research question, whether it is possible to outline the traits of the nascent hashtag research. However, we have focused

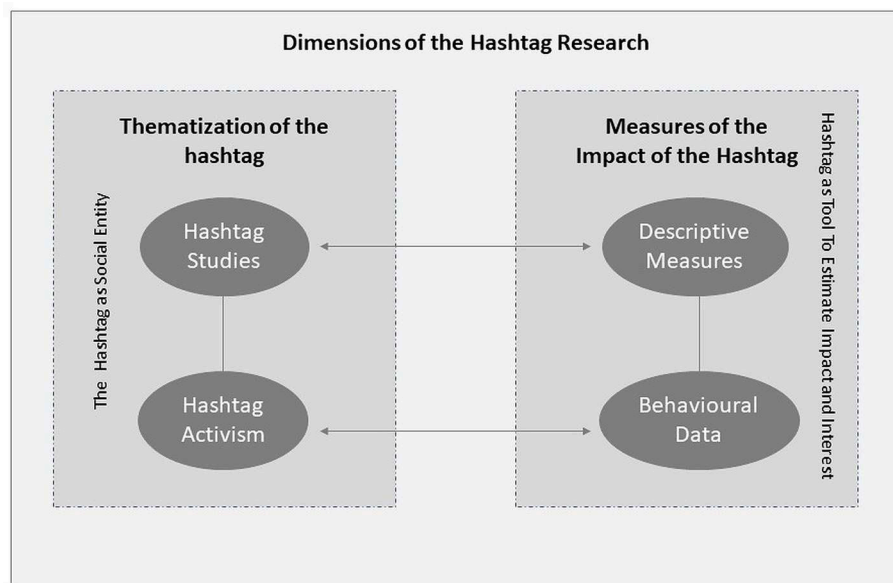


FIGURE 1
Current dimensions of the hashtag research.

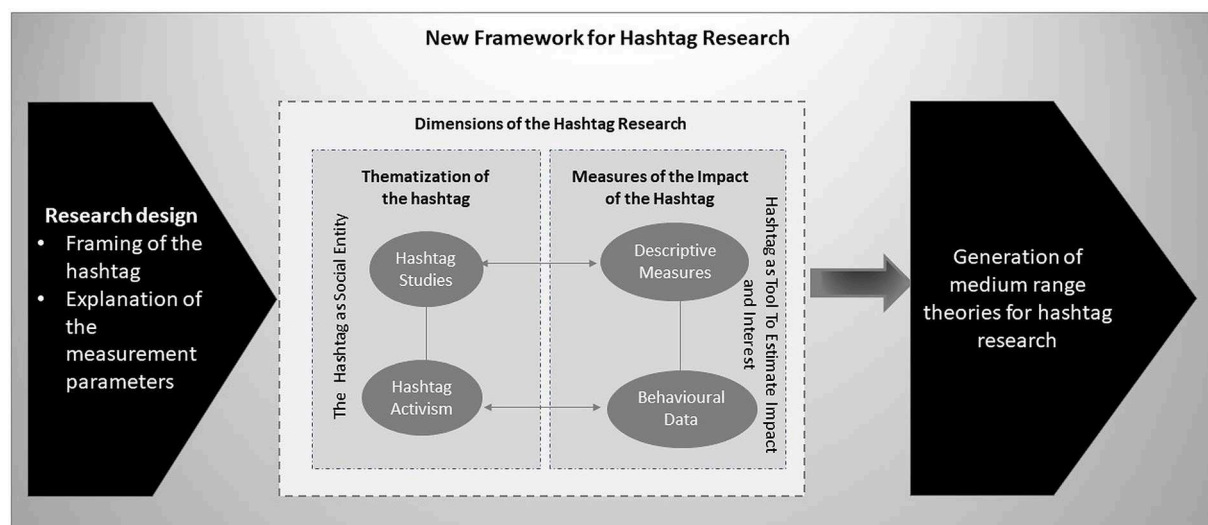


FIGURE 2
New perspectives for hashtag research.

on meta-synthesis to do this, as it offers the possibility of revealing new insights, if it is possible to trace new spaces for this area.

Two different ways of looking at hashtags emerged from the appraisal of the studies (see Table 2), which are a result of our research, since they are not explicit in the analyzed studies. Furthermore, we understand that the work on hashtags, on the texts connected to them,

on the analysis of the relationships generated through them or on the metrics, is a post-reconstruction work conducted by the researcher. Whether it is a social entity or propagation-effect practice, the researcher's work consists of a reconstruction operation, which differs from studies with surveys or interviews as there is no question stimulus. The researcher does not direct the stimulus, which, in this case, is a hashtag. The stimulus for discussion, response to

the discussion, and interest in the topic are all compressed in the hashtag. Therefore, specifying how the hashtag is viewed or framed in the research design is necessary in the conceptualization process and consequently, to explain which measurement parameters are adopted and for what reasons. Furthermore, the effect of propagation and interconnection between the different social structures within which the instance/theme/event that the hashtag represents spreads, must be considered. Additionally, in this case, the researchers should specify the reasons, because they follow the hashtag only within a media environment or because they consider the interconnection in the analysis of the hashtags of the media ecosystem.

These procedural and a priori indications that can transform research with hashtags from a simple description of a social phenomenon into theories focused on a given object of study, by putting forward a series of assumptions to derive and empirically verify specific hypotheses over time because a hidden dimension of studies is made explicit and made comparable in other works of the same type. This allows you to compare the results, because a parameter is indicated that can be taken as a reference by various scholars. And it specifies what conceptual-procedural strategy is being followed in order to move from a mass of data without structure to an interpretation.

The integration of these elements into the hashtag research is able to outline future developments for what is becoming a specific research sector (see Figure 2).

In this way, future directions for hashtag research are outlined, which go toward a sedimentation of the results and the construction of a research area.

Conclusion

In an era in which research is data-driven and the focus is on the visualization of big data, addressing issues related to the conceptualization of the object of analysis may seem unpopular. However, the elements we propose here to add to the studies that fall within the hashtag research offer some advantages.

First, they clarify the orientation of the research, allowing the contextualization of both through framing of the hashtag in the study, and in data collection and in analysis of the results. Second, they are applicable to all fields in which the study of hashtags is widespread. They also pave the way for combined studies along the axes—horizontal and vertical—of the dimensions of the research hashtag. In the face of this,

there are also some limitations that this study has. Some of these limits are inherent in the meta-synthesis which is often accused of being reductionist; and another is the partiality of the studies selected to bring out the evidence discussed in this study. Compared to the limitations inherent in the meta-synthesis, we follow the approach of Walsh and Downe (2004, p. 205) who maintain “In response to the postmodernist critique that synthesis is reductionist, it may be helpful to view the process as opening up spaces for new insights and understandings to emerge, rather than one in which totalizing concepts are valued over richness and thickness of description”. And it is precisely by following this characteristic of meta-synthesis that we have used it here. Regarding the selection of the studies, we specified that it followed the berrypeacking model, however most of the studies found and discussed here deal with Twitter and Instagram, leaving out the other platforms.

However, we consider the impact of this element in our study to be negligible because the indications added to the hashtag research (see Figure 2) are placed upstream of the choice of the platform on which to work.

Another element to consider is the transience of this study due to the evolution of technologies and related social dynamics. This study is a reflection of today and we are unsure of whether it will remain valid tomorrow. However, it is nevertheless a starting point.

Author contributions

These authors contributed equally to this work. All authors contributed to the article and approved the submitted version.

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Lessons for a digital future from the school of the pandemic: From distance learning to virtual reality

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The unexpected onset of the pandemic emergency placed so-called Distance Learning (DL) at the center of the academic world, affecting students and teachers across all formative steps. The DL experience has opened up the way for many queries in terms of research on the front of education, besides showcasing instances of innovation within the schooling institution, both increasingly urgent and no longer deferrable. The collective shock that started in March of 2020 was an opportunity to incentivize a leap in evolution, heavily digital in nature, within the educational system; however, the generation of digital natives were already, prior to the onset of COVID-19, waiting to sense greater openness in the Italian school system toward newer technologies, in addition to less standardized, more innovative, creative and hybrid didactic formulas. In the presented study—a web survey launched in the spring of 2021—a large sample of students were invited to retrace their experience with DL, and express their relating assessments and reviews. Conducting the entirety of the study remotely turned out to be a winning data collection technique given a situation, comparable to the one experienced globally, in which face-to-face meetings had become impossible. Through in-depth analysis of the different contexts—social, cultural, technological, spatial, relational—in which the DL experience took hold, this contribution holds the purpose of illustrating the main DL adaptation profiles of the sample reached, valorizing the perceptual dimension, through the systematic comparison of online and in-person didactics. Analysis of the identified forms of adaptation created an opportunity to reconstruct the image of school that the interviewees held, how much they valued it, the trust they placed therein, the developments they predicted and desired for the institution. Focusing—responsibly, and taking stock of the possible ethical implications—on the future opportunities held by technological progress, in itself boosted by the pandemic, are located within a wider experimentation of VR-equipped classrooms, in a multidisciplinary perspective, offering a concrete solution to the needs of both students and teachers.

KEYWORDS

distance learning, pandemic, secondary school, educational inequalities, digital technologies, VR technology, digital research, web survey

Introduction

This contribution highlights a portion of the data within a broader dataset, with the intention of identifying the main *adaptation profiles to Distance Learning (DL)* within a *sample of Italian secondary school students*. Before venturing into the description of the research instrumentation devised, before illustrating the survey findings and drawing the opportune conclusions, it is important to describe the scenario in which the study is located, and the premises from which it stems. Not before, however, having stressed that the reference participants, from their varying solid socio-economic and cultural backgrounds, and with differing degrees of support from educational figures in their households, and in their scholastic and extra-scholastic environments, were called to face and adapt to the living conditions dictated by the pandemic, in a very delicate existential phase that is anything but linear, in which the formation of personal and social identity requires a great deal of energy (see [Adnan and Anwar, 2020](#); [Aucejo et al., 2020](#)).

In the face of a potential range of the youths' reactions to the ongoing transition in the academic world—and partly due to the participants' differing and preceding cognitive, emotional and social background—presented herein is empirical evidence concerning the differences perceived by the interviewees in in-person and distance learning, taking for granted that, for a large portion of students, and by and large transversally, the advent of *Distance Learning* reduced cognitive-emotional involvement in didactic activities, as well as abruptly, and at times dramatically, depleting opportunities for interaction and relations on different levels (see [Almahasees et al., 2021](#)).

Much of the scientific debate around DL has focused on the issue of *worsening social inequalities* and the *accentuation of preexisting gaps* in the school system, and in broader society likewise. Admittedly (and the empirical evidence herein confirms this picture), notwithstanding all the effort in the direction of digitalizing didactics, in a school system busy with generating *emergency training solutions*, there were those who—already struggling (due to social extraction and technological endowment/access to technology)—were left even further behind and experienced particularly critical forms of hardship ([Ciurnelli and Izzo, 2020](#); [Lombardo and Mauceri, 2020](#); [Nuzzaci et al., 2020](#); [Ghigi and Piras, 2021](#); [Istituto Toniolo, 2021](#); [Saraceno, 2021](#)).

Whereas, however, it is true that DL, in its expression, caused trouble especially to those who were already struggling, another observation cannot likewise be ignored: *the assessment of the DL experience* (and the consequent form of individual adaptation to it) *on part of adolescents*, notoriously defined as *digital natives*, also depends on their starting digital competencies, presumably already advanced and extensive in the pre-pandemic stage. On the other hand, in the face of *remotization* and

radical transformation of broad spheres of social activity—school, free time, social life etc.—in response to a system of restrictions aimed at stopping the spread of the Coronavirus ([Mancaniello, 2020](#)), the effects of which have essentially rolled over into the current post-pandemic phase, the interest in the challenges and opportunities, and in the pitfalls concerning the use of digital technology during adolescence, cannot but gain substance and beget new research questions ([Riva, 2014, 2016](#)). It is, in fact, evident how technology, already at the center of digital natives' lives, took on a pervasive character throughout the pandemic, and youngsters spent much of their *daily lives before a screen*, their existence increasingly characterized by ever-extensive usage of electronic devices. In the face of this, the contribution, therefore, has the objective of investigating how, in such a scenario, “remote” student-life took shape. This led to the interest in carrying out an observation empirically founded on the opportunities and risks connected with the use of platforms, in a scenario where the digital burst-out in schools was compounded by a preexisting, deep-seated usage of the digital (the *touch generation—native speakers* of netspeak, and the language of social networks and videogames—widely represented in our survey sample, are notoriously characterized by an ability to interact with technological devices that precedes any approach to reading or writing), especially for entertainment and recreation (consider the use of social platforms, notably Instagram, or *gaming* activities).

Evidently, in the life of the interviewed teenagers, *Information and Communication Technologies (ICT)* play a major role, along with family, school, and other significant collective subjects, rightfully entering the realm of socialization agents in contemporary digital society, in the face of their ample contribution in terms of the reproduction of symbols, representations, outlooks and cultural products of reference. Technology redefines the boundaries of bodies and space, as well as the way emotions are experienced; it multiplies networks and bonds, creates new forms of belonging and unprecedented communal bonds; it reconfigures the sense, structure and distribution of social capital; it hybridizes spaces (real-virtual), spheres (public-private), existence and relations (online-offline). Therefore, it appears essential to dwell, among other aspects, on the media diet of the interviewed adolescents, analyzing the range of technologies and services to which they have access, and partly in reaction to the upheaval on the back of the COVID-19 pandemic, while also paying mind to the nature of the familial context, and the quality and sturdiness of the relations therein. In such a scenario, one may suppose that a large chunk of *youngsters thrown into DL*, used to aptly navigating platforms long before the onset of COVID-19, possessed *digital competencies* suited to reviewing the didactics produced throughout the pandemic. In view of this, the assessment of DL on part of the reached students (see cfr. [Fasanella and Faggiano, 2022](#); [Faggiano and Mauceri, 2022](#)),

besides calling on well-known dynamics connected with social stratification, and with the effects of a social life stripped of face-to-face interaction, should take into account a cognizant, familial and widespread usage of platforms (especially those for entertainment purposes, or, at any rate, non-scholastic) on part of the young, which predates the pandemic. In this sense, a critical evaluation of DL—presuming an analysis of the students' teacher evaluations filtered, so to speak, through a “high bar”—could also be connected to 1. *the little appeal* held by e-learning platforms, hypothetically defined by digital natives as a tool for issuing didactics that is “far removed” (obsolete, poorly interactive etc.) from their daily lives; 2. the e-learning platform usage by teachers (not by chance referred to in literature as *digital immigrants*—Prensky, 2001), perhaps “clumsy” players in an academic scenario that was now suddenly remote and radically different from the “real life” one wherein, hitherto, they had moved as experts, with the utmost ease and confidence¹. In this perspective, DL could be compared to a “hastily tailored coat” sewn around the faculty, in many instances not fully up to par in the students' eyes, probably focused—throughout the pandemic—more on the available instruments for the transfer of knowledge/competency (the *means*), on the *usage of the means* and the *packaging of content*, rather than on the content itself (Pitzalis et al., 2016; Giancola et al., 2019).

All the latest studies on *online education*, see the efficient use of digital technologies for educational purposes combined with meticulous planning and preparation groundwork, aimed at engaging students and holding their attention, a collaborative working style of a reciprocal nature, along with the production of quality didactics, potentially capable, even, of exceeding the apprehension results associated to traditional didactics (see GarcíaBotero et al., 2018; Bower, 2019; Gonzalez et al., 2020; Hodges et al., 2020; Nguyen et al., 2021). Nonetheless, although it presented a challenge, DL was launched without the teachers having time to learn, in a reasoned and gradual manner, efficient transformation and adaptation strategies for their teaching style, without modifying the educational objectives, or the expected results². The abrupt interchange, therefore, took place in a way that prevented educators from adequately designing an online education that was able to mitigate the negative effects of the digital transition on the students' *cognitive engagement* and *cognitive absorption*, of which the salient

ingredients are *attention*, *interest/curiosity*, *concentration* (along with the “springs” needed to activate them (Saade and Bahli, 2005; Kemp et al., 2019). Moreover, the emergency did not give students and teachers the time to identify, tweak and test alternative communicative-relational models, suitable for transforming digital environments into spaces that efficiently express learning models based on participation and cooperation (Weick and Sutcliffe, 2011); the aforementioned was not free of repercussions on the expected learning results (Bower, 2019), on the overall psycho-emotional state of the actors involved—especially with a view to relations between peers, and between students and educators—, on the conventional achievement of educational objectives³.

Some observations on the world of *social networks* and *gaming* allows further development of the initial introductory framework in this contribution. The former are a privileged dimension in the daily activity of digital natives, for the purpose of creating hybrid social networks straddling the online and offline dimensions (Riva, 2016). The offer of *networking* platforms is now very extensive, and with that, the instruments the younger generation have to express and represent themselves are multiplying. Images and videos become an optional vessel for sponsoring oneself; meanwhile, the offer of increasingly updated applications grows, configured, nowadays, as the instruments to construct one's personal and social identity: from video editing *tools* to retouching options for pictures, from post-production applications to emojis, and so on. Instagram, namely, is the most widely used and appreciated network when it comes to teenagers sharing visual content, from existential images, to the expression of one's individual and social portent. As known, the archive and functions to share videos and images with followers, on said platform, combine with comments, the upload of temporary stories, tags, hashtags; the latter, as thematic aggregators, are keywords, issues, overarching interests, specific virtual communities. The *gaming* dimension completes the *digital identikit* of the world of the reference youth group. Its main elements of appeal can be so classified: 1. *Interactivity* (dynamic, creative and strategic roles during gameplay; challenges experienced in the first person; personal contribution to the course of the game); 2. *Immersion* (relating to characters/mission of the game; complex storylines; emotional impact); 3. *Simulation* (even when set in a fantastical setting, the game presents such a level of detail that the player, becoming immersed in the portrayed situation, can experience situations that near reality, be it a journey into space, piloting a racecar or the adventures of a superhero); 4. *Shared gaming experience*

1 These considerations are certainly valid, above all, for older educators, inevitably further removed, and not just chronologically, from the digital natives generation, and for faculty in primary and secondary schools, more than for university professors, who have a longer history (thus, before the advent of COVID-19) of involvement in the process of digitalization and innovation of didactics.

2 On the innovative potential that recourse to digital holds in periods of “normalcy”, and with adequate degrees of design and planning, refer to the volume edited by Veletsianos (2016).

3 There is another aspect that, at least, warrants a mention: the physical space where students utilized DL is found within the household, a space that is anything but neutral, inhabited by a varying number of individuals and, commonly, the setting for a variety of activities, not exempt from problematic aspects and forms of interference vis-à-vis the ordinary flow of the educational-training process.

in a hybrid space/Socializing function (in terms of reinforcing preexisting friendships and/or the possibility of forming new ones, the realization of forms of conversation and interaction carried on by extroverted subjects, and shy, more reserved profiles alike). Several are the benefits and positive aspects connected with the dimension of *gaming*: the existence of complex and enigmatic storylines can run concurrently to the development of logical thinking, incentivize the capacity to devise strategies and identify solutions to problems, it can affect creativity; the presence of *group tasks* reinforces the sense of belonging and the propensity to collaborate with others, exposure to different cultures, be they real or imaginary, and other identities. It is not by chance that the term *gamification* refers to a tendency, that is increasingly gaining traction, to import rules, techniques and methods from the gaming world into other dimensions, for example education, with the purpose of intensifying and improving—as regards the end user—the communicative effectiveness of content, interest and curiosity, enjoyment (why not have fun while learning at school?), *engagement*, learning/assimilation opportunities, interaction dynamics. In this regard, experimenting with digitally-supported innovative didactic methods—of which there is no shortage of concrete examples in both the pre-pandemic and pandemic stages—could represent a stimulus for the future implementation of participatory education models, capable of fostering and reinforcing critical thinking, the desire to delve deeper and the development of basic, transversal competencies on part of the students.

It is abundantly evident that the world of social networks and online games, here referred to as it constitutes a precious reference model for designing the didactics of the future, besides the advantages and opportunities, carries risks and snares. It will suffice to consider situations in which a teenager may invest excessive temporal or cognitive resources, or worse still, fall into veritable forms of *digital addiction* (Mauceri and Di Censi, 2020), and/or *social isolation-withdrawal*. The restrictive measures in place to contain the pandemic, and the consequent social isolation, on the one hand, in combination with DL, with an end to avoiding the interruption of scholastic-training programs, have incontrovertibly contributed to increasing the time spent on digital devices/platforms. The trait of *hyper-connection* is certainly not risk-free (in terms of the reference target, a red flag is constituted by the decline in academic performance), including the rise in aggressive behavior, a wide array of forms of psychological distress, the frantic search for confirmation and virtual admiration, body shaming, cyber-bullying (Quwaider et al., 2019; Li et al., 2020; Rudolf, 2020). Only a trained and cognizant use of platforms can protect these youngsters from snares and from drifting, and from a dysfunctional use of DL, and insufficiently innovative post-pandemic didactic formulas. This brings into question the main socialization agencies around adolescents, parents and teachers first of all, who represent—facts at hand—a generation that is still too distant from their younger

counterpart in terms of digital competencies and penchant for innovation. These role models are the ones holding the key to these youngsters' future, provided they prove themselves more willing to “make their own”—in a constructive and reciprocal manner—the daily practices of the young: 1. educators, by way of a more active contribution to the digital switch, not just in terms of expanding their digital competencies, but simultaneously implicating greater openness and empathy toward the young, for whom to develop and systemize the willingness to meet needs, innovative solutions and tools for designing the school of tomorrow (see Wang et al., 2021); 2. parents, again by way of closing the gap in terms of the digital natives generation, with a view to a more careful monitoring, and more active participation in the lives of their children, who are inevitably at risk in an increasingly digitalized world, and who may plausibly switch off their cameras during a boring lesson, preferring an immersion—with no regard for time—in a non-academic virtual experience, considered more appealing, and more important to the self.

Given these premises, our question, also taking into account the possible ethical implications, is whether, among the future opportunities for the world of school-born out of a technological progress, in itself boosted by the pandemic —, a more widespread experimentation of VR-equipped classrooms could appear, thus identifying concrete solutions to the needs of both students and teachers students and teachers, in a multidisciplinary perspective.

Materials and methods

The study from which the present contribution⁴ stems, carried out nationwide at the height of the pandemic (spring of 2021), is a *closed web survey targeting a specific population* (see Mauceri et al., 2022), funded by Sapienza University in Rome, which comprised 209 of the 1,599⁵ institutions in Italy's region and province capitals (calculated return on percentage on academic institutions: 13%). The cases reached were 6,689 overall, whereas the chosen classes for the survey, two per institute, were second and fourth-year students.

Starting with the complete list of contacts, arranged by institute and territorial context, all school Directors were sent, well-before the official launch of the survey, an email inviting them to participate in the research initiative, comprising—other

4 The study, entitled *Critical Thinking and Cognitive Populism in the Digital Platform Society*, is within the scope of activity of the Observatory of Electoral Sociology and the Department of Communication and Social Research (Scientific Director of the Observatory: Prof. Maria Paola Faggiano/Research Coordinator: Prof. Carmelo Lombardo).

5 The complete updated list of the email addresses of upper-secondary Italian schools located in region and province capitals nationwide is available online on the website for the Ministry of Education (Source: *Open Data MIUR 2019–2020*).

than the questionnaire file, which was subsequently digitalized for the purpose of online data collection—detailed information about the sponsoring bodies, and institutional entities formally involved in the project (University, Department, Observatory, scientific Coordination), about the scientific objectives, the research tools (techniques, tools, data analysis methods), and the intended use of the findings. A complex, careful reminder plan was provided for (three in all, sent out every 2 weeks of survey); furthermore, with the individual confirmation obtained, scientific collaboration effectively took shape on the basis of the active role of a teacher-representative for each relevant institute, an invaluable link between the research team and the interviewed students.

The survey took place in class during an entire period, wherein students from the selected classes (chosen by the school, on the back of the research group's indications, intended to reach a sample as ample and heterogenous as possible—in terms of variables like gender, nationality, academic performance etc.) completed the questionnaire online, mostly using their smartphones (in residual cases, with PCs or tablets provided by the school).

Recourse to the web survey, essentially “mandatory” in contingencies heavily conditioned by the restrictions dictated by the medical emergency, presented advantages and drawbacks. Typical web survey limits, including *sample mortality* and its *lacking statistical representativeness* (the sample reached is “self-extracted”), affect the present research occasion as well. However, as for the former aspect, it must be underlined that the element of “closure”, i.e., the inclusion of a *special population*—in this case Italian upper-secondary school students—constitutes (and has in fact constituted) an incentive to participation in the research. Moreover, the advantages connected with the use of such technique also fully characterize the present study: ample *sample coverage*; high *response rate*; *possibility of comparing*, subsequently, *the reached sample and the reference population* as to known characteristics; *curbing the cost of data collection and data entry*; *possibility of prompting sample subjects to respond*; *lower risk of social desirability of answers* and *higher drive for honesty* in case of intrusive questions (probably, in this latter regard, interviewees felt more comfortable in their assessment of the DL experience, as of their teachers' performance, in the absence of an interviewer).

The survey questionnaire is semi-structured and its web form was obtained through the platform *LimeSurvey*; it comprises 68 questions—including: closed, semi-closed and open questions; single-answer, multiple choice and battery—and presents as a fairly complex and intricate tool (numerous thematic dimensions were studied, and it contains several filter-questions).

As much as the sample reached cannot be considered statistically representative (the choice of second and fourth-year classes was not fortuitous), it is still notable that, when comparing the population and sample as per the

variables *course of study* and *geographical area*, no particular unbalances emerged:

1. *Course of study in the population*—Gymnasium (High School Curriculum): 44.2%; Technical: 22.8%; Vocational: 21.3%; Mixed Institutes: 11.7%; *Course of study in the sample*—Gymnasium (High School Curriculum): 42%; Technical: 27.8%; Vocational: 25.4%; Mixed Institutes: 4.8%;
2. *Geographical area in the population* — Northeast: 14.9%; Northwest: 28%; Midland: 24.4; South: 20.8%; Islands: 11.9%; *Geographical area in the sample*—Northeast: 15.3%; Northwest: 23%; Midland: 25.8; South: 28.2%; Islands: 7.7%.

As mentioned, the study touched upon different aspects of young people's daily lives (from their school curriculum to family life, from uses of spare time to utilization of digital platforms, etc.), including the DL experience; the object of the work is to evaluate the *impact of DL on the students' lives*, actualized in terms of the perception of said expression of training, in a comparison of DL and in-person didactics as per three main spheres: *sociality* (interaction and relations with peers and educators), *energy invested* (time management, school commitment, study load), *efficacy* (appeal, acquisition of knowledge and competencies), *performance*.

Among the agents of influence considered to evaluate the weight of DL on studies, are:

1. *Socio-demographic variables* (gender, age, region/area of residence, nationality, composition of family unit, family's cultural capital, parents' job, etc.);
2. *Environment in which DL takes place* (available technology—in the household or school—and characteristics of the living space, oftentimes shared, throughout the COVID-19 emergency, with other subjects in DL and/or Remote Working frameworks).
3. *Familial atmosphere and system of relations/social and cultural opportunities fostered in the household*;
4. *School performance and quality of relationships in the context of school*;
5. *Usage of digital platforms, social networks and gaming*.

Finally, it appears gainful and appropriate to point out that within the questionnaire, are few and specific questions relating to DL, as there are few, targeted queries regarding the availability, at home and on the respondents' school campus, of adequate equipment (internet connection, e-learning platforms and digital devices in use), as a starting point for dealing with the emergency from a learning perspective. For obvious reasons of instrument economy (filled, furthermore, with references to multiple area of young people's daily lives), the questionnaire does not aim to retrace prior instances of the implementation of the digital in Italy's upper-secondary schools (in terms of investments predating the pandemic toward digital innovation

and the acquisition of digital culture at school), nor the didactic methodologies adopted in the participants' study contexts. In the face of said limits, the questionnaire attributes the utmost relevance to the interviewees' assessments of the experience; moreover, a rich selection of questions aims at accounting for the interviewees' social profiles (with a particular view to: socio-cultural capital; material living conditions; affective, cognitive and relational resources of the subjects reached), a background that is variable and, simultaneously, essential to carry the load of an unprecedented emergency.

Results

Interviewees' opinions and assessments 1 year later: From the items to the factorial axes

A year from the outbreak of the Coronavirus emergency, the participants were asked to state their *preferred mode of didactic issuance*: within a picture that appears decidedly complex, the highest percentage of responses indicates a predilection for traditional in-person didactics (45.6%); followed by a preference for mixed didactics (30.6%), then the favoring of distance learning (23.8%).

Opinions on DL—which represent assessments bearing a specific reference to personal experience, not generalized judgments on the effects of DL on the figure of the student and school as an institution—are analytically depicted in the ribbon chart below (Figure 1). As can be seen, DL increases the risk of distraction and disruption, and negatively and transversally affects interactions between peers and with educators, leading to a decline, in one in four cases, of academic performance. However, the latter remains unchanged in 53.3% of cases—the highest percentage of consistency in the comparison between the pre-pandemic and pandemic phases—and improves 22.5% of the time. In terms of the positive effects of DL, noteworthy is the substantial percentage of responses (49.6%) concentrated on the option “allows for better time-management.”

The application of *Multiple Correspondence Analysis*, based on the 9 items referring to the assessment of the DL experience, allowed for the creation of an interesting synthesis of the pool of starting variables. Two factors were identified, which respectively explain 35.26 and 13.05% of the common inertia, the denomination for which was derived from careful overall reading of coefficients and factorial coordinates:

1. *Impact on the efficacy of the course of study* (appeal, learning and acquiring competencies) *and on the quality of teacher/student relations* (negative pole: no/positive pole: yes);
2. *Impact on the study load, performance* (timely progression, marks received) *and on the quality of peer relations*

(negative pole: yes, increase and declining performance, but no difficulty interacting with peers; positive pole: no increase nor declining performance, but difficulty in interacting with peers).

DL adaptation profiles: The influence of the physical and socio-cultural environment

Based on the extracted factors, through the application of *Cluster Analysis*, four main DL adaptation profiles were identified. Observing the internal composition of the groups that emerged, an attempt was made to *gauge the actual weight* of DL, *beyond the estimated, perceived, not always fully conscious one* supplied by the recorded answers. With the following tables (Tables 1–4), where the *test-values* are listed in descending order of importance (more specifically, they show coefficients higher than 2 in absolute value, i.e., those highlighting statistically significant associations between groups and active and illustrative variables-modalities), the process of interpretation and labeling of the emerged groups can be retraced (see the key below Tables 1–4 for the distinction of critical aspects, and not between active and illustrative variables-modalities). The review of the individual groups that emerged, yielded the following findings:

- *First Group: Adversarial* (24.9%–Table 1)—These subjects present serious distress both on the educational and relational levels, which hinders any and all future projects, and seems to imply the compounding of past and present hardships. Their *attitude* toward DL is one of complete *rejection* (hoping for a return to in-person didactics). These are socially vulnerable subjects, more often from traditional High School curricula, which bear the brunt of serious deficits and problems both at home and at school. A return to school is therefore perceived as the only deterrent in the face of difficulties that appear increasingly unsurmountable.
- *Second group: Dialectics* (36.9%–Table 2)—These are students who suffer most of all on a relational level (it is a problem of the present pandemic times, not a legacy of the past), who miss face to face interaction with their peers and their educators. They present a strong penchant for studying, and their *dialectic* approach is *of an adaptive type* (their predilection is for in-person didactics, but they are open to mixed didactics). Theirs is evidently not an open conflict with DL, seeing their capacity to keep their interest and motivation for study alive, to complete a successful course of study and design their future in higher education. These students, geographically located in Italy's Northeast (equalized, plausibly, by a local society which fruitfully

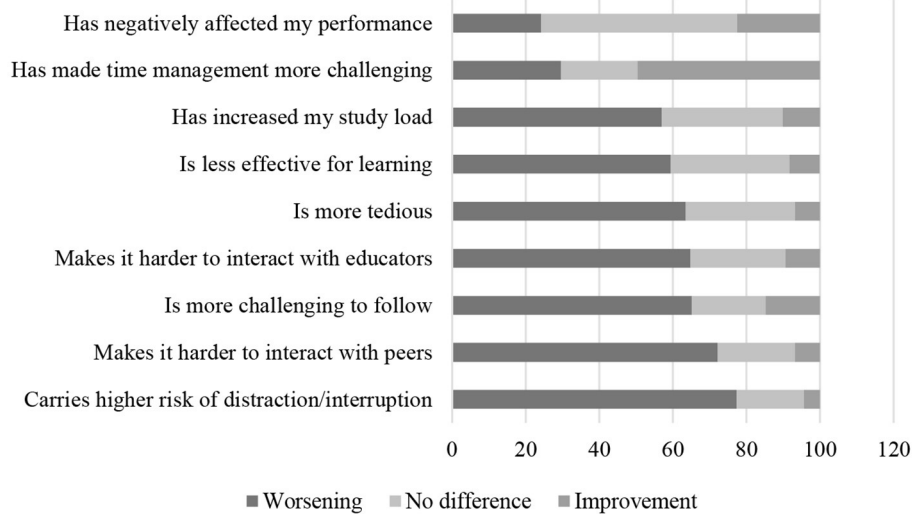


FIGURE 1
Opinions on DL.

invests in education and scholastic organization), are the strongest high school students, socially (employed parents, elevated cultural capital etc.), academically (consider the data on academic performance, prior to and throughout the pandemic) and emotionally (solid family bonds, quality relations at school etc.). The critical approach of the *Dialectics*, «deprived of quality relationships» and brilliant academic records, implies an awareness of the consequences, and not just in the short term, of DL; in the face of a strong connection to school (as to values, content, actors), they, in practice, resent the form didactics took on during the emergency phase.

- **Third Group: Consensual Critics** (18.7%–Table 3)–This group of students, despite favoring DL (and not excluding mixed didactics), seem to be having trouble due to increased work load, the greater effort required for educational activities, time management; in view of their prior instrumental/Heterodirected choice of their course of studies they are burdened, all things considered, by the weight of DL, with no support from their family of origin.

Observing, in synthesis, profiles 1 and 3, these seem to receive the full force of the negative impact of DL, and the *interpretative key of prior deficits, material and relational*, may apply. It in fact appears that the students most afflicted by DL are those:

- With troubled academic records;
- Non-Italian;
- Whose families experience serious economic and employment issues;

- With prior problems with relations, family and school;
- Struggling in terms of available household spaces (for studying and personal leisure) and with limited opportunities for entertainment and cultural growth.

DL, therefore, entails *the scaling of future projects on part of the very subjects who are «already» vulnerable*, who are at higher risk of dropping out of school, and of social exclusion.

Fourth Group: Consensual Opportunists (19.5%–Table 4)–These subjects present an *adaptation to DL, on the educational and relational fronts*, based on an *instrumental-acritical type of consent*. In the eyes of these students, typically from the South of Italy (like *Consensual Critics*), DL appears as an efficient solution, with a view to quickly wrapping up, without too much effort, their time in school and break speedily into the world of work. In terms of these participants–*their audio and video* presumably unfailingly *turned off*, whose attendance during lessons and, more generally, at school is anything but active – the impression is that an individual acritical approach, and an opportunistic one lacking farsightedness have insidiously combined, possibly with *the help of the faculty* (perhaps not overly concerned with monitoring the attention and participation of the student body). The collected answers point toward a decrease in study load, a surprise indeed in contexts such as technical institutes, known for exposing students to workshop, like technical-practical, activities.

These kids, evidently projected toward the professional world, are eager to find a job and, simultaneously, come from family contexts that struggle in this regard. In view of a behavior that appears to be institutionally tolerated at higher levels as well, they experience DL as a *cushy parking area*

TABLE 1 First group (24.9%): Adversarial.

Active/illustrative variable label	Significantly associated modality	Test-value
DL makes time management more challenging	Yes	47.81
DL increases the study load	Yes	36.70
DL leads to a decline in performance	Yes	36.23
DL requires more effort	Yes	35.39
DL undermines the learning process	Yes	35.31
DL is more tedious	Yes	33.50
DL makes it harder to interact with educators	Yes	30.51
DL carries greater risk of distraction	Yes	24.78
Preferred didactics	In-person	24.69
DL makes it harder to interact with peers	Yes	15.50
Changes in own social life on account of the pandemic	Used to be satisfying, now unsatisfying	9.70
Assessment of suitability of available space in the home	Unsuitable	9.55
Degree of confidence in teachers	Low/None	7.33
Relational criticalities at school	Problems with peers/teachers	6.97
Gender	Female	5.92
Quality of familial atmosphere	Ambivalent/Negative	5.04
Satisfaction as to free time in the family modality	Low/None	4.89
Number of electronic devices in the household	At least one	4.63
Able to rely on parents and teachers if necessary	Somewhat on teachers	4.04
Comparison of the modality free time in with family/others	Fewer opportunities for leisure	3.92
Satisfaction as to free time in the family modality	Satisfied to some degree	3.50
Composition of family unit	Absent parents – one parent present/yes siblings	3.12
Type of institution	Gymnasium (traditional HS syllabus)	2.89
Number of people that can be relied on if necessary	Small	2.50

Critical aspects active variables.

No critical aspects active variables.

Illustrative neutral/positive variables.

Illustrative variables negative connotation.

TABLE 2 Second group (36.9%): Dialectics.

Active/illustrative variable label	Significantly associated modality	Test-value
DL makes it harder to interact with peers	Yes	32.38
DL makes time management more challenging	No	31.05
DL increases the study load	No	30.16
DL carries greater risk of distraction	Yes	29.74
DL makes it harder to interact with educators	Yes	29.68
DL is more tedious	Yes	27.80
DL undermines the learning process	Yes	27.33
DL leads to a decline in performance	No	14.89
Preferred didactics	In-person	8.81
Preferred didactics	Mixed teaching	5.15
Distance Learning requires more effort	Yes	3.26
Post-graduation prospects	University	6.09
Academic record	Good/Excellent	6.05
Type of institution	Gymnasium (traditional HS syllabus)	6.04
Parents' employment situation	Employed	5.38
Quality of familial atmosphere	Positive	5.35
Assessment of suitability of available space in the home	Suitable	4.96
Relational criticalities at school	No issues	4.95
Geographical location	Northeast	4.67
Degree of confidence in teachers	High	4.58
Nationality	Italian	4.11
Geographical location	Midland	3.33
Cultural capital of family	High	3.29
Composition of family unit	Both parents present/yes siblings	2.99
Intensity of family life in social and cultural terms	Medium-high	2.95
Individuals in Distance Learning or Remote Working frameworks present in household	Presence of RW	2.94
Satisfaction as to free time spent in the family modality	High	2.76
Choice of secondary school	Self-directed	2.75

Critical aspects active variables.

No critical aspects active variables.

Illustrative neutral/positive variables.

Illustrative variables negative connotation.

TABLE 3 Third group (18.7%): Consensual critics.

Active/illustrative variable label	Significantly associated modality	Test-value
DL increases the study load	Yes	23.91
DL undermines the learning process	No	23.27
DL makes it harder to interact with educators	No	18.63
DL is more tedious	No	18.22
DL makes it harder to interact with peers	No	18.13
<i>Preferred didactics</i>	<i>Distance Learning</i>	10.70
DL carries greater risk of distraction	No	7.82
<i>Geographical location</i>	<i>South</i>	4.88
DL makes time management more challenging	Yes	4.82
DL leads to a decline in performance	No	4.41
<i>Preferred didactics</i>	<i>Mixed teaching</i>	3.71
DL requires more effort	Yes	3.56
<i>Nationality</i>	<i>Not Italian</i>	3.69
<i>Composition of family unit</i>	<i>Absent parents – one parent present/no siblings</i>	2.69
<i>Quality of familial atmosphere</i>	<i>Ambivalent/Negative</i>	2.63
<i>Choice of secondary school</i>	<i>Heterodirected</i>	2.47

Critical aspects active variables.
No critical aspects active variables.
Illustrative neutral/positive variables.
Illustrative variables negative connotation.

in a manner that's not problematic or conflictual. However, they are also at risk of exclusion: *DL as an expedient and exit strategy* vis-a-vis school, perceived as a hindrance, which also reflects a strong connection between socio-cultural and geographical contexts and schooling (Bourdieu, 1984), could end up undermining the traditional functions of school and the role of teachers, as well as condemning those kids trapped in this spiral to *likely social descent*. Scant commitment and studying, the degradation of the content and activities provided, school marks perhaps stemming more from ritualistic practices than actual assessments of performance, cannot but result in modest academic profiles devoid of any specific skills, and not too enticing on the job market.

TABLE 4 Fourth group (19.5%): Consensual opportunists.

Active/illustrative variable label	Significantly associated modality	Test-value
DL is more tedious	No	48.60
DL undermines the learning process	No	46.98
DL makes it harder to interact with educators	No	46.65
DL carries greater risk of distraction	No	45.48
DL requires more effort	No	41.31
DL makes it harder to interact with peers	No	32.43
<i>Preferred didactics</i>	<i>Distance Learning</i>	28.58
DL makes time management more challenging	No	26.04
DL increases the study load	No	22.87
DL leads to a decline in performance	No	22.51
<i>Changes in own social life on account of the pandemic</i>	<i>Satisfying in past and present</i>	8.63
<i>Geographical location</i>	<i>South</i>	7.96
<i>Type of institution</i>	<i>Technical institute</i>	6.60
<i>Post-graduation prospects</i>	<i>Employment</i>	6.51
<i>Gender</i>	<i>Male</i>	6.49
<i>Assessment of suitability of available space in the home</i>	<i>Suitable</i>	5.22
<i>Parents' employment situation</i>	<i>Unemployed</i>	3.92
<i>Academic record</i>	<i>Satisfactory</i>	3.85
<i>Type of institution</i>	<i>Vocational</i>	3.77
<i>Choice of secondary school</i>	<i>Heterodirected</i>	3.68
<i>Relational criticalities at school</i>	<i>No issues</i>	3.37
<i>Satisfaction as to free time in the family modality</i>	<i>Satisfied</i>	3.33
<i>Parents' employment situation</i>	<i>One parent unemployed</i>	2.95
<i>Intensity of family life in social and cultural terms</i>	<i>Low</i>	2.55

Critical aspects active variables.
No critical aspects active variables.
Illustrative neutral/positive variables.
Illustrative variables negative connotation.

DL adaptation profiles: Influence of the digital environment

The available data paint a fairly eloquent picture in terms of the interviewees' usage of technology. Before reviewing the findings regarding the usage of digital platforms and social networks for non-educational purposes, it is certainly worth dwelling on a critical aspect directly connected to the DL

experience, the foundation, as it were, of a process of adaptation to it, or lack thereof.

Starting with *Internet connection*, essential to access online lessons and to complete assigned homework and tasks: in reference to their own *household*, it is viewed as inadequate by 14.2% of participants, in reference to *the school campus*, it is defined as lacking by 61.6% of them (a twofold negative review, at home and at school, is found in 8.7% of cases); these are clearly remarkable percentages if one thinks the survey did not take place at the start of the pandemic, but in its second year [see the 2021 Youth Report (Rapporto Giovani), published by the Toniolo Institute]. Either way, the perceptive data presented herein on the dimension of the *density/functionality of the connection* would need to be compared to their objective counterpart, encompassing a targeted assessment of the current technological equipment in Italian schools. Less problematic are the data regarding the available technology in the household: among the available devices laptop computers stand out (85.6%), followed by tablets (57.4%) and desktop computers (38.9%); only 2.5% of participants appear to have no devices (excluding smartphones, which were available to all the contacted interviewees). *Adversarial*s are the most affected students in this regard as they, above others, lament precarious internet connections both at school (35.9% vs. values between 17.1 and 28.4% for the other profiles) and at home (32.6 vs. 17.3–18.1%). The *problem of “access” to the internet and to technology*, along with that of *inadequate household spaces for studying-leisure*, when present, *exacerbate all other identified issues*. In contrast to the school's subpar performance, most households were instead found to have *electronic devices* (one in 45.4% of cases; more than one for 35.2% of them) and *an internet connection*.

Moving on to the hardware and software components, and focusing on the digital environment in which the young participants are located, the traits of *diffusion* (or better still, *immersion*) and *transversality* with respect to *access and usage to/of entertainment platforms for streaming movies, TV shows and music* appear glaring within our sample: 95.2% of respondents state they access at least one of the listed platforms (Netflix, Amazon Prime Video, Disney+, Sky, Spotify, Infinity, TIMvision, Dazn, YouTube Premium, Now TV, Discovery+ e Apple Music) and nearly one third (30.1%) say their family has five subscriptions or more. Accessing audio-video content, more than a leisure activity of a personal nature, is above all an opportunity to share and compare in identity and relational terms (Caneva, 2012; Coviello and Re, 2020), capable, by virtue of the web and social platforms, of feeding and consolidating networks of interactions and connections, and specific skills likewise, both within and without the family context.

The interviewees were also asked to rate, by importance, the most utilized social networks and apps. Whatsapp comes out on top, followed by Instagram (the use of both Whatsapp and Instagram pertained to about 90% of interviewees, while 60%

or so of the sample was characterized by the combined usage of said apps). TikTok and YouTube follow, then, residually, the remaining platforms. By aggregating all the data, *instant messaging platforms* amount to 33.6% of all answers and *social networks centered around images* (among which Instagram prevails) embrace 32.4% of the collected responses. In third place are *social networks for videos and live streams* and, residually, *platforms for online meetings and non-descript social networks*.

Where all the teenagers in the sample use social platforms in general, nearly all of them have an Instagram profile. It in fact surfaced that 1 student in 10 does not use Instagram, around 20% of respondents are characterized by reduced usage of said platform (up to 1 h - we here find 40% of *Dialectics*, in the face of percentages between 15.4 and 28.4 in other groups), just over 40% by moderate usage (1–2 h), the remaining 30% or so by substantial use (2 or more h per day). The latter group comprises the sub-group of the hyper-connected, who have claimed to spend over 5 h on Instagram each day, right up to estimates in the double digits.

In line with national and international studies on young people's use of Instagram, the presented case also saw the widespread and transversal use of the platform, its assiduous, sometimes pervasive consumption, a certain pull toward acquiring the status of influencer, a tendency for *showcasing* as an instrument to construct and reinforce the ever-growing social and media exposure (Codeluppi, 2021). Findings, reported in detail below, which highlight the need for an increasingly active and prepared involvement in the lives of growing youngsters—for whom digital technology and internet connection are the norm—on part of families and the world of education. Girls more than boys (31.1 vs. 25.5%), like students in vocational institutes (36.4%) more so than those in traditional Gymnasium-type curricula (25.1%) and technical schools (29.5%)—who are clearly subjected to a heavier study load—are characterized by a particularly substantial use of Instagram daily. An occasionally excessive consumption of this app (which, it must be recalled, is used in combination with other platforms) is also associated with unsatisfactory school performance (37% of cases, compared to 31.9% of subjects with satisfactory achievements and the 24.1% who average good or excellent marks).

The participants were asked, moreover, to list the number of their Instagram followers and following, with the purpose of assessing the breadth of their network on said platform, and grasp the diffusion of *potential influencer* profiles, subjects, in other words, capable of conditioning their reference community, evidently by virtue of their power of communication and aggregation, and engaged in building their reputation within their reference network. The resulting picture shows the interviewees clearly immersed in copious networks, and a good number of them inserted into the category of potential influencers; it shall suffice to consider that around 15% of students can claim over 1,000 following, and ~20% presents over 1,000 followers.

The questionnaire comprised an interesting question (*Open your Instagram “browse” tab now, what are the first three things you see?*), aimed at grasping what, amidst the contacted students, the main uses of the platform were. On the open-answer format of the 5,536 valid cases totaled (of the 6,689 contacted through the survey), statistical-textual analyses were carried out. The text comprised 39,240 occurrences, including 3,717 distinct forms. By using a mixed procedure, partly automated and partly customized, 385 keywords were identified. These, essential to a correct breakdown of the functions attributable to Instagram, are presented in the following word cloud (Figure 2).

Besides generic words like post, video, meme, photo (which each recur between 900 and 1,000 times), it is notable how the pillars of young people's searches on Instagram orbit, essentially, the following focal points: soccer, clothing, friends, food, girls (400 occurrences and above); fashion, make-up, sports, TV shows (300–399); motorbikes, anime-manga, quotes and phrases, shoes, news, nails (between 200 and 299).

The analysis of the data available on Instagram ends with a reference to the linguistic specificities surfaced in the analysis of the textual corpus as per the DL adaptation profiles: 1. *Dialectics* present a use of the platform that is especially complex, varied and sophisticated, in which the mainstream media and real life find ample room—their searches comprise several *sporting disciplines, music festivals, art, current events*; 2. *Adversarial*s feature persistent references to *fashion* and well-known *brands, make-up, star signs*; 3. *cartoons, gaming, drugs, engines* prevail in the *Consensual Critics'* searches; 4. similarly, *gaming, soccer, MotoGP, celebrities* are the specifics of the *Consensual Opportunists'* profile.

Moving on to the data collected on the dimension of gaming, it can be said that a large chunk of *non-players* (38.2%) counterbalances an even greater number of *gamers*, assiduous and passionate to varying degrees (the remaining 61.8%). The *occasional gamer* profile recurs in nearly 30% of cases, followed closely by that of the *assiduous gamer*, who dedicates at least 1 h a day to this dimension, up to a maximum of 4 h (25.1%). At the bottom, *hardcore gamers*, who allocate a substantial number of hours to videogames each day (at least 4, but in some cases 8 or more).

Amidst the *subjects removed from the gaming world* there is an abundance of females (62.9 vs. 11.6% of males), high school students and those enrolled in vocational schools (45.4 and 42.7 vs. 26.2% for technical institutes), students with a good or excellent academic record (44.3% vs. percentages between 28.2 and 33.2 for profiles with lower marks), those subjects intending to continue their studies and oriented toward higher education (45.6 vs. 27.9%—subjects intending to seek employment after graduation—and 30.9%—subjects who are undecided or intending to take a break after completing secondary school), interviewees with a particularly intense social and cultural family life (in the dichotomous capacity of the index: 42.2 vs. 33.6%).

Among the assiduous and hardcore gamers boys prevail over girls (respectively 43.7 vs. 7.7% and 12.9 vs. 2.5%), technical institute pupils (33% vs percentages between 20.4 and 21.8 for assiduous gaming, and 11.2% vs values between 4.5 and 8.3% for the hardcore tier) and *Consensual Opportunists* (32% of hardcore gamers vs. values under 23% for other clusters); moreover, it would seem that extreme or assiduous gaming has a negative impact on academic performance, while being contemporaneously connected with the prospective of leaving education after secondary school, and with a more modest cultural input on part of the family of origin ($p = 0.000$). It should be noted that the degree of satisfaction relating to the quality of free time spent within the family is fairly high/very high in 80% of cases, in an almost transversal manner. In the case of *Consensual Opportunists*—hypothetical DL users with no audio or video, but also passionate and frequent multi-platform users—the feeling is that the faculty's tolerance of certain academic behaviors, is met with just as much carelessness, if not general laxity in the household, a source of satisfaction for these youngsters. The abovementioned figures lead to the hypothesis that an opportunistic conduct may be more widespread than what was actually recorded. What emerged seems to lend itself to be interpreted as a form of *gratification connected with meeting particularistic and “surface” needs, disconnected from the achievement of concrete, personal educational-growth objectives*. In the face of these facts, the doubt creeps up that the *household environment* may be so broadly permissive, that it could be defined as *tailored to the youngsters' needs*. There is no shortage of particularly conscientious and responsible youngsters; however, most probably take advantage of such freedom, which in the long term is detrimental, as well as very risky.

The information at our disposal ends with references to preferred gaming mates. One fourth of interviewees preferred *playing solo*, the majority (54%) claim they *share gaming with real-life friends*. The remaining participants, in similar proportions, which in both cases are just over 10%, prefer on the one hand, games they share with their family members (real-life subjects, siblings in particular), on the other, gaming practiced within the reference *virtual community* (the latter surfaces as a typical trait of *Consensual Critics* — $p = .000$). While assiduous gamers tend to select real-life friends for online games, thus fully hybridizing the two spheres of life, *hardcore gamers*, conversely, tend to prefer relations and *gaming* experiences that originate within the Web, and develop and take form therein (25.8% vs. percentages between 5.9 and 11.2% for other interviewee profiles).

The available empirical base encourages the problematization, and critical observation of extreme exposure to the world of *gaming*, which—within a process where it is a causally relevant factor (for example, with respect to bumpy academic performance), or a factor with significant effects (as a fallback for or reaction to familial and social contexts offering

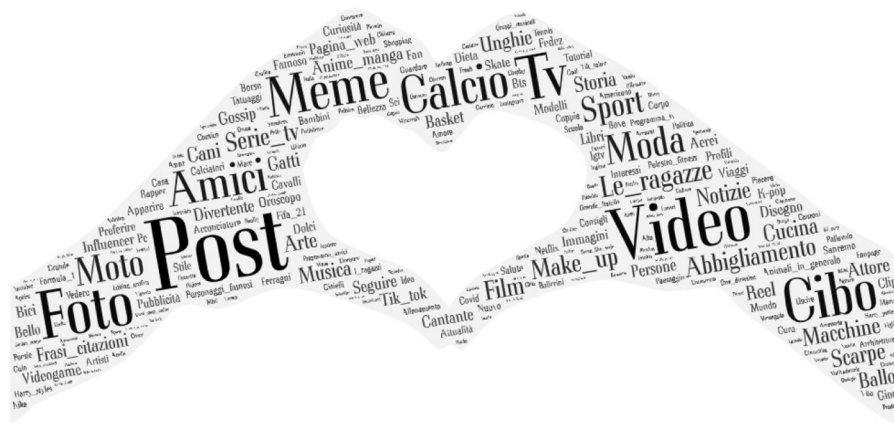


FIGURE 2
The instagram “browse tab”: keyword cloud.

little stimulation or appeal to youngsters, resulting, in extreme cases, in forms of social withdrawal; the expression of a personal immersion into a given community; or still, a reflection of an existence heavily conditioned by the pandemic emergency)—can turn out to be an insidious source of depletion of resources (attention, focus, psycho-physical balance, time, money) and future prospective. By contrast, there are tangible elements to define most of the interviewees' approach to the world of *gaming* as responsible; in this sense, it could be interpreted as a cultural and cognitive resource, as well as a basis to form expectations vis-a-vis school, and for reviewing the performance of teachers/the degree of innovation of the instruments available in schools.

Discussion

The empirical evidences presented herein lend themselves to reflection which, it could be said, enriches and elaborates the reading, confirmed⁶ on several fronts, of the DL experience centered on the theme of *digital divide*. As known, the pandemic emergency has deeply affected schools' priorities, suddenly moving the needs connected with, precisely, digitalization to the top of the list (it shall suffice to consider the government's substantial economic investments in 2020 and 2021⁷, aimed

6 For further information on the official statistics relating to IT-digital equipment in Italian families, divided by the age of their offspring, by relevant territorial area, (the deficit is particularly problematic in the South), by the presence, or lack thereof, of differently abled students, etc., see Istat, 2020, 2021.

7 The Italian government has deployed sizeable resources to support DL during the lockdown and the height of the pandemic; moreover, the PNRR (National Recovery and Resilience Plan) includes three transversal priorities shared by Europe at large, among which are *digitalization*

at improving the connectivity of educational institutes), albeit the results of such assistance did not always appear fully conclusive, nor evenly distributed on the territory. Moreover, with respect to the issue of digital competencies, closely connected with teachers, who represent the fundamental link for the transmission of educational content (and less connected, assuredly, with students, that is to say, the demographic of digital natives), it was found that half of Italian educators—who, furthermore, widely consider themselves poorly equipped in terms of using digital technology—were never exposed to practical and specialized forms of training devoted to innovative didactics of a *digital* stamp (OECD, 2020).

In the face of this, one can imagine the unease experienced by a large number of Italian educators, suddenly catapulted into the realm of distance learning platforms, and forced to direct old knowledge into new and unfamiliar, or wholly uncharted, channels.

Although the combined action of the abovementioned deficit factors, also considered in view of appropriate socio-territorial variables, could sufficiently explain most of the above findings, it is necessary to carry the ongoing reflection forward, transforming the surfaced evidence as to “the school of the pandemic” into a broader “lesson for the future” for the national education system. This, above all, based on the concerns expressed by the vast majority of students—including those who maintained brilliant academic careers throughout the pandemic, the motivated ones, inserted in scholastic/household contexts with effective technological equipment—in the condition of potentially optimal usage of DL.

As known, a wide range of webinar and videoconferencing apps (including Google Meet, Zoom, Cisco, Webex etc.), along with integrated system for module-based learning (such

and *innovation*, and comprises six essential missions, including the one denominated *Digitalization, Innovation, Competitiveness, Culture*.

as Microsoft Teams and GSuite for Education), and instant messaging services (like Whatsapp, Telegram), comprise the most widely used “technology pack” for the issuance of DL (see Mascheroni et al., 2021). Though not excluding that said tools represent a fruitful channel for the transmittal of some content, which can also provide for the tangible learning results, it makes sense to question whether, and to what degree, platforms with said communicative-interrelation architecture can effectively reproduce complex experience compositions like *being at school* and *going to school*. Whereas, in fact, DL has also complicated and impeached the indispensable function of evaluating learning, the school dimension that in all “remote” contexts has suffered the gravest depletion is indubitably the social one, attributable to a system of peer, and teacher-student, relationships. Even when implemented in optimal conditions, as to connectivity and to educators’ digital competencies, DL has generated an objective break between two processes which are inextricably connected in conditions of normalcy (acquiring academic-curricular knowledge and acquiring socio-relational competencies, needed in school and in life, in the present and future). Worse still it has, in fact, compromised the actualization of socio-relational dynamics, essential for solid, long-lasting transference of curricular knowledge as well (the majority of interviewed students found serious difficulty in communicating with their classmates and teachers throughout the pandemic).

Starting with this grave weakness, reflection on alternatives to DL becomes essential, projecting oneself in a future scholastic dimension that can safeguard, above all, the *human and relational components*, while still being receptive to technological advances. In such a scenario, one could think in terms of a profitable combination of school with virtual reality (VR), albeit the road ahead is certainly lengthy, considering the fact that DL was, in the Italian context—and at best—a mere transmittal of traditional lessons into a decidedly poor virtual environment, generally comparable to forms of individual MOOC-style training (see Head, 2014).

The impression is that in the last few years, notwithstanding a context of generalized investment toward digitalization, schooling has mostly ignored the powerful cues stemming from digital and technological innovation, remaining essentially anchored to the “classic”—or traditional, as some may prefer to say—models and systems of didactic issuance. The potential clash between innovation and tradition had not happened, remaining, furthermore, in a latent state of sorts on account of the surefire adaptation capabilities of the training’s end-users, unfailing activators of a *switch off and on* procedure: students in class, digital natives on the outside. The pandemic broke that spell, producing an unseen short-circuit, the effects of which we have tried to report. Traditional education has had to, concretely and dramatically, endure the challenge of innovation and, for the first time, found itself having to enter and move exclusively on digital terrain, registering—as was to be expected—difficulties, delays, widespread and visible ineptitude, which the digital

natives most assuredly noticed, they who, paradoxically, were perfectly up to the challenge. Many digital natives, for their part, found themselves, as seen, missing traditional models, having the new DL system caused many dysfunctions and a general depletion in terms of learning, as well as the essential socio-relational deprivation due to the disappearance of school classes, as physically intended. In this context, a return to normalcy—i.e., the reestablishment of the *switch off and on* model—for most stakeholders (institutes, students, families, policymakers) represented a moment of immeasurable relief. However, it would be very worrisome if the feeling of liberation from DL concealed even the slightest conception that digitalization and technological education are a hindrance to scholastic educational processes.

The potential intersection between the scholastic realm and VR would in fact imply a veritable paradigm shift, keeping in mind that VR, in the virtual reproduction of swatches of the real world, would allow its end users to move in an artificially created, computer-generated three-dimensional environment, and to interact with simulated objects and people (avatars) (Burdea and Coiffet, 2003; Steinicke, 2016; Kamińska et al., 2019). As known, access to VR is generally controlled *via* an HMD (Head-Mounted Display) device, with an integrated display and lenses, which confers the user with three-dimensional vision; having donned the HMD, the user is then able to experience, as if in an actual physical space, immersion into a digital environment, sometimes experiencing sensory stimuli so ample and profound (visual, auditory as well as touch, smell and taste-related), as to allow VR to be defined as the technology of the three Is (Immersion, Interaction, Imagination—see Burdea and Coiffet, 2003). Shifting focus onto the core aspect of our interest, the process of acquiring academic competencies, it is possible to state that the areas where VR could reach its maximum degree of expression are the following: engaging students; learning style (potentially, a particularly active and constructive one); empathic charge in the learning experience; exercising creativity and the capacity for abstraction (Hu-Au and Lee, 2017).

The hypothesis herein is an application of VR, as much to the classroom’s physical space, as to the object-subject of the lesson, in an effort to reproduce the entire school classroom virtually (including student and teacher desks, boards, other teaching aids, etc.), wherein the avatars of the students and teachers in attendance act and interact as per styles and dynamics based on actual school life. Resorting to said technology, which is evidently capable of prompting substantial cognitive and emotional engagement, would, on the one hand, be finalized to limit, as much as possible, the household isolation of students which started with the pandemic emergency, and on the other, to contrast those practices which, as our data attest, have severely reduced the reach of DL (cameras off, parallel engagement in chatting, simultaneous execution of other activities, etc.). The promulgation of experimentation of VR technology in said direction is, from the authors’ point of view, desirable albeit,

as known, the operating costs of VR are still too high, and the potential effects of tolerance-building on the users (loss of motivational drive, physical illness, etc.—see [Kavanagh et al., 2017](#)), especially on the back of prolonged usage of HMDs, must not be overlooked. Furthermore, the VR technology sector is in very rapid expansion (to this effect, a new version of HMD glasses—more wearable and comparable to said accessory's customary models—is among the short-term expectations), partly by virtue of the exceptional vitality of market leaders such as HTC, Valve, Oculus, Google, Sony. Facebook's 2014 acquisition of Oculus, an active startup in the production of VR technology and HMDs, and the founding, by Zuckerberg himself, in late 2021, of the multinational Meta Platforms Inc., are within this scenario of rapid technological advancement, and their mission concentrates around a few keystone principles⁸—interaction/co-penetration of the real and virtual realms; social connection; economic, social and environmental sustainability; balancing wellbeing, work and life needs; breaking down inequalities—which would seem to imply the transference of VR technology testing into broad—and not niche—segments of society ([Beck, 1986](#); trans. it. 2000).

Clearly the possible introduction—efficient, of large proportions and shielded from the trap of technological virtuosity as an end in itself—, of VR technology into the field of education implies the adoption of a multidisciplinary collaboration between disciplines (such as IT, mathematics, sociology, educational psychology). On the other hand, one cannot gloss over the consequences, in ethical terms as well, of the testing encouraged herein, on the back of the survey results emerged ([Falck et al., 2018](#)). As previously mentioned, VR experiences imply a fairly elevated level of sensory, cognitive, emotional and physical engagement, especially in view of activities, such as DL, which are prolonged and systematic. Therefore, in the face of likely favorable initial responses, it is fundamentally important to be able to gauge the potential tolerance-building effects of such equipment, and all the more reason to monitor the impact on human health, in terms of the different physio-psycho-sensory disorders, of intense usage of VR technology and devices. Nevertheless, faced with a technological advancement that appears constant and inexorable (and which, regardless, will never completely annul the distance between real

and virtual), it is reasonable to believe the scale of such disorders may gradually decrease, leaving room to the extensive, desirable testing of innovative didactic forms based on VR.

For these reasons, possible developments in the direction of VR seem to be, at least on paper, very promising, capable of pushing back against forms of skepticism with respect to digital schooling, partly fed by the unproductive DL ordeal. As the authors have tried to argue, VR is not just a strictly technical approach to the transmittal of knowledge that, for many school subjects, and not just of the strictly applied type, seems to have a competitive edge over more traditional teaching modalities. VR, above all—and this is the element of most interest in the authors' view—seems to provide a valid design base to the possibility of remotely recreating at least the semblance of a class-group, thus achieving the reduction of the damage done on the socio-economic front to which the videoconferencing system, that characterizes DL, inevitably leads.

Finally, VR could perhaps succeed in closing the gap and reducing potential conflicts between students and digital natives, that is, two sides of the same coin: the young users of institutionalized educational procedures. Just as DL was a missed opportunity of sorts, even resulting, where possible, in an increase of the student-digital native rift, except for a subsection of youths who—as seen—employed it in a chiefly opportunistic manner—VR could embody a veritable moment of vindication for the digital, as it were, as it would offer its undoubted service potential to users capable of its competent and efficient usage. A vindication that would deserve to be tested and actualized swiftly, without awaiting other—undesirable—epidemics or comparable quasi-apocalyptic occurrences that would bring the same isolation effects priorly endured, and which unfortunately cannot be excluded in view of a society which seems unprecedentedly exposed to such risks.

In conclusion, returning both to the premises of this work, and to the findings, extensive training on, and efficient monitoring of, the risks and benefits of new technologies requires constant *dialogue* and *discussion* between the relevant actors and agencies (starting with that *between generations*—at the moment, *parents-children* and *teachers-students* appear too distant), as well as *clear and common rules* on the phasing and manner of use of digital technology, on the content it applies to, and on the meetings and exchanges it shall beget. Forms of opportunism and short-sightedness associated with the young which the data have revealed, like the inferred expressions of tolerance, laxity and/or carelessness attributable to the adult world, bring the authors to highlight the importance of a more cognizant tutelage of youngsters on part of their parents, and of students on part of the educators. This takes concrete shape in constant and competent availability to *register and analyze expressions of unease and apathy*, implying a *dialogue on equal terms* and *rapport* between generations (starting with *competent and responsible practices* enforced by adults whom,

⁸ With specific reference to the realm of school, the same principles, and that of social inclusion first of all, long before the pandemic, were at the basis of Digital School Centers (CSD - established with bill n. 179 dated 18/10/2012), likewise, amidst the expressions of Indire (National institute for educational documentation innovation and research), the movement of *Avanguardia educative* (2014) and the *Manifesto delle piccole scuole* (2017), called to answer the needs of the student body on the islands and in inland mountain areas, at constant risk of social isolation and irregular in-person school attendance, on account of the environmental and weather conditions in relevant areas.

at the moment, youths perceive as extraneous, in effect, to their world (see Livingstone, 2008; Boyd, 2011).

With a view to *laying the foundation for further agreements to be made*, looking beyond the pandemic, *the young, multitasking and hyper-connected*, as described in previous pages, need *care, closeness and empathic attention*, like they need *fresh motivational inputs*. Today, these appear to be novel challenges for the adult world, on the back of reasonable expectations on part of the youth. In terms of these legitimate anticipations, what will not suffice are attempts, illustrious as they may be, that are isolated and non-continual, as they evidently require systematic projects and investments, a common vision and intent, incentivized and supported in politics as well. Having bridged the gaps and the distance, and following a reasoned and productive investment in the area of competencies (including: schooling educators as to the platforms used by digital natives; inserting said platforms in the teaching method, etc.), these *newer forms of didactics* (which certainly do not coincide with current e-learning platforms), appropriately combined with in-person instruction, can go from being *hindrances and multipliers of difficulties* to representing *sweeping advantages* in addition to *efficient and transversal solutions*.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation

and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

MF was responsible for the sections entitled: introduction, materials and methods, and results–DL adaptation profiles: influence of the digital environment. AF for the sections entitled: results–interviewees' opinions and assessments 1 year later: from the items to the factorial axes; results–DL adaptations profiles: the influence of the physical and socio-cultural environment, and discussion. All authors contributed to the study design and approved the final version of the manuscript for submission.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Potential and limitations of digital ethnographic research: A case study on a web community

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Introduction: This work aims at transposing ethnographic research into digital contexts to probe its potential and limitations in a specific field of study: that of sexuality, particularly suited to ethnographic exploration. We chose as our case study a web community of Italian asexual people. As we shall see, this allowed us to simultaneously explore both the various techniques called into play in digital ethnography and the digital as a specific sphere within which sexuality takes on a very peculiar meaning. Digital sociality is paramount for the definition of imaginaries, meanings, and practices that could not be explored elsewhere. This is due to the implicit characteristics of the population studied, which does not find corresponding physical spaces of aggregation.

Methods: The paper will present the research design using this specific case study to address some of the typical dilemmas that researchers face when following the digital ethnographic approach and will explore the research results as an example of the kind of analysis available with the information and data collected through this method.

Results and discussion: The conclusions will attempt to briefly outline the shortfalls and advantages of this method, considering its application to this specific field of study.

KEYWORDS

digital ethnographic research, case study, typology of asexual people, shortfalls and advantages, qualitative research

Introduction

Among the social research methods, ethnography is one of the most comprehensive tools available to researchers to reconstruct the visions, perspectives, imaginaries, beliefs, values, and practices that underpin a given culture (Masullo et al., 2020). It is no coincidence that many manuals on social research methods and techniques consider the ethnographic approach to be among the most representative of a “specific” way of doing research. Ethnography also has the merit of successfully combining three procedures that may not simultaneously come into play in research inspired by the interpretative tradition, namely: observing, questioning, and reading (Corbetta, 2005). In ethnographic research, researchers immerse themselves fully in their field of research—and, in some cases, are themselves part of it as members of the community investigated (auto-ethnography). In this type of study, all the senses are put to the test by the objective of the investigation. The choice of such an approach is not neutral and implies upstream decisions that are articulated along three planes: ontological, epistemological,

and methodological. The ontological one refers to a reality understood as a social construction of meaning. The epistemological relates to the relationship between researchers and the object of the research. Finally, the methodological one concerns a multi-method approach involving the use of different techniques of information-gathering: observing (participant observation), questioning (the interview), and reading (triangulation with secondary data sources).

This work aims at transposing ethnographic research into digital contexts to probe its potential and limitations in a specific field of study: that of sexuality, particularly suited to ethnographic exploration (Delli Paoli, 2022). We chose as our case study a web community of Italian asexual people. As we shall see, this allowed us to simultaneously explore both the various techniques called into play in digital ethnography and the digital as a specific sphere within which sexuality takes on a very peculiar meaning. Digital sociality is paramount for the definition of imaginaries, meanings, and practices that could not be explored elsewhere. This is due to the implicit characteristics of the population studied, which does not find corresponding physical spaces of aggregation.

The first section of the paper will detail some theoretical aspects relating to the digital ethnography approach, analyzing the similarities and differences with the traditional ethnographic approach, followed by a description of the community under investigation (asexual people). We will highlight the processes that lead this sexual minority to consider the digital environment as the only place in which to self-define and express themselves. The second section of the paper will present the research design using this specific case study to address some of the typical dilemmas that researchers face when following the digital ethnographic approach. The third section will explore the research results as an example of the kind of analysis available with the information and data collected through this method. The conclusions will attempt to briefly outline the shortfalls and advantages of this method, considering its application to this specific field of study.

The digital ethnographic approach: Similarities and differences with the traditional ethnographic approach

Born in recent years as a transposition of the classical ethnographic approach into the digital environment, digital ethnography is in some respects still an unexplored field currently attracting young as well as more experienced scholars (Masullo, 2020). Its transversal pull can be ascribed to the fact that, though retaining many of its original features (directly linked to the hermeneutic sociological tradition), its application to the digital environment and the interpretative and methodological challenges it entails bring out new potential. The

methodological literature on this approach is not yet systematic, as shown by the plurality of terminological labels attributed to it. Some of these, mainly used in the sociological field, frame this approach in the tradition of digital sociology and digital methods and thus speak of “digital ethnography” (Murthy, 2008); others, particularly in marketing, refer to the importance of the network and thus define it as “netnography” (Kozinets, 2002, 2010, 2015)¹.

The new information and communication technologies greatly affect many areas of people's life and, therefore, many processes at the heart of the sociological investigation. Focusing on micro-sociological aspects and everyday life, platforms and new communication tools have engendered *for* and *in* individuals a new way of conceiving themselves and their reality. They broadened their social and collective horizons and their way of meeting and interacting with others (Masullo and Addeo, 2021). The pervasiveness of technology and the ubiquity determined by the so-called “internet of things” configure new realities in which some juxtapositions are irrelevant and no longer explicative—for example, online/offline, virtual/real, material/immaterial (Garcia et al., 2009; Beneito-Montagut, 2011; Scaramuzzino, 2012). The normative and value references connected to social action no longer relate only to a precise sphere delimited in space and time but expand through the subjects' ability to surf the net and take full advantage of all the potential (informative, communicative, and relational) offered therein. In the face of the current expansion of the web society, the perspectives of ethnographic research are expanding in tandem with the digital world. Concerning the objects of study, we can distinguish between the exploration of classic sociological objects of study and how they can be rethought in the digital sphere and through digitisation, or the exploration of natively digital phenomena, which arise directly within the web. In the latter case, the web becomes both the field in which the observation takes place and the context in which the phenomenon itself originated. Initially, the ethnographic approach applied mainly to online communities, delimited digital spaces of social aggregation around a specific domain of interest. In recent years, however, these privileged sites have been supplemented or sometimes replaced by social media sites and metadata in digital ethnographic research. The ongoing rise of these new spaces for ethnographic fieldwork, in turn, promotes new types of ethnographic practice that are still partly unexplored (Delli Paoli, 2022). Despite this change, ethnographic activity retains its original meaning, namely the interest in culture as a text that must be decoded by the ethnographers, who cannot merely read the data. It is,

1 Among the many definitions, we find: Cyber Ethnography (Morton, 2001), Ethnography of Virtual Spaces (Burrell, 2009), Virtual Ethnography (Hine, 2008), Internet Ethnography (Boyd, 2008), Ethnography on the Internet (Beaulieu, 2004), Internet-related ethnography (Postill and Pink, 2012); Webnography (Puri, 2007).

therefore, still assumed as ontologically central that creation and creativity are inherent in ethnographic research (Delli Paoli, 2022). Geertz (1973) defines “thick descriptions” as deep cultural representations, which do not stop at the exteriority of things, but take into account stratified cultural meanings and thus manage to unravel the fabric of culture and produce descriptions that are consistent with the indigenous point of view. On an epistemological level, the process of cultural translation appears (including in the digital environment) as a tension between foreignness and familiarity, in the dialogical dialectic between detachment and empathy. Just as in in-presence ethnography, digital ethnographers must maintain what Davis (1973) defines as the balance between the Martian, who strives to maintain detachment from the cultural and cognitive assumptions of the natives, and the convert, who identifies totally with the cultural models of the natives. On the methodological level, digital ethnography reaffirms the centrality of observation. As in classical ethnography, such observation can involve a different involvement of the researcher in the community under investigation. However, unlike classical ethnography, this observation opens up further, hidden forms of observation that are not possible in the case of the physical participation of the researcher on the field—as it is not possible to conceal his presence. The literature is divided between proponents of the two types of observation. The arguments in favor of overt observation revolve around the ethical and deontological aspects of research and the need to reveal to the subjects that they are being observed and studied. From this point of view, covert observation, also known as covert access or lurking, would be an unethical practice. Arguments in favor of covert (or lurking) observation, on the other hand, emphasize the non-intrusiveness of this method, which favors the “naturalness” of the information gathered (Masullo et al., 2020).

From this point of view, Delli Paoli (2022, p. 200) observes that “On the one hand, there are scholars who suggest that lurking is not an ethnographic observation in the traditional sense and therefore not a “correct” ethnography (....) it provides any deep understanding of the community, but only a superficial description. On the other hand, there are scholars who idealize the possibility of lurking, which would offer a unique opportunity for “natural” data collection, as members are unaware of their status as informants and the presence of the researcher does not cause them to change their behavior”.

The choice between one and the other type of observation is not completely free. In cases where the presence of a researcher would not be welcome, for instance in the case of sexual minorities or practices at the limits of legality, covert observation remains the only possible way into the field.

Other specificities of the digital ethnographic approach, compared to classical face-to-face ethnography, are to be found in its efficiency in data collection, which requires much less time, and its opportunity to expand the geographical dimension of the research field and connect networks scattered all over the world.

The researcher does not need to travel anywhere; information can be located and stored on the Internet without having to be recorded and transcribed as the traditional ethnographer must do (Kozinets, 2002). Another strength is the invisibility and relative discretion of the researcher: cyberspace allows researchers to be invisible to the people they are observing more easily than in face-to-face observation (Kozinets, 2010; Scaramuzzino, 2012; Murthy, 2013; Varis, 2014; Masullo et al., 2020). However, the digital ethnographic approach also has some limitations compared to in-person research. In the online environment, the episodic nature of the relationship that the members have with a virtual community (such as a blog, a discussion forum, or a Facebook group) requires a rethinking of the concept of community and communitarianism and makes it difficult to investigate relevant aspects in physical contexts, such as those of a structural nature relating to the dimension of power (which in the sociological sense cannot be deduced only from the level of participation of the users, nor from the configuration of the posts, opinion leaders, and shifts in interaction). The level of involvement of the researchers in the community studied will also vary depending on the degree of familiarity they can create with the members of a community—who, moreover, are ever-changing and for whom socio-demographic characteristics (gender, age, ethnicity, educational qualification, social class, etc.) do not always come to the fore (or are not always true in the digital sphere). The latter aspect makes it clear that digital ethnography cannot be considered a mere transposition of physical ethnography, and that the renunciations it requires are acceptable in the case of phenomena that find their only form of expression in the digital world and require a multi-method approach of exploration (of observing, questioning, and reading).

The following section will describe in detail the phenomenon of asexuality to provide some characteristics of the population that recognizes itself in this expression of sexual orientation. This will also allow us to grasp the reasons why digital ethnography is considered a particularly valid approach for studying hidden populations, which find many spaces for their expression in the digital environment (Monaco, 2021).

The phenomenon of asexuality: A literature review

In recent years, the number of self-described “asexual” people has increased. In the literature, asexuality (or the acronym ACE) is defined as a sexual orientation in which the person declares an absence and/or a consistent reduction in sexual and erotic attraction or frequency of face-to-face sexual practices (Decker, 2015; Gupta, 2017). Recently, the definition has been updated in the experience of little or no

sexual attraction to include a more comprehensive spectrum of experiences of sexual attraction (Carrigan, 2011; Decker, 2015).

The study of asexuality has prompted the scientific community to trace the possible motivations and explanations that contributed to the formation and spread of the phenomenon. On the other hand, it also made explicit the need to rework and reconsider the normative parameters on the meaning of sexuality, which in our society is often understood as a *sine qua non* of romantic and emotional relationships between partners. In a context characterized by a widespread appeal to sexuality, asexuality challenges the dominant conceptualization of sex as a universal and natural dimension and sheds light on the different ways in which individuals conceive it depending on their biographical experience and subjective desires (Delli Paoli and Masullo, 2022).

Bogaert and Skorska (2011), one of the main authors who studied asexuality, highlights two different subcategories: *primary*, in which the subjects never experienced a hetero-referenced sexual attraction/interest, and *acquired*, in which the subjects, after a period of hetero-referenced sexual attraction/interest, define themselves as ACE due to personal and social motivations that scholars are beginning to explore.

A further distinction (and sub-classification) within the ACE condition stems from the studies of Poston and Bauble (2010), who highlighted how some categories of people cannot be included in that of asexuality. For example, those who choose chastity before marriage, or who are celibate for religious reasons, or, finally, INCELS (involuntary celibates), subjects in whom sexual attraction and erotic desire are not absent, but “unexpressed” due to social, psychological, or cultural conditions.

Lehmiller and Gormezano (2022) pointed out that asexuality affects about 1% of the American population, pinpointing four aspects that identify this condition.

- a) *It does not correspond to chastity.* Both conditions are characterized by the absence of sexual activity, but their motivations differ. Asexual people experience a total or partial absence of erotic desire and sexual attraction toward others. Conversely, people who choose chastity continue to have sexual attraction toward other people.
- b) *It is not a sexual dysfunction.* The asexual condition is a normal and possible expression of sexual orientation; it is not related to any organic or psychological pathology of the sexual sphere.
- c) *It is not related to inexperience.* Asexuality is not attributable to shyness or other expressions of a psychological nature.
- d) *It is not devoid of autoeroticism.* While it is true that asexual persons are not attracted to other people, this does not imply that they avoid regular autoeroticism and sexual self-gratification.

For Lehmiller, the asexual condition is ultimately an identifiable and well-structured sexual orientation in its own right.

The scholar also proposes a further classification of asexual persons depending on their relationship with sex and sexual practices, distinguishing between the following: (a) *sex-repulsed*, i.e., people who feel repulsion toward sex or some specific elements of it; (b) *sex-averse*, i.e., people who have no intention of having sexual experiences, who are distinguished from sex-repulsed in that a sex-averse person does not necessarily feel repulsion toward general sex, but does not consider it a central aspect of their existence; (c) *sex-indifferent*, those who do not have a particular interest in sex; (d) *sex-favorable*, people who experience interest and desire in sex, without being reflected in a constant search for sexual experience.

The asexual condition does not exclude sentimental and romantic attraction to other people, an emotional attraction that is not reflected in a sexual experience (the latter being understood as a practice). Asexual persons, therefore, can be identified as *homoromantic*, who experience emotional attraction to persons of the same sex, *heteroromantic*, who experience relational and emotional attraction to persons of the opposite sex, *biromantic*, who experience emotional attraction to both sexes, *panromantic*, who experience attraction to other people regardless of their sex and gender identity, and, finally, *aromantic* (AroAce in the literature) who do not experience sexual, emotional, or relational attraction to any person, regardless of their gender and sexuality.

The asexual condition has been on the rise in recent years among adolescents and young adults, to the point that some scholars are questioning whether this constitutes a generational trait of our age which needs to be addressed. To test this hypothesis, McInroy et al. (2021) recently conducted a study of 600 Americans aged between 14 and 24 in which they found that around 24% defined themselves as not interested in sex or sexual practices, a percentage that almost doubles in the 14 to 18 years old cohort, to around 45%. The authors link this condition, particularly for younger people, to a phase of “identity instability” or a “transitional” phase of self-knowledge, a hypothesis also supported by the progressive reduction in the percentage of asexual people as age increases.

Studies show that the condition of asexuality and aromanticism is stigmatized not only within mainstream society but also in the LGBTQ+ environment, as it is considered unnatural and/or related to dysfunctional aspects of the psychological or sexual sphere (Robbins et al., 2016).

In this regard, a study conducted by MacNeela and Murphy (2015) on an LGBTQ+ online community found that around 56% of members had not made their asexual orientation explicit in their profile presentations, and that disclosure of their asexual status only occurred at a later stage and/or during an offline meeting.

Finally, Gupta (2017) traces similarities and differences between the coming out of other non-conforming identities in the LGBTQ+ community and that of asexual and aromantic people. In both cases, there is a desire to come out of the closet, for authenticity and the possibility to relate to people coherently, explicitly highlighting fundamental aspects of the process of identity self-determination. However, this choice also increases the subjects' vulnerability to negative experiences such as harassment, discrimination, marginalization, and violence, since in mainstream society the absence of sexuality is not accepted and integrated—where sexuality is understood as an obligation to which both men and women (albeit with different meanings) are naturally called upon to respond (Kosciw et al., 2013; Gupta, 2017).

Recent studies in Italy have confirmed the preference of LGBTQ+ people for digital environments to make their sexual identity explicit and as a specific field of socialization to sexuality, also considering the persistence of a general homophobic and transphobic culture together with the repudiation of alternative sexual expressions. Consequently, the latter enjoy a greater possibility of being experienced in digital spaces than in offline reality (Carrigan, 2011; Bacio and Peruzzi, 2017; Masullo and Coppola, 2020, 2022). Although the condition of asexuality constitutes a sexual orientation in its own right, it shares some characteristics with other subjectivities of the LGBTQ+ universe: it is, to all intents and purposes, one of the “non-normative” sexual orientations and, therefore, contrast with the imposition of a prevailing sexual model, which finds its *raison d'être* in “reproduction”. Furthermore, it experiences the same mechanisms of discrimination insofar as this orientation does not find space for its open and complete explicitness in the environments of public society.

The recent digital revolution has affected various spheres of everyday life, broadening and complexifying the social and communicative contexts and spaces for everyone.

The creation of “virtual spaces” has represented a precious opportunity for social emancipation for those subcultures that previously struggled to find aggregative contexts and opportunities for confrontation in mainstream and offline society.

These resources for “emancipation” have proved to be suitable and convenient for the LGBTQ community and asexual people who, thanks to the peculiar characteristics of the web society, have created different and diversified tools for knowledge, comparison, aggregation, and the search for possible sentimental and/or sexual partners.

Cyberspace represents the main, if not the only, space for the aggregation and sharing of opinions, reflections, and of identity confrontation for the new non-conforming sexual identities, such as non-binary, pansexual, and asexual people.

On the one hand, these “new instances” find in the virtual sphere impulses and identity drives to emancipate themselves and consolidate their process of self-determination. On the other

hand, however, it is precisely within the online community that they experience forms of discrimination and social disavowal.

In this regard, Smith (2012) spoke of the *delegitimation of the ACE identity* from public discourse, defining it as an *invisible and denied society* in the offline and online mainstream community, positing the need for specifically dedicated, private, closed, and selective communicative spaces and spheres of confrontation.

The need to build spaces of emancipation and sharing specifically for ACE persons has given rise to the creation of numerous communities, chats, and social pages for this condition worldwide.

McInroy et al. (2021) recently investigated the use of online communities by people who self-define as asexual and aromantic, highlighting certain functions considered fundamental to a process of *self-determination* and *self-definition*. According to the research data, about 14.6% of the participants stated that they had attended or were attending online LGBTQ+ support groups to find information, to find information and *clarifications* about their condition for the self-determination process. Another important aspect is the search for information on pathologising the Ace condition: about 45.7% of participants sought and requested news, information, and experiences on mental health, psychological, biological, and sexual aspects possibly involved. Finally, 34.5% of participants explicitly stated a relational and social purpose of using the community, highlighting how expressing oneself in a safe, albeit virtual, place is among the main motivations to join the platform, as well as to look for people with similar or partly overlapping experiences.

Materials and methods

Research design

Starting from the theoretical premises argued above, this section aims to document the various steps of digital ethnographic research in the light of the specific field examined here, that is, the processes of self-definition of the users of the Italian online community dedicated to asexual people, to identify and analyse common traits and differentiations in the imagery and use of cyberspace. It should be noted that this essay follows previous work on the AVEN (Asexual Visibility and Education Network) web community, one of the most important online communities of asexual people, aimed at analyzing the processes of self-identification, as well as the plurality of experiences and attitudes expressed by these people in their request for greater freedom from the constraints of sexuality as a necessary imperative for building meaningful relationships with others, including on a romantic level (Delli Paoli and Masullo, 2022).

We decided to replicate the same study in a community frequented mainly by Italian people, given that the previous research focused on people familiar with the English language. This choice excluded those who did not speak the language and generated a partial view of the phenomenon in the country. While it is true that patriarchy and heterosexism almost universally shape how relate to the identity-related dimensions of gender and sexuality, in Italy these normative axes can affect them in a very peculiar way. Therefore, we decided to apply the same research approach (that of digital ethnography) to explore in greater detail this specific Italian web community in which relational and power dynamics may be at work in a different way from the case previously examined².

The first fundamental step in the ethnographic research was the definition of the field which, as [Kozinets \(2015\)](#) points out, concerns not so much the characteristics of the medium or its use, but rather the cultural, relational, and value experiences developed within cross-media digital spaces—in other words, the digital worlds of meaning.

As already out above, digital ethnography was initially born to study online communities that organized themselves around shared lifestyles, values and moral beliefs, emotions, and consumption practices ([Cova, 1997](#)). The recent technological developments of Web 2.0 and the pervasive diffusion of mobile devices forced the research to adapt to the fact that the spaces and times of online discussions have become increasingly transmedia and linked to a thematic domain rather than a single medium. As [Delli Paoli](#) points out, “Most online interactions take shape in a volatile context, without defined spaces but with content delimited by the use of tags, algorithms and data mining techniques that organize the flow of information and act as transversal metadata across web pages, allowing actors to move in non-linear directions from one medium to another” ([Cova, 1997](#), p. 46).

Given its digital nature, the netnographic approach cannot be media-centric—i.e., tied exclusively to the study of defined online spaces such as blogs and communities.

Adopting the distinction between meta-fields as spaces unrelated to a media and built around a topic and contextual fields as contextualized spaces in blogs, communities, discussion forums, social media groups, etc. ([Airoidi, 2018](#); [Delli Paoli, 2022](#)), the study opts for the latter by examining the Italian online community, which has around 3,000 users. The cases observed are the result of a reasoned selection based on “theoretical sampling” criteria that envisage the selection of typical cases able to provide the best opportunities to find the information necessary for the study and that, as a sample,

can be close enough to the population analyzed (though not representative).

Digital ethnography can be considered a distinctive method to study social changes resulting from the digital world itself. In the case of sexuality, for instance, the digital sphere offers unprecedented discursive spaces to those sexual minorities that find no space in offline reality. It is in the digital world that these minorities find the full possibility for self-expression (as in the case of asexual people) and within this context that these individuals interact and construct their own language, giving rise to specific practices and scripts that would not be possible or imaginable outside this sphere ([Rinaldi, 2016](#); [Delli Paoli and Masullo, 2022](#)). Digital ethnography thus proves to be particularly appropriate as a research approach, especially to study those phenomena born in the digital realm, and to investigate generative and productive (and not only reflexive) digital identities and cultures, making it possible to document the performative use of language ([Butler, 2004](#)).

The second step entailed the definition of research questions. From this point of view, the digital ethnographic approach highlights the typical advantages of interpretive approaches, insofar as there is no sequential order between field definition and research questions ([Hammersley, 1995](#)). While it is true that in some cases the research questions guide the selection of the field, the difficulty of finding information on the asexual condition, which is considered a hidden and invisible population in offline reality, determined the need to first select the field of study, and then the research questions. Nevertheless, the latter also gradually emerged during the observation, given that this is a virtually unexplored field in Italian research.

The lack of studies on the subject does not imply that the research approach lacks a theoretical foundation. On the contrary, we believe that the choice of field, and the selection of what to observe, are choices that must always be contextualized to the fields and objects examined (in our case, that of sexuality). It could not be otherwise: an observation without a guide, not oriented by what [Blumer \(1954\)](#) called “sensitizing” concepts, would prevent the researchers from selecting and distinguishing, within the reality observed, the “meaningful” elements from those “banal” and misleading. Moreover, observation can only take place based on a series of pre-cognitions relating to the field one intends to explore. As we can learn from one of the most famous community studies, conducted by [Lynd and Lynd \(1970\)](#) on Middletown, observation must always be preceded by background research that includes not only the study of specific literature on the subject but also documentary analysis (in the case in point, the study of statistical sources).

Another fundamental aspect was the accessibility of the field. In this case, it depends on both the characteristics of the platform being examined, i.e., its “accessibility” and the need to choose an online community in which the level of interaction is particularly intense and which for the chosen topic constitutes a reference in the digital environment. Regarding

² While some considerations and results are akin to those emerged from the previous research on the AVEN community ([Delli Paoli and Masullo, 2022](#)), we will not be making any comparison. The phenomenon of asexuality is here a case study to present the digital ethnographic approach and not the aim of the essay.

the first point, the asexual community allows access only after registering and filling in a profile. Regarding the second point, the chosen online community represents the main space where Italian asexuals meet. This digital field was chosen after an exploratory observation aimed at detecting the main users and gatekeepers, the intensity of interactions and the affordances of the platform.

From the outset, the research was confronted with ethical dilemmas, directly related to its objectives and the techniques it intended to employ. Regarding observation—understood as the main technique of digital ethnographic research—we opted for a mixed mode between covert access and the explication of our identity as researchers. From an ethical point of view, as pointed out above, the omission of identity becomes justifiable and legitimate, as some scholars claim, in certain circumstances, especially when the benefits outweigh the social and ethical costs of such a violation. In this case, for instance, making the researcher's role explicit from the outset would have made the field inaccessible.

In the first phase, we gathered information covertly without revealing our presence to those concerned, a more appropriate—if ethically questionable—choice for studying invisible populations. In the second phase, we informed users of the research and our role as researchers. We never intervened to alter the context of the interactions. On the contrary, we strove to preserve the ecology of the environment and, therefore, our method can be defined as non-participant observation.

The observation period went from 22 October to 22 December 2021. We examined 200 profiles and presentations and over 500 related posts, collected in a specific excel grid. Alongside the grid, we drew up a daily diary in which we noted down field notes related to what we read in the online community, which proved valuable in the definition of the first research questions. Among the most significant, which guided the subsequent steps of the research, were the following:

RQ1: What are the main motivations and/or paths that lead the individual to choose a relational modality involving the absence and/or reduction of sexual activity?

RQ2: How do users use the community and for what purposes?

RQ3: How do users define themselves in relation to the different meanings attributed to the concept of asexuality?

RQ4: What differences emerge between the way users define themselves and their main socio-demographic characteristics?

The researchers' identity was later made explicit by contacting certain users willing to answer questions through a private messaging system provided by the platform. This procedure constitutes the second technique employed in this study: we decided not to limit ourselves to "observing" but also to "question" our cases, for two main purposes:

(1) to clarify certain meanings connected to the language typical of this subculture which could have escaped the researcher inexperienced in the universe examined, (2) to delve deeper and reinforce certain intuitions gathered during the observation phase.

About the "reading", we decided to examine 200 profiles in the observed period. We proceeded to extrapolate a series of information on socio-biographical variables to infer possible associations between them and certain traits of asexual persons identified in the literature.

The decision to analyse the ecological information made available by the medium Rogers (2013) when he affirmed the *follow-the-medium* principle as foundational to digital methods: the researcher is called upon to follow the ontological properties of the medium, to immerse himself in it, to equip himself with a methodological apparatus that is natively digital by making the technical strategies and natural logics of digital media his own and using them as methodological sources.

For clarity's sake, we described the operations of "observing", "questioning", and "reading" sequentially, in relation to the three techniques employed in this study. However, they most often occurred in parallel, taking full advantage of the flexibility of the ethnographic approach.

The last phase of the research concerned information analysis and was mainly conducted through qualitative content analysis approaches, also known as Ethnographic Content Analysis (Altheide, 1987).

Content analysis is essentially based on the interpretation and classification of texts with the help of the most diverse, sometimes competing, and contradictory procedures (Rositi, 1998) to infer from the texts their meanings and contexts of use (Krippendorff, 2013, p. 24). Through this method, texts are brought back to a limited number of categories using explicit analytical decomposition, classification, and coding procedures (Weber, 1990).

Content classification employs inductive coding strategies. In other words, instead of coding the texts based on *a priori* classifications, the classification is adapted in the process through the reading and re-reading of the texts. Text interpretation is carried out following the principles and techniques of the hermeneutic approach to social research (Montesperielli, 1998), which aimed to identify the widespread and shared common-sense dimensions related to the world of asexuality.

The following section will present some results. For ease of reading, we will begin by describing online presentations and interactions to construct a typology of asexual people. We will then try to see how these profiles are distributed according to the main socio-demographic variables deduced from the profile analysis. The aim is not only to arrive at a more complete analysis of the phenomenon but also to describe all the analytical procedures that can be used in this type of approach.

Results

Following mainstream models: Emotional fragility and social pressures

When registering to the community, users are required to fill in a personal profile with socio-biographical information, including their gender, sexual orientation, age, place of residence and some considerations about themselves in terms of a brief presentation. These are generally followed by comments from other users. The resulting interactions shed a light on the various points of view on asexuality.

To delve deeper into the motives that lead people to self-identify as asexual, we examined the presentations in profiles, comments, and general interactions within the platform.

Through the analysis of this information, we discovered some of the motivations that lead users to identify themselves as “asexual”. We identified both individual factors, such as personality traits or emotional aspects connected to experiences that led them to voluntarily renounce sexual relations, and social and cultural factors, partly referring to social pressures connected to stigmatization and discrimination.

About the former, fragility-related experiences frame the choice of asexuality. According to the studies by Carrigan (2012), Foster and Scherrer (2014) and Yule et al. (2015), low self-esteem and a lack of trust in others are positively correlated with the decision to renounce sexuality. This same issue is also highlighted in some posts, such as the one below.

I am asexual. That is, I've never had sex and I don't care. The truth is that since childhood I have always been shy and awkward. My mother was alone, I mean I never knew my father and I have no brothers or sisters. It was always just the two of us, alone. In high school, I had few friends and those few had more problems than me. I currently study literature (...) and live in a house with other people. I have exchanged very few words with them. My life is full of silence and time. Perhaps I am asexual by choice, not my own. I see the future with fear (ID76)³

Asexuality is experienced with great difficulty because the obligation to sexuality is taken for granted in intimate relationships, often leading to the need to envisage strategies to avoid all situations where the pressure becomes stronger.

Basically, I am absolutely not interested in sex, so much so that every time I fell in love I did absolutely nothing, I enjoyed being in their company every free moment, but constantly feared the moment when it would be inevitable to touch the

subject (of course the “sexuals” expect it and at some point, sometimes pretending to joke about it, they will ask “but don't you like me? how come we never..?”)

Aware of being unfit to sustain a normal relationship, I have avoided it, I have tried to live with them exciting moments (and there have always been many), and I have carefully avoided situations in which we could risk finding ourselves alone in non-public places, I have always made sure that “it was getting so late that at that point I could at most offer them a ride home... like, you know, tomorrow I have a very busy day at work” (ID51).

Many users name social expectations and other people's pressures on their personal experiences as one of the main reasons which have, over time, dulled and in many cases extinguished their interest in sexuality and sexual practices. Self-presentations often reveal cases of marginalization, loneliness, and high demands in the life contexts of individuals, starting with the family and ending with social and/or educational contexts.

I am terrible at introducing myself, so I'll get straight to the point. In my life, I have always perceived that something about me was different from my peers, until a few months ago. I was seen as the odd one out, maybe gay or who knows what was on his mind, perpetually lonely and not participating in male banter. As I grew up, I developed the “ability” to adapt and hide from others to make that awkwardness go away, which didn't belong to me, actually, since it had always seemed more like someone else's problem. I tried to be with girls, but they expected too much from me compared to what I could give both sexually and emotionally. The hardest thing was being able to talk and explain how I felt but when I tried to do that... “go to a psychologist and solve your problems”. Not that it helped much, actually, and the ironic thing, after all this time, at 35, I felt better watching BoJack Horseman and its explanation of Todd. Immediately afterwards I started to feel at peace with myself. A cartoon explained what I felt about myself and that above all I am not alone (ID80)

I am not exactly in my prime: I am 57 years old and for a long time now I have been, as I understand it, asexual. Sex has never been important to me. But I must say that since I got rid of it, I've been living much better. It was always a “gold rush” and many women made me feel inadequate because I was never good enough. Interest has steadily waned. Now I live my time with friends and people who have the same interests. Maybe I can find new friends even in this chat room. (ID123)

Ethnographic observation of self-presentations and interactions shows that some users experience a condition that

³ In order to preserve participants' anonymity we have used an alphanumeric code for each participant (ID*). For the same reason, we have dropped out any socio-biographical information.

in some ways overlaps with voluntary social self-isolation, better known as the Hikikomori Effect.

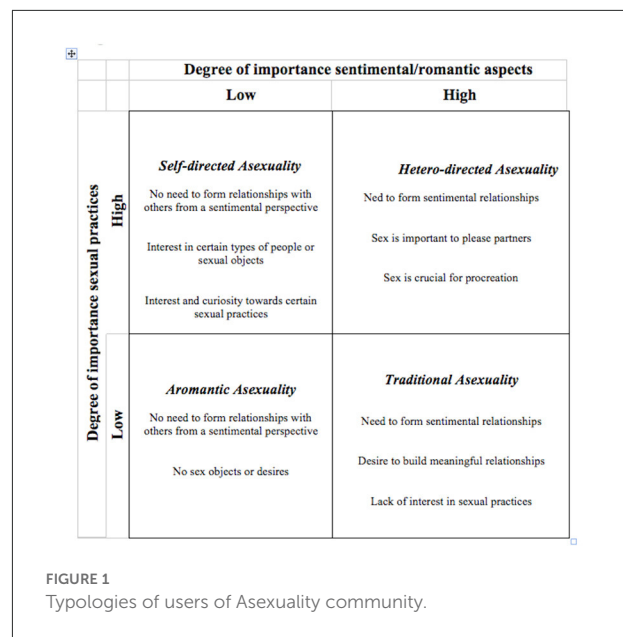
Recent studies (Masullo, 2021) have shown that the phenomenon of voluntary social self-isolation is rapidly expanding, particularly in younger people, and that this phenomenon has redefined and reworked many processes of socialization. In this case, the redefinition also encompasses sexual aspects, as highlighted by this post:

I hope I am on the right forum (...) I don't know if I can call myself asexual, but my situation is this. I have never had a relationship with anyone, and I have no sexual interest in anyone. I don't think I even know if I like boys or girls. But that's simply because I don't live among people, I haven't left the house since graduation. Yes, maybe I've gone out a few times to buy clothes or accompany my mother somewhere, but I tend to never leave the house and I don't have any friends, at least, not in Bergamo. So, I would like to know if there are people in this forum who are in the same situation as me? (ID44)

A typology of asexual people

The self-presentations and interactions on the platform allowed us to trace some of the specificities of people who define themselves as asexual or who are questioning their sexual identity, thus making it possible to obtain more details regarding the meaning of this choice, of which users are often not even clearly aware. The posts highlight two main characteristics, which would seem to ground or delineate certain ways of experiencing their condition as an asexual person, (even in the absence of shared definitions in the mainstream LGBTQ+ community): in simple terms, “love”, and sex. The former is how users consider and feel about the need to form relationships with others in sentimental terms, i.e., to build a meaningful relationship which can be a prelude to love and an emotionally fulfilling relationship. The latter is the degree of importance they attribute to sexual practices, which calls into play the need to relate with the other in a physical sense, in response to both a self-directed impulse (to feel sexual desire) and a hetero-directed one (in response to a social expectation connected to the influence of the main agencies of socialization to sexuality, including partners, family, friends, etc.).

Based on these dimensions, we constructed a typology of asexual identities, taking full advantage of the potential of digital ethnographic research (Kozinets, 2015; Masullo et al., 2020). The typology results from the intersection of two dimensions: the degree of importance attached to the construction of a romantic relationship and the degree of importance attached to sex. Four hypothetical ways of being an asexual person are thus highlighted, which can be summarized in the following diagram (Figure 1):



The first quadrant in the upper left-hand corner includes those in an initial process of self-reflection regarding their sexual identity, who also use the web community to gather information to better define themselves. We called them “self-directed” asexuals. This group comprises individuals who focus their attention on *sexuality per se* rather than on the need to build meaningful relationships with others in a sentimental or romantic sense. Their posts—often in the form of a question—focus on the meaning of sex *per se* and on certain sexual practices, toward which they express curiosity or, in some cases, aversion. In this case, we see a hybrid form of asexuality, not yet clarified, or transitory, as is shown in the following post:

The aspect of autoeroticism and fantasies has not changed since I stopped seeking sexual relationships with partners. When I chat with someone, I try to sabotage any in-person meeting, I prefer to just have fantasies about that person, I think it is the right compromise between pleasure and self-protection (ID189)

I have read that many do not even practice masturbation, I couldn't do without it! But then I don't know if I can call myself asexual... is there someone like me who has no interest in sex with other people but doesn't stop pleasuring himself? (ID166)

In the second box at the top right, we find “hetero-directed” asexuals, i.e., individuals who feel the need to build meaningful romantic relationships with others but, at the same time, feel no interest toward sex and, in general, all kinds of sexual practices. It is worth noticing that, in this group, sex does not disappear

but takes on significance depending on the pressures exerted by the social environment. These may relate, for example, to the demands of a partner, the desire to conform socially to others or the need for sexuality to ensure the continuation of the species, as the following two excerpts show:

Hello, in my life I have never felt a need to have sex, although I have made an effort to look like others, I am interested in sexual energies, (...) I am looking for simple acquaintance, on a friendship level and given my age I need "companionship". I have many interests, I do meditation, I like traveling, and I like archaeology. (ID33)

Hi, I am an asexual guy who finds it unpleasant to have sex with girls and boys.

I think sex is not fundamental to a relationship but only a necessary act for reproduction. If you feel the same way and want to compare notes, you can write to me (ID38)

The third box on the lower left is characterized by an exacerbation of relational closure toward others, a condition defined in the literature as AroACE or *asexual aromantics*. AroACE people are interested neither in the sexual aspects of the relationship nor in emotional and sentimental involvement.

Aromantic Asexual, I love art, old films, reading, and sport. I love walking surrounded by nature. I like meeting new people, and establishing friendly and sharing relationships, like many of you I do not feel the need for a sexual relationship (ID20).

I can define myself as asexual but also aromantic. Romantic love is only a concept, and a very recent one at that, just think of history, who married for love? Personally, I find it bothersome to think about sex and I find it hard to think about love. Friendship is already demanding enough. (ID6).

In the last box on the bottom right are the cases identified in the literature through the acronym ACE (Bogaert and Skorska, 2011; McInroy et al., 2021). They lack sexual impulses and a consequent reduction of sexual relations but maintain a strong desire to form relationships [with others] in romantic terms, according to the classic scheme of "platonic love". This condition adheres to the purist conception of asexuality that is transversally evident in almost all users, without distinction for sexual orientation (that is, among both homosexual and heterosexual people). This is in line with recent theories that consider asexuality to be outside the official classification and taxonomies of sexual orientations. Below are two examples of typical presentations of ACE persons:

I discovered I was asexual last January after I made a recap of all my relational experiences with both girls and boys, which were characterized by a total lack of sexual attraction (always on my part), but by romantic attraction with strong emotional ties; but, alas, I was rejected because they saw me more as a friend. Forgive me if I have not written much, I am a man of few words. (ID3).

Good evening, everyone. (...) I'm asexual and have recently been living this condition of mine with serenity. I must say that in my youth I was ashamed, especially in groups or at home, I felt like I was wrong. But now I am happy that I don't have to hide. I like being in company, I love the mountains and traveling. But above all I like polite people, if I were to meet someone interesting, I'm open to a sentimental relationship. Of course, I am looking for an asexual partner (ID40)

As per the research design, the final stage of the analysis, corresponding to the "reading" procedure, addressed the distribution of certain socio-biographic traits on the profiles of asexual persons on the platform. We reconstructed the latter through the typology presented above and deduced the former from the analysis of the profiles selected in the asexual community. Although we are aware that these data are not representative of the universe examined, we synthesized them from a statistical point of view, intending to also verify the relationships between the socio-biographical traits collected and certain characteristics associated in the literature with asexual people.

On the distribution of gender identity and sexual orientation on the profiles sampled, 68% of users self-identify with a male gender identity and 20% with a female gender identity. It is worth noticing that there is a significant presence of people declaring a non-binary gender identity (about 12%). The same applies to sexual orientation: while the majority identify as heterosexual (73.5%) or homosexual (about 17%), there is no shortage of people identifying as non-binary or pansexual (Table 1).

This difference in the incidence of males over females could lend itself to multiple interpretations, depending also on the different ways in which Italian men and women relate to sexuality and the most widespread collective imaginaries connected to it (Corbisiero and Nocenzi, 2022). While it is true that the current hypersexualisation of society affects all genders indiscriminately, prescribing a sort of "obligatory" sexuality, this takes on different meanings in the sample examined, also due to the different socialization paths to gender and sexuality experienced by men and women (Masullo, 2021). For the former, sexuality is a core aspect of the acquisition of a "hegemonic" male gender identity—thus a compulsory step as proof of one's

TABLE 1 Distribution of the sample surveyed according to gender and sexual orientation.

	General cases	Gender M	Gender F	Another gender	Heterosexual	Homosexual	Other sexual orientation
Total number of general cases	200	68%	20%	12%	73.5%	17%	12.5%

appropriateness in the execution of one's gender role. For the latter, instead, sexuality is characterized by a lesser "centrality" which, even in the online environment, still fails to find an adequate space of explicitness (Masullo, 2021). In the case of men, the absence of sexual desire can be experienced as a source of concern, not least because of social pressures. For women, this condition is less felt, as sexuality remains relegated to the idea of a stable relationship and in specific cultural environments still bound to the idea of reproduction. In this sense, the absence of sexual desire is experienced by women with less concern, as this condition is regarded as a normal aspect of the process of socialization to sexuality, and subordinate to the need to establish an emotionally satisfying relationship.

All the users in the community define themselves as asexual or question their sexuality as falling into this category. Out of the 200 profiles surveyed during the period under consideration, about 54% identify themselves as "tout court" asexuals, what we called "traditional asexuality" (ACE in the literature). They are characterized by the total or partial absence of sexual desire but wish to establish an emotional and sentimental relationship (Table 2). 32.5% of the profiles report total closure toward the other, lacking desire toward both sex and the need to establish a sentimental relationship, a condition defined as "Aromatic Asexual" (AroAce in the literature). Finally, 13.5 per cent of the users are unclear or uncertain about their identity: they show interest in sexuality or at least curiosity about it. This is true in both a hetero-directed and a self-directed sense. In the former case, for example, to accommodate the desires of a partner; in the latter, there is desire to experience certain practices such as sexting or cybersex). These people only partly fall within the category of asexuality—which, however, it is worth remembering, does not constitute a fixed identity but is subject to change and negotiation processes over time and in the spaces of online and offline sociality. Any attempt at classification would, therefore, prove inadequate, even if it is analytically valid when constructed to describe the phenomenon (Table 2).

Finally, we explore the distribution of the identified types in class age following the criterion of division defined by the ISTAT and longitudinal surveys on youth which in the Italian context consider to be young people between 18 and 34 years old (Toniole, 2022 and previous annual reports). Those under 18 years old may be considered teenager and those above 35 adults.

By cross-referencing the reconstructed categories of asexual people with the age groups considered, we can highlight the

TABLE 2 Distribution of the types of asexual persons.

Asexual categories	Cases	%
Traditional asexual	108	54
Aromatic asexual	65	32.5
Hetero-directed asexual	17	8.5
Self-directed asexual	10	5
Total	200	100

generational distribution of the phenomenon examined, as shown in Table 3.

Traditional Asexuals (ACE in the literature) are mainly those between 18 and 34 years old (68%) and under 17 years old (42%). For the younger age cohorts, sentimental aspects seem to be more important than for the later cohorts. This is also evident if one compares this with the Aromatic Asexual condition (AroACE in the literature) which is more concentrated among the over 55-year-old (75%) followed by the 35–54 year-old (59%). It can be hypothesized that for the latter cohorts, the condition of aromatic asexuality is the outcome of a progressive disinterest in sexuality following unsatisfactory experiences.

The condition of aromatic asexuality is also evident among the under 17-year-old group (40%). It could be a "comfort choice" to delay the creation of sentimental and sexual relationships to avoid disappointment, alleviate relational performance anxiety, or for subjective reasons that would require a more in-depth study with qualitative research approaches.

The more complexly defined "self-directed" and "hetero-directed" asexual profiles refer to hybrid conditions ranging from situations which express curiosity only for certain sexual practices (such as sexting or cybersex) to others marked by a total lack of interest in sexuality, which is practiced only under external pressures.

They are more common among the teenagers (under 17-year-old) and the young people between 18 and 34 year-old compared to other cohorts.

Although it is not the purpose of this article to analyse the characteristics associated with these age cohorts, the greater propensity toward hybrid profiles of the younger generations (meaning both those under 17 and those between 18 and 34 years of age) could be associated with the complex and

TABLE 3 Distribution by age cohorts of the types of asexual people.

	% Under 17	% 18–34	% 35–54	% Over 55	% Total
Traditional asexual	42%	68%	26%	25%	54%
Aromantic asexual	40%	13%	59%	75%	32.5%
Hetero-directed asexual	4%	10%	10%	0	8.5%
self-directed asexual	14%	9%	5%	0	5%
Total 200 (v.a)	100% (50)	100% (107)	100% (42)	100% (4)	100% (203)

nuanced stage of their life with multiple sexual and romantic attractions, which are rarely static but fluctuate throughout their lives (Porrovecchio, 2012; Savin-Williams, 2021). Although the data would need further investigation, it can be hypothesized that the greater propensity of these age cohorts to experiment could indicate that the choice of asexuality is only temporary, or linked to specific relationships, and it can hardly be framed within the asexual condition tout court as defined in the literature.

Discussion and conclusions

Limitations and potential of digital ethnographic research and considerations on its application to the field of sexuality studies

The present study addressed asexual people and the processes of self-definition in the digital environment. The digital ethnographic research approach allowed us to explore some of the essential steps of the research design inspired by digital ethnography, highlighting the main techniques to employ, the dilemmas to resolve before commencing the fieldwork, and the types of analysis to carry out. The transposition of classical ethnographic techniques into the digital environment constitutes a resource for researchers who intend to explore phenomena concerning populations that are difficult to reach. Digital ethnography proves particularly suitable where such populations take on their specific connotation in digital spaces, as in the case considered here. Our research shows that, in the absence of a shared interpretation of asexuality, its definition results from the interaction with others, an intersubjective process occurring mainly in the digital environment and which has no place elsewhere. By offering the possibility of creating profiles, introducing and describing oneself, and commenting, the web community provides useful tools to arrive at a shared definition, create languages and socialize with them, and attribute meanings—the scripts of a digital subculture still in the making but with its specificities compared to others that make up the variegated LGBTQ+ universe. The study

of the profiles, self-presentations and comments allowed us to explore how the asexual condition goes far beyond the question of sexual orientation, resulting instead from how people relate to a norm that sees sexuality as a “compulsory” step in the processes of gender and sex identification. It is no coincidence that in the web community examined, most of the users are men. For them, sex is the benchmark against which gender identity is socially tested. Asexuality can be seen as an indicator of a crisis of masculinity, a hypothesis that deserves future exploration with the help of other techniques and a larger sample.

The proposed typology of asexual persons highlights how the choice of asexuality is a process characterized by numerous ways of understanding sexuality and the desire for romantic relationships, marked by discontinuities more than endpoints. These subjective propensities depend on biographical, social, and imaginary experiences rather than natural predispositions or simplistic and essentialist readings of sexual identity. While this approach has its advantages, as highlighted by this case study, it is precisely within its framework that the concrete limitations to its application become apparent. The first refers to ethical issues, which directly call into question the role of the researcher and his positioning in the research field and the consequences produced by his representations. In the field of sexuality, in particular, critical approaches—such as postcolonial theory, feminist critique, and queer theory—have greatly emphasized the researcher as an interpreter of the Other/s, as a privileged observer who risks subordinating those being observed and described. The emphasis on reflexivity in social research makes it possible to understand how “meanings result from the interpretive negotiation occurring on the field between researchers and participating subjects as embedded subjects and producers of knowledge whose interactions (both in the field and through textual strategies) are filtered and constructed based on gender, sexuality, nationality, race and ethnicity, social class, age, and bodily ability” (Grassi et al., 2020, p. 111). Guided by these concerns, we chose to declare ourselves as researchers to deepen some reflections stemming from what we observed and to respect the point of view of the natives as much as possible. We were, indeed, well aware that the readings produced without this confrontation could unleash multiple consequences on subjects who are already vulnerable, and

therefore expose them to further processes of marginalization and exclusion. A further issue of digital ethnography is taking into account the peculiarities of an observation that takes place in a digital environment. We must consider the effect of the medium of communication which, unlike in the case of face-to-face observation, often does not allow researchers to go deeper into the characteristics of the subjects. By conducting in-depth research through “questioning” (that is, privately contacting some users and asking them for details and clarifications), we intended to make up for some of these gaps. The discontinuity, nevertheless, remains “unbridgeable” compared to traditional face-to-face ethnographic research—the main limitation to be taken into account when choosing this type of approach. The future of digital ethnographic research will thus lie in the way it manages to meet some of these challenges, which will depend both on the researchers’ ability to combine different research techniques, and on the technological evolution of the tools proposed by the web society. The latter seems to be increasingly moving toward overcoming the differences between real and virtual, between research carried face-to-face or remotely.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation

and institutional requirements. Written informed consent from the participants’ legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

The whole research is a result of intense collaboration among the authors. In the final draft, GM wrote sections: Introduction, The digital ethnographic approach: Similarities and differences with the traditional ethnographic approach, Research design, and A typology of asexual people. MC wrote sections: The phenomenon of asexuality: A literature review and Following mainstream models: Emotional fragility and social pressures. The authors co-wrote section Discussion and conclusions. Both authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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COVID-19 policies and the arising of debate on twitter

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This study focuses on the analysis of contacts and communications on Twitter concerning pandemic policies. The goal is both show mobilization processes rising from the web and detect main actors, themes, and contents within the European context. Through a mixed method procedure, we tried to identify the main themes and most relevant communities, the main users, the most relevant topics and languages, and the underlined meanings and differences related to languages (as *proxies* of areas). Monitoring the communication on 3 main topics ("no-mask", "covid-19", "greenpass"), we noticed the weight of the gap between the government's attempts to communicate information motivating measures geared toward managing the crisis and the perceptions of private users. These perceptions spread through the web with such force the more the emotional, ironic, or polemical plane weighs. In this sense, online communication could be considered a tool for understanding the weight of the interaction between the institutional, social, and private dimensions, with effects on the social construction of identities. Digital communication is becoming an element of this process. The paper describes the "reassuring" role played by the digital community in the construction of ontological forms of security resulting from the construction of a shared digital culture. Results show the emergence of digital communities, structured on reference hubs and standing out from the detected phenomenon, prevalence of idioms and even language structures. The relevant role of the emotional (French), ironic (Italian), protest (English) component is confirmed, but also the changing and *fluid* structure of the debate and the co-presence of many parallel discussion communities.

KEYWORDS

automatic content analysis, social network, network analysis, pandemic, narratives

1. Introduction

This study focuses on the analysis of contacts and communications on twitter about pandemic policies. The goal is both showing mobilization processes rising from the web and detecting main actors, themes and contents within the European context. The choice of twitter as a social network to monitor derives from several considerations:

- the political nature of the debate leads us to believe that this social network is particularly useful;
- the widespread and transnational use of the same social network allows you to compare information and narratives in different contexts, using the language as a proxy for the area;
- the possibility of identifying short phrases, videos and links allows you to reconstruct the political and identity profiles.

The main question to be answered is if the online communication about the pandemic phenomenon produced something as social and/or political common feelings. With this in mind, the work monitored the on line communication during different phases of pandemic crisis, identifying a keyword for each. We selected, in particular, three main topics/phases (on an international perspective), named as: “No-mask,” “COVID-19,” “Greenpass.” A specific focus was on the protest communication. When the No-mask protests decreased, the communication centered on the “COVID-19” lemma was monitored. This made it possible to compare the different communication structures, the relative narratives, the weight of (residual) protest communication, and the persistence of dialogue on the more general topic of the pandemic. The “No-mask” and “COVID-19” communication—although centered on the same issue (the effect of the pandemic crisis in social life) differ in structure, persistence, narratives and also characterizing languages. Another communication structure is referred on a specific form of protest: that against the “COVID-pass.” This, compared to the No-mask one, presents some specific characteristics: the greater endurance over time and the particular presence of Italian protests. The decision to make mandatory a document certifying the immunization to allow the free movement of the population, in fact, assumed a different weight in each State and, consequently, the communication on this specific issue is mainly referred to areas in which the weight of the legislation was particularly stringent.

We did not want to analyse comments centered on only one key-word, but to choose the characterizing topic each specific period. This was possible by monitoring both the discussion in the media (newspapers, television programs, etc.) and the trend of the debate on social networks. We opted for an analysis conveyed by the same trend of public opinion, being the risk communication an important part of the social perception and construction of collective meanings (Ansell et al., 2010). The work therefore analyses the effects of the perception of the COVID-19 pandemic and related political interventions, consciously with respect to its construction as a social event.

In fact, can the on line communication be defined as a unique process? The answer is: no, it cannot! First of all, the COVID-19 emergence issue, as social and political topic, changed in time for political relevance, social perception, narratives, as real health threat and consequently for its economic impact. So we distinguish at least three different phases of the pandemic crisis, depending on the social perception, political choices, juridical decisions and subsequent economic impacts (all in a European perspective). These phases are well-identified even through a monitoring of the specific on line communication on twitter.

Twitter as social network is particularly suitable for the purpose because each user has a small number of characters for each message, which can be commented on or shared by others, and at the same time the content and users are usually politically oriented. Moreover, the on line communication was particularly

spread between 2020 and 2022, when pandemic crisis affected all European States, limiting direct contacts and encouraging digitization (also as a forced choice). Besides, twitter is a very used platform in all States of European union and in England.

The use and platform availability is very important because comments on social networks (as the off line ones) underline different opinions and communities, interests and intentions and we are interested in evaluating the incidence of choices and opinions but also of the structure of communication from a supranational point of view. At the same times, there are many different questions, opinions, problems related to the COVID-19 crisis.

We tried to identify different facets, as:

- the main themes and most relevant communities;
- the main hubs (if there are any), that is the main users, subjects or entities (associations, organizations, newspapers, etc.) that send and receive a large amount of information;
- the most relevant topics and languages, even in a comparative perspective;
- the underlined meanings and differences related to languages (as *proxies* of areas).

During some phase and period, issues have certainly produced more than just a virtual protests or reactions in many European States. On the other hand, we also note some local specificities both with respect to themes and issues, and with respect to the narratives characterizing the area. It is interesting to note, for example, how in the early stages, shortly after the tragedy that hit Italy (the first European area to face the pandemic in particularly problematic conditions) many of the Italian comments extracted on the “No-mask” keyword, are aggressive or ironic, but however opposed to the movement.

2. Materials and methods

While certainly one of the key actions of the government during the pandemic crisis was to “make sense” of the crisis, conveying meanings and informing about risks and related decisions, the acceptance of this meanings did not always happen.

Most emergency risk communication is based on the assumption that technical and social improvements in the warning system can motivate people to take protective action. Contrary to popular belief, it has become particularly clear how communicating (even high) risks to the population does not automatically lead to changes in behavior (Floyd et al., 2000; Lindell and Perry, 2012). The work presented aims, therefore, to reconstruct the collective narratives related to the pandemic emergency by adopting different points of view and attempting to reconstruct the motivations that led to the prevalence of one or the other position. This type of analysis wants to investigate

the reasons of specific behaviors, for or against emergency policies. Certainly an important concept in this sense is that of the social construction of reality (Pellizzoni and Biancheri, 2021), here redefined in terms of digital ethnography (Amaturo and Aragona, 2019) and risk communication, as well as the analysis of social communication to planning social policies (Bamberger, 2016, 2018; Picciotto, 2020).

2.1. Ontological insecurity and digital culture

Is virtual experience itself important for the construction of cultural identities? This is an important question for this study. Although this work focuses on the specific analysis of online communication, it must necessarily address this issue as the relationship between the construction of shared political identities and online communication is becoming more and more relevant and certainly it has significantly impacted the topic of reference. In fact, this is an issue that cannot be ignored when confronting the perception and management of policies on the COVID-19 pandemic.

The on line communication could be considered, in this sense, a tool to understand the weight of the interaction between the micro (individual) and macro (social) dimensions referred to the social construction of identities. Digital communication has become such an element of these process because of it is capable to produce meanings, behavioral models and norms.

The communication on social networks today can, in fact, be considered as one of the elements that convey the construction of identity, as it produces interaction (virtual and real) and derives from prior positions and choices. Identity structure, as well as awareness of a reference context or community are all features that help to produce ontological security. This function is particularly important in the period we are dealing with.

Cultural theory (Thompson, 2008; Johnson and Swedlow, 2021) identifies, specifically, four cultural worldviews, which may be relevant for the outcomes on the reconstructed debate: Individualism; Egalitarianism; Hierarchism; Fatalism. According with this perspective, reality is socially constructed through cognitive mechanisms with which people reproduce the expectations of their in-group (even if digitally constructed, as in this case) as a protective reaction against insecurity and fear (...).

This condition can lead to the spread of false information among groups and communities of users, reducing ontological insecurity and relative perception of risk, with results on individual and/or collective behavior (Raffini and Penalva-Verdú, 2022). In this sense, it was useful to monitor in particular communications centered on “No-mask” and on COVID-pass (in particular with respect to the binding use of the Greenpass in Italy). Specifically, the issue of the diffusion

of the confirmation bias (Bessi and Quattrociochi, 2015; Del Vicario et al., 2016) linked to the individual selection of information and news that confirm one's prejudices, including the sources of access to information, is significant, up to the creation of customized user profiles. Besides, other biases may emerge or overlap with this by depending on additional on line or off line relational, social, and cognitive dynamics and/or psychological distress and anxiety (Tei and Fujino, 2022). Furthermore, different studies highlight how behind conflicts there are causes that go beyond disinformation and individualism and that are related to many causes (Bennett and Pfetsch, 2018).

The sharing of misleading communications, controversies and fake news, crossed with a climate of widespread ontological insecurity, usually produces a high risk of distortion in information. Besides, considering the communication on social networks, the algorithmic management of the sending of customized communications intensifies these identification and identity construction mechanisms, initiating forms of access to dis-information that are no longer controlled even by the user himself. The outcome of the process described is the growing polarization of messages and the public on social media. These dynamics, already noted and discussed due to the negative effects on the social, political, and relational level (Del Vicario et al., 2016), have assumed particular relevance for the possible effects on the health level, linked to the diffusion of opinions contrary to vaccination and, more generally, against every precaution aimed at limiting the increase in infections and the most harmful effects of the pandemic.

The debate that emerged on social media and, more generally, on the media, has produced unprecedented fractures, including transversal ones on the political level, which have led—in Italy—to the emergence of positions defined as communitarian, liberal, progressive and radical (Battistelli and Galatino, 2020). The role of ideology for the cognitive management of ontological insecurity is, in this sense, relevant. People with more political knowledge have, in particular, more developed ideological positions (Carpini and Keeter, 1996). Likewise, cultural worldviews are generally more consistent and their influences are stronger among people with political knowledge (Gastil et al., 2011). So, we can distinguish multiple reactions to the pandemic crisis, alternatively attributable to political ideologies and to the four cultural worldviews identified, especially if we consider the original distinction of individualism vs. communitarianism and egalitarianism vs. hierarchism (Johnson and Swedlow, 2021). In fact, we can identify a communitarian right-wing tending to be alarmist and a liberal right-wing oriented, instead, to minimize the gravity of the pandemic, as well as a progressive left-wing asking for closures as measure extraordinary and a radical left-wing criticism against any closure as risk of authoritarian drift.

2.2. Three European phases of pandemic crisis

The pandemic crisis has certainly entailed exceptional and emergency conditions. Everywhere it has been necessary to impose more or less severe measures aimed at limiting infections. In terms of ontological security, the choices made, more oriented toward opening than closing, have certainly influenced the climate of opinion, implying a specific balance between fears of contagion and the risk of impoverishment. These positions certainly emerged from the analysis of the tweets, with a certain distinguishable strength also in terms of different languages, conveying some themes rather than others. As we will note, this implies several stages, characteristics, and related perceptions/definitions. It is interesting to note that the three phases identified through the analysis of the comments and progressive findings that emerged from media monitoring, correspond to as many distinct phases considering the spread of infections in the European context and related more or less binding political decisions (Zupi, 2021). The analysis of the communication on social networks allows to obtain, therefore, information relating to contexts and conditions even distant and different. If this is certainly an advantage, it was decided to limit the analysis only to the European context, which has similar traits and in which the various states have moved with a certain homogeneity. If in this context three specific moments are identifiable (corresponding to the changes in the monitored lemma), the conditions—at least in terms of the reconstructed phases—could change by including comments in other languages.

The first wave of the virus implies a phase of high alert in which almost all European states close schools, many businesses and restrict public gatherings at various levels. Many States also involve the military, reduce public services and introduce night curfews. These decisions trigger protests mainly of a liberal and/or individualist orientation (the “No-mask” protest is born), continuing in Europe also during the second wave of the pandemic (since autumn 2020), in particular during Christmas (December). The second period is, however, a period of loosening of restrictions, in which many European governments decide to adopt a less drastic approach than the previous lockdown, with some alignment of approach but with time and regional lags in implementation.

At the beginning of 2021, many EU countries still adopt restrictive measures, but not comparable to the strict closures of a year earlier: Germany and the United Kingdom adopt a partial lockdown; France, Spain and the Netherlands instead adopt a curfew. In this phase, progressively, the No-mask protest diminishes while communication about the need for closures and the severity of the infection, but also about the economic crisis, remains and intensifies. This is the period in which communication “COVID-19” is monitored. At this stage, on the socio-economic front, European governments are

committed, although with different margins for maneuver, to providing massive fiscal, financial and economic support to protect businesses, workers, families and vulnerable populations. National and European public funds are reallocated in favor of the priorities dictated by the crisis, supporting healthcare, vulnerable populations and regions particularly affected by the crisis. These facilitations and supports certainly helps to limit protests and various forms of dissent.

Lastly, and precisely in relation to the centrality of the economic crisis, a third phase of thematic communication on the pandemic emerges, which does not occur in all areas with equal intensity and which refers to prohibitions and controls linked to vaccination and/or immunization. It concerns the need to have a document proving the immunization in order to be able to regularly attend public and private services, offices and facilities. On twitter, the protest centered on the lemma “Greenpass” (the document required and obligatory in Italy) emerges with particular force. This is a phase in which socio-economic benefits are becoming increasingly scarce and, consequently, protest and dissent centered on economic issues are increasing.

2.3. Three topics of communication for three features of pandemic crisis

The distinguishable forms of protest and/or discussion in Europe refer to phases and forms of evolution of the online debate, related narratives and limits of mobilization. Although different phases can be identified for each context, linked to the combination of the spread of contagion, political decisions and the different balances that each area has maintained with respect to the need to protect public health and economic interests, the work shows we can distinguish three specific moments of discussion. The first phase of the pandemic was characterized by the “No-mask” protest, linked to the closure and distancing decisions that gradually emerged. In this phase, the presence and mobilization of the protest group is especially widespread in certain areas (England and France) and is characterized by a refusal to adhere to forms of restriction of individual freedom.

The work monitors, at this stage, the recursive online communication between subjects critical of government choices against the risks of contagion underlying the pandemic. We used, in particular, web-scraping tools to extract tweets containing reference lemmas of communication with respect to measures to contain the contagion. Communication centered on “No-mask” was monitored from November 2020 to February 2021.

Subsequently, having noticed a clear reduction in reference communication, the communication centered on “COVID-19” was monitored from March until June 2021. Finally, the last monitoring phase concerned the lemma “Greenpass” (also when associated with variants such as COVID-pass). This

observation lasted until December 2021. In March 2022, Italy, which prolonged the state of emergency for a particularly long period, also declared its end.

The decision to monitor the use of these words depends on several considerations, most of which have already been described. Referring specifically to the analysis of the data, the word “No-mask” becomes *de facto* irrelevant in February 2021, while later on, especially in the summer, dissent becomes macroscopic in relation to the ban on openings and aggregation. Between March and June, there is no other clearly semantically connoted lemma, so we opt to monitor—for comparative and evaluative purposes—the communication on “COVID-19.” This extraction-key makes it possible to distinguish between communication structures and themes. The third phase identified through media monitoring and communication content analysis is the one in which dissent toward emergency measures becomes particularly incisive, especially where—as in Italy—these still persist and strongly condition citizens’ lives, especially when they decide not to vaccinate. At this point, the protest again becomes visible and associated with specific lemmas, once again connoting itself on a thematic level. If the headword changes, explicitly leading back to the demand for proof of vaccination (Greenpass, COVID-pass, etc.), the protest re-emerges again in association with the keywords of the first phase (no-vax, No-mask, no-vaccines, etc.). The media visibility of the new wave of protest is evident and trans-national, although it is concentrated in certain areas and—in particular—we centered our analysis in the Italian context.

3. Results

Technically, we propose a three-step procedure, which is useful for obtaining information on data extracted from social networks using a number of analysis techniques borrowed from the in-depth qualitative analysis, graph theory and automatic content analysis. Concerning the graph theory, users are defined as nodes and the comments, links and images posted and viewed constitute the links (Hansen et al., 2010, 2012). In this way, the hubs of the network (i.e., those nodes on which the entire network structure depends) are identified and all information regarding the relevance of the messages is reconstructed. Their attractiveness, the potential for intermediation, the selective reach of some messages as opposed to the ability to quickly reach many or all users of others, is information that can be detected using the group analysis function and the various network analysis measures referring to centrality *degree*, *betweenness*, and *closeness* (Junlong and Yu, 2017).

The same procedure has also been successfully used to analyse other forms of communication on social networks and allows for a kind of controlled, non-automated data mining, skimming relevant information from a potentially infinite database of data and communications (Gozzo and D'Agata,

2020, 2021). This approach captures and integrates information on several levels, cross-referencing the preliminary qualitative analysis of the detectable information on the main network comments with the quantitative investigation of the network structure of the communication, aimed at identifying the most significant structural elements.

Specifically, large samples of tweets were extracted systematically covering the emergence period for the most part of European states: from November 2020 to March 2021. Three main keywords were selected from the debate: No-mask (from November 2020 to February 2021), COVID-19 (from March to June 2021), and green/COVID pass (from June 2021 to December 2021). After collecting edges and comments in 13 waves, we observed different structures of the nets representing links among users. Technically, we remark a three steps procedure applied to obtain complementary information about data extracted from social networks:

- 1) First of all, we carried out an in-depth (and qualitative) study on the content of the most important tweets. For each extraction, the top-10-tweets, i.e., the most frequent comments among those extracted, were selected, also taking into account the weight of views and re-tweets in the network. The result is an in-depth analysis of the main content posted by the network's hubs, that is the users whose comments were most often viewed and commented on in turn. The qualitative study at this stage allowed us to exclude some tweets, as referred to specific or atypical issues, and to select the main languages for each keyword/period.
- 2) Then we focused on the analysis of relational structures, employing network analysis tools. This quantitative analysis is carried out on all comments extracted (not only the European ones) by applying network analysis. This step made it possible to detect the eventual presence, weight and quantity of actual parallel communities. It is possible to potentially distinguish a stage of birth, formation and decay of communities by considering the number of reciprocal ties, self-loops, unique ties and the presence of cohesive or non-cohesive subgroups. Finding the presence of small groups and fragmentation of communication on several specific themes indicates a lack of cohesion and therefore of community (even virtual), while detecting large groups shows the structuring of discussions around strong arguments and / or aggregation on thematic points. The analysis is unrolled for each extraction, in order to evaluate how (and if) the network's structure changes. Various considerations are possible with respect to the volatility of the relational and participatory structure, including the aggregation and dispersion of a particularly large number of users on specific themes or moments. This step allowed to select—for each extraction—the communication structure and the main groups as subnets obtained by

extracting clusters connected to each other, with greater internal homogeneity and external heterogeneity in terms of links.

- 3) Finally, the semantic analysis is applied. To perform the automatic content analysis, only main European languages are selected. From the comments in the different European languages, those of the most frequently used languages (identified already in a first stage with qualitative analysis) were selected. This last stage shows differences and specificity on topics and discussions both at the level of languages and periods. This kind of analysis allows to detect the main elementary contexts and themes for each language and to compare thematic clusters with respect to the different periods by progressively employing exploratory co-occurrence analysis, extraction of elementary contexts, identification of clusters of main lemmas and factorial analysis for each language and keyword.

3.1. The main users

The first step of the analysis aims at highlighting the Tweets emerged from each extraction. This qualitative step is crucial to determine the network's hub as it is from them that users' reaction will branch. A deeper analysis of the main comments will be needed for a correct matching between the language and the related geographical area.

Certainly, the choice of the extraction keys is going to have an impact on both the structure and the content of the communication. In this case extraction keys are hashtags and they are going to be weighted based on their frequency.

In the first extraction the chosen hashtag is “No-mask.” During this period (from 30th November 2020 to 5th February 2021) five draws were carried out. A close monitoring of the communication showed a high share of comments in Italian, English and French. This first period goes through at least three specific moments of tension: the first vaccine distribution, the growing spread of the contagion and the decision of many Governments to close shops, restaurants and attractions in many parts of the world.

During the second period, ranging from 1st March 2021 to 30th June 2021, governments' measures weakened due to a contagion rate reduction. In order to monitor the communication on twitter, the chosen lemma is “COVID-19.” This generic extraction key has a high incidence of comments in Asiatic languages and English. In particular, most of the comments appear in agreement with the need to impose limitations and restrictions.

Last wave of extraction (from 1st July 2021 to 1st December 2021) refers to the communication centered on the hashtag “Greenpass.” This is specifically characterized by a communication in Italian language, tending to contrast anti-COVID measures. The almost exclusive presence of Italian

tweets depends on the hashtag selection. #Greenpass, in fact, is chosen Italian name to refer to a digital COVID-19 certificate, named otherwise all over Europe (France—*passe sanitaire*, Denmark—*coronapass*, etc...) when not specifically named at all.

This preparatory stage of analysis, as mentioned before, shed light not only on comments and prevalent sentiments but it also gave other relevant information about users, recipients and specific topics. In particular, “No-mask” communication seems to be almost exclusively private and contest-oriented (Figure 1). In fact, while it denotes a satirical approach against no-vax in Italy, it appears more centered on mobility protests and claims to freely purchase in English. If British protests on twitter appear characterized by a form of liberal-populism, in France they seem to be the outcome of a more emotional-individualistic approach; suffice to think about the number of retweets a comment against mask usage in kindergartens had.

As was to be expected, the comments drawn searching the lemma “COVID-19,” are more generic and cover different topics. It emerges, however, a more positive reaction to controls and restrictions. Moreover, this wave shows a marginal importance of no-vax and No-mask claims and—unlike the former wave—comments are posted not only by individuals but also by Institutions like political parties, trade unions, associations and newspapers too.

Hence, it is possible to witness both institutional and non-institutional comments, equally addressed to political institutions and people. The first mainly express dissent to shops' openings against scientific advice, social distancing and mandatory mask usage abolitions. In other cases, these comments tend to criticize the virus mismanagement in schools and prisons. The second, instead, tend either to promote compliance with containment measures (masks wearing, vaccinations, etc.), or contain general updates on the number of infections, the availability of oxygen cylinders and beds in hospitals, i.e., data (confirmed and official), institutional advices and solicitation to respect the rules.

In the opposite direction, the third wave communication (focused on hashtag “Greenpass”), although coming mainly from private citizens, is evidently made up of subjects with a high sense of political effectiveness and self-directed, largely oriented to reach and “influence” political institutions and decision-makers (Figure 2).

As anticipated at the beginning of the paragraph, this first descriptive step of the analysis aimed to identify (when possible) information on geographical origins, on the sources of comments (politicians, newspapers, private citizens, etc.) and on the feelings that can be deduced from the type of users involved, main topics and recipients. Overall, it turns out that the main hubs are different for each selected hashtag.

The tweets about the hashtag “No-mask” are almost exclusively managed by private individuals and constitute networks that are not very dynamic, closed, mostly focused

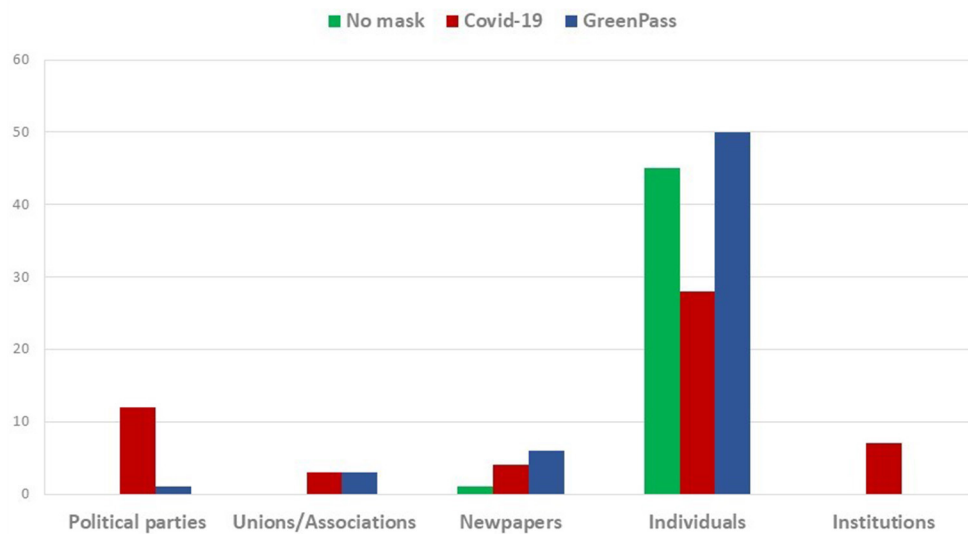


FIGURE 1
Top 10 tweets: distribution of hashtag for different sources.

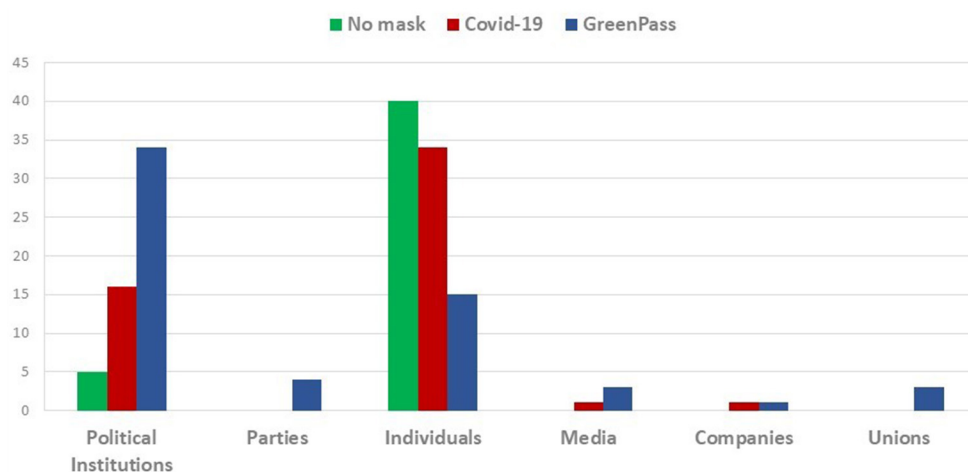


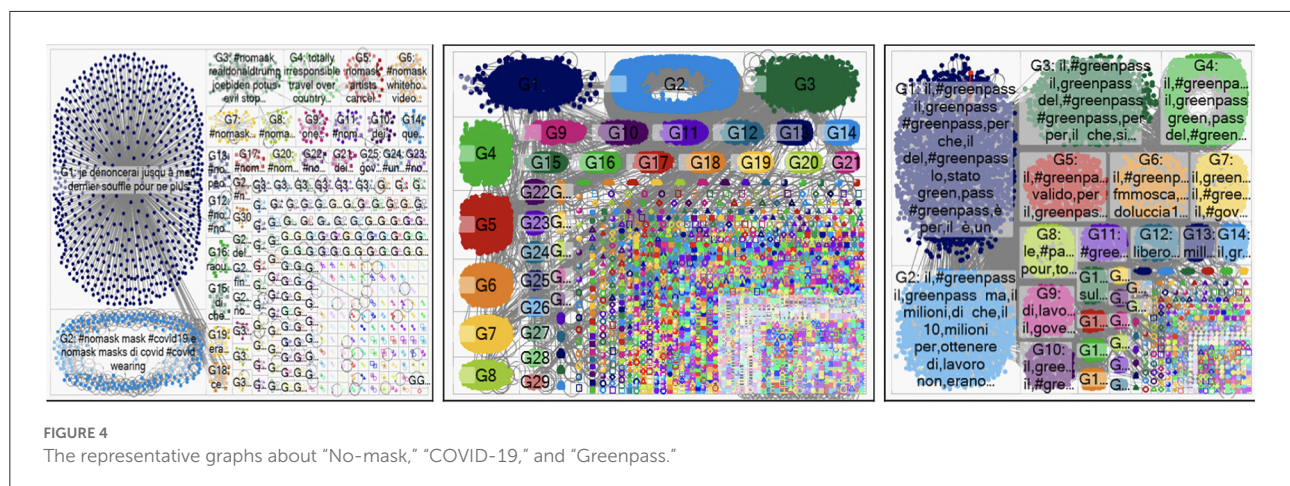
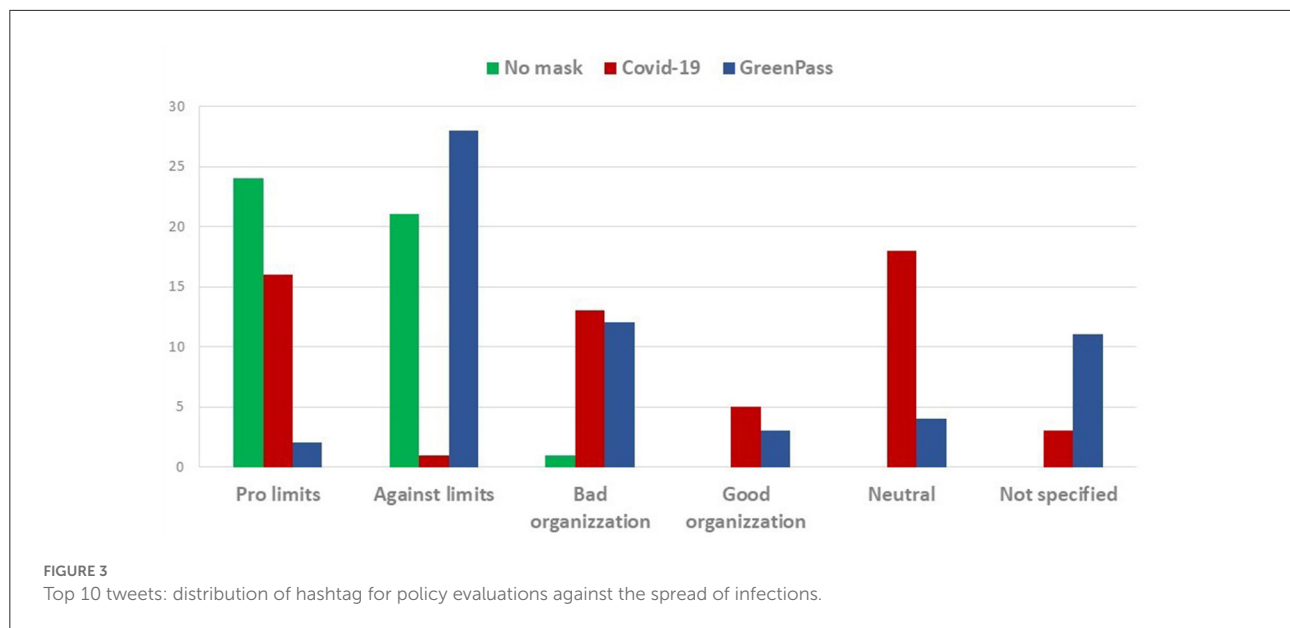
FIGURE 2
Top 10 tweets: distribution of hashtag for different recipients.

on small groups, with forms of communication very similar to those typically oriented by popular rumors. These networks can be further divided into two clear exclusive categories: the pro-restrictive measures that use the hashtag for derisive or ironic purposes (mostly in Italian), and the actual “No-masks,” which are opposed to any form of freedom limitation (Figure 3).

The patterns of the communication change when the “COVID-19” tweets are extracted. In this wave, neutral positions prevail and frequent is the reference to other themes other than the contagion containment policies. The comments related to “COVID-19” are more oriented to the claim of mismanagement

or, again, to support the restriction measures. The most noteworthy characteristic of this network, however, remains the fact that tweets are not only posted by private users but also by institutional actors.

Finally, the communication related to hashtag “Greenpass” shows many typical traits in common with “No-mask” communication. It’s mainly politically oriented movements that—unlike the latter—are localized in Italy and (at a lesser extend) in United Kingdom. Therefore, it seems to emerge a new phase with a participatory structure oriented to protest and raising from below but more polarized than the previous one.



3.2. The structure of communication

The choice of hashtags shed light on particular types of users, target and communication aims (information, protest, advices, etc.). At the same time, it also affects the structure of communication. For example, it is possible to identify the presence of thematic groups or real communities.

Figure 4 shows the graphs of communication network for each hashtag. The first to the left is the one related to the keyword "No-mask." It is possible to notice how communication is divided into two parallel communities with only two main components and a series of unconnected nodes. By contrast, the communication centered on the lemma "COVID-19" (at the center) appears divided into a large number of subgroups. Finally, the "Greenpass" communication (to the right) seems to be in an intermediate position between the two with a high

number of dense groups. The hypothesis is that the more divisive a topic is, the more likely it is that large groups with conflicting opinions will emerge, the more general a topic is, the less likely it is to observe polarized subgroups.

To better understand the diachronic dynamics underlying the structure of the groups and their communication, the major network measurements were applied to the tweet analysis (Priyanta and Prayana Trisna, 2019). The first of these measurements is *closeness centrality*—calculated as the sum of reciprocals of the smallest distance between each node, in formula:

$$C_c(n_i) = \left[\sum_{j=1}^g d(n_i, n_j) \right]^{-1} \quad (1)$$

where $d(n_i, n_j)$ is the distance among the i -th node and all the other g -th nodes. So, the *closeness* provides information on the presence of thematic groups. The higher the *closeness*, the higher the presence of compact communities sharing a specific topic. On the other hand, low levels of *closeness* suggest a communication with no specific focus and small groups, which implies that most of the network's nodes rarely interact. Despite the *closeness* never reaches high values during the observed periods (Figure 5), it is true that the highest values are recorded in the period in which the hashtag “No-mask” was observed. This would seem to be in line with what the graphs suggest (Figure 4).

During the “No-mask” detection period, in fact, few distinct thematically polarized groups (but with many nodes) are observed. By changing hashtags, inserting a more general topic (such as COVID-19) communication is “pulverized” into as many subgroups as possible subtopics. A whole different speech deserves the “Greenpass” hashtag. As said, it mainly concerns Italy, it is addressed to institutional actors (Figure 2) and it was carried on at that time when the phenomenon was considered outdated. It may not be a coincidence that in November and December (restarting the infections) there is a reversal of the *closeness* trend as consequence of debate resumption.

The second network measure employed in the analysis is centrality *degree*, here used in standardized form. Centrality *degree* is obtained considering the number of linkages each node has— $d(n_i)$ on the total amount of possible linkages underneath the network ($g-1$), in formula:

$$C'_d = \frac{d(n_i)}{g-1} \quad (2)$$

In the specific case, centrality *degree* refers to the number of relations among nodes, detected looking at the reactions to the tweet, i.e., visualization, retweet, likes, etc. (Bild et al., 2015). As it is possible to notice from Figure 5, the *degree* shows a trend growing over time. Such an increase seems to be triggered by the specific topics observed and it reaches its acme when dealing with communication on “Greenpass” (Figure 5).

The “No-mask” communication does not appear centered on few particular nodes but, as shown by the *closeness*, it will generate few discussion groups containing very homogeneous nodes in thematic terms. The low *degree* values—in fact—suggest a peer communication within groups and not centered on public users. Moving on to analyse the *degree* in “COVID-19” communication, there is a slight value increase compared to the previous period. This could be due to the “source” nodes of this communication. As observed in Figure 1, in this period the debate is often generated by political and institutional actors whose visibility consequently triggers a greater chance of reaction, both in terms of protest and in terms of inspiring the wish to go deeper (Miller, 2020).

The *degree* centrality reaches its peak in October (2, 57) when observing the network structures related to the third focus of the analysis: the hashtag “Greenpass.” The high *degree* value, in this case, highlights the existence of a broad and open communicative dynamic. In such a case, communication does not only imply reactions—which are still present—but it becomes more direct, creating an actual debate between private and public users which communicate with one another in the “digital square” and not in close subgroup as observed in the “No-mask” network.

The third measure used in the analysis is the *betweenness* centrality. It is obtained through the sum of all of the partial *betweenness* calculated for each couple of nodes, in formula:

$$C_b(n_i) = \sum_{j < k} g_{jk}(n_i) / g_{jk} \quad (3)$$

where $g_{jk}(n_i)$ is the number of geodesics that connect two nodes containing a i -th node. *Betweenness* centrality highlights the presence of users that play an intermediate role between either users or groups of users. A high value of *betweenness* indicates an open communication network characterized by continuous exchanges between nodes and between subgroups. On the other hand, a low value of *betweenness* underlines the presence of closed groups not interested in communicative exchange with other groups. The analysis of *betweenness* in “No-mask” period (Figure 6) confirms what has been previously noted. In this case, in fact, the communicative structure seems sparser, a sort of pseudo-dialogue among people sharing the same thoughts. Closed groups within which no nodes with intermediary roles are observed and reluctant to accept exchanges with other groups.

On the other hand, communication in the following two periods appears more intense. The presence of intermediaries emerges, in fact, when looking at the “COVID-19” centered communications and becomes evident with “Greenpass” centered discussions. The involved nodes, in this case, not only participate by reacting to tweets but sharing them contributes to their dissemination and in some cases generates protest movements on the digital and real streets.

3.3. The main contents

In order to analyse the content of the comments disseminated in the networks, we opted—finally—to conduct an analysis on the main languages, for each of the selected lemmas. The structure of the communication is different, depending on the lemma identified, and the contents are not necessarily aligned. Highlighted dynamics and emerged points of view are very different, depending on the reference context. First of all,

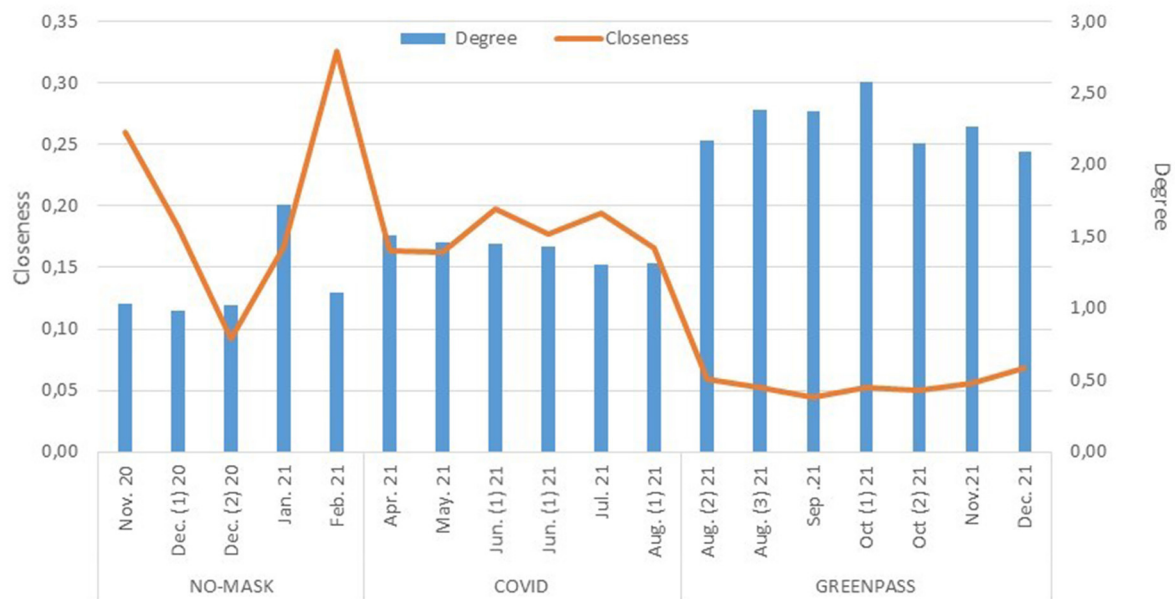


FIGURE 5
Distribution of *degree* and *closeness*. Time series: November 2022–December 2121.

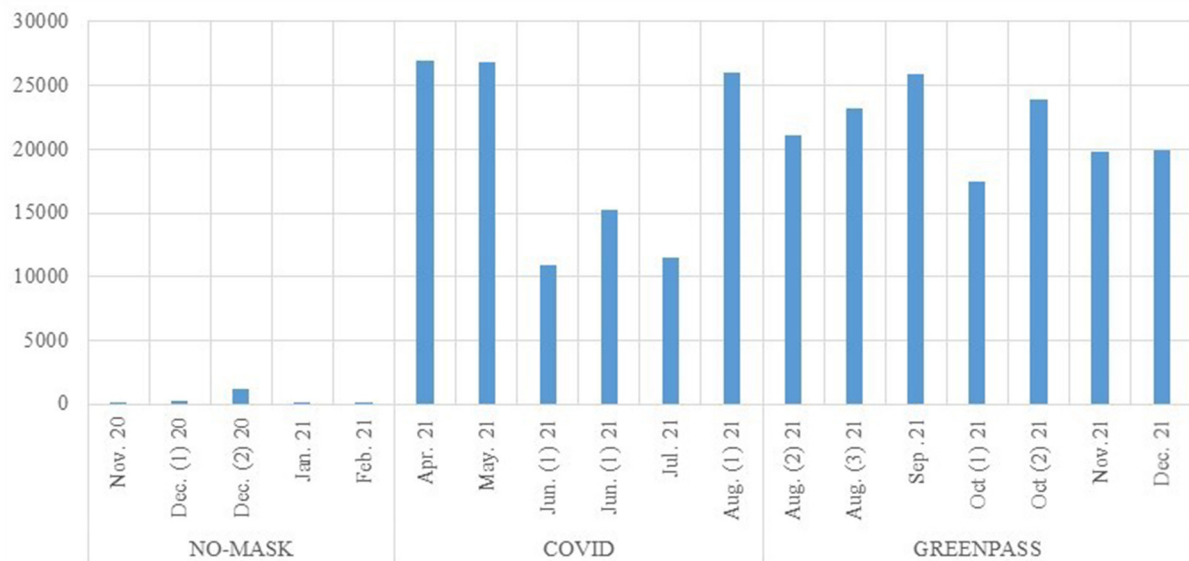
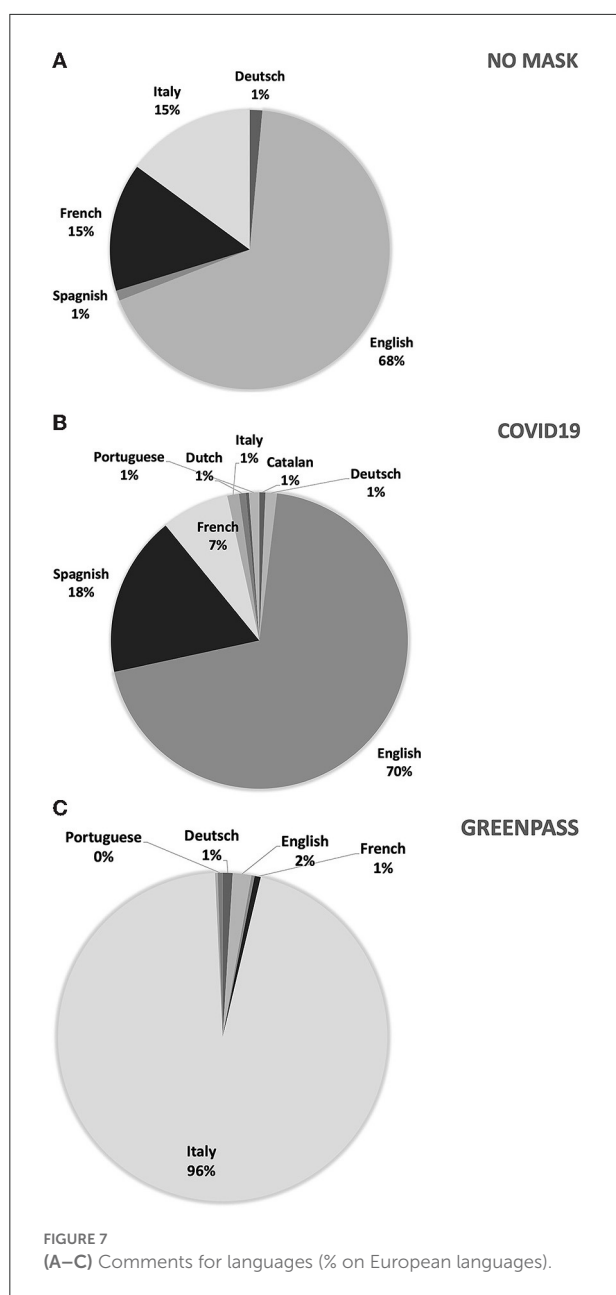


FIGURE 6
Distribution of *betweenness*. Time series: November 2022–December 2121.

the prevailing languages are not always the same. If we restrict the analysis to European languages, it emerges that most of the “No-mask” comments are in English, Italian and French and those on “COVID-19” are mainly in English and, to a lesser

extent, Spanish. Those centered on the word “Greenpass” are, however, predominantly in Italian (Figure 7).

The first analyzed lemma, “No-mask,” mainly involves (reciprocal) communication between private users. That said,



the structure and content of communication are identified progressively, moving from the analysis of associations between basic units of communication (co-occurrences between lemmas), to the identification of clusters of main phrases (elementary contents of communication).

The analysis of co-occurrences centered on the abstraction key allows us to detect some content specificities. The meanings related to the keyword “No-mask,” for example, change depending on the languages. In Italian there is a clear association with no-vax, conspiracy, but also with a series of terms used to ironize against the self-styled No-mask movement (manginobrioches and terrapiattisti).

The French communication is deeply different: the ironic element disappears and it is replaced by the emotive one, particularly with respect to the limitations imposed on children (enfant, coronaprincess, and denoncer) and the reference to historical events traceable to wars and revolts (resistance and genocide). The meaning of these associations is not always evident, but becomes clear in the other phases of the analysis when phrases and comments emerge, which are also traced back to precise links and references.

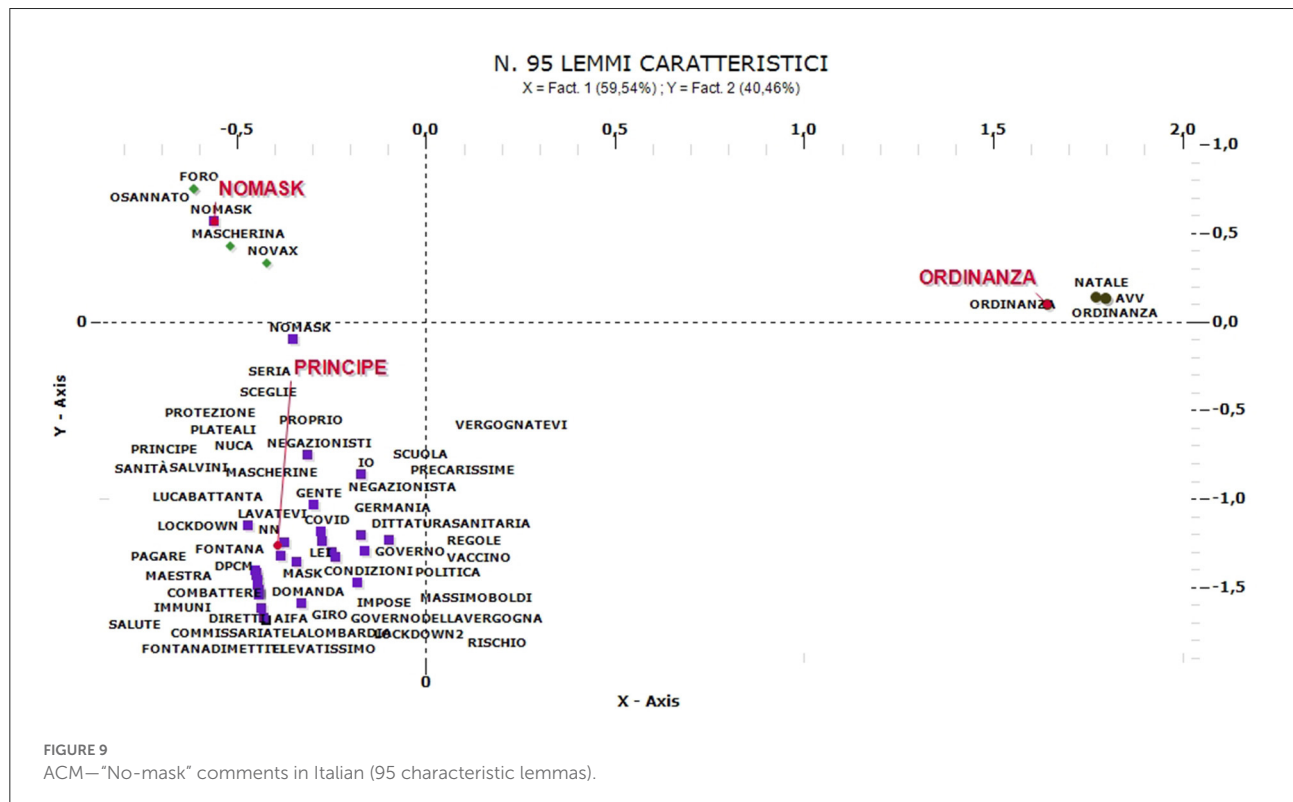
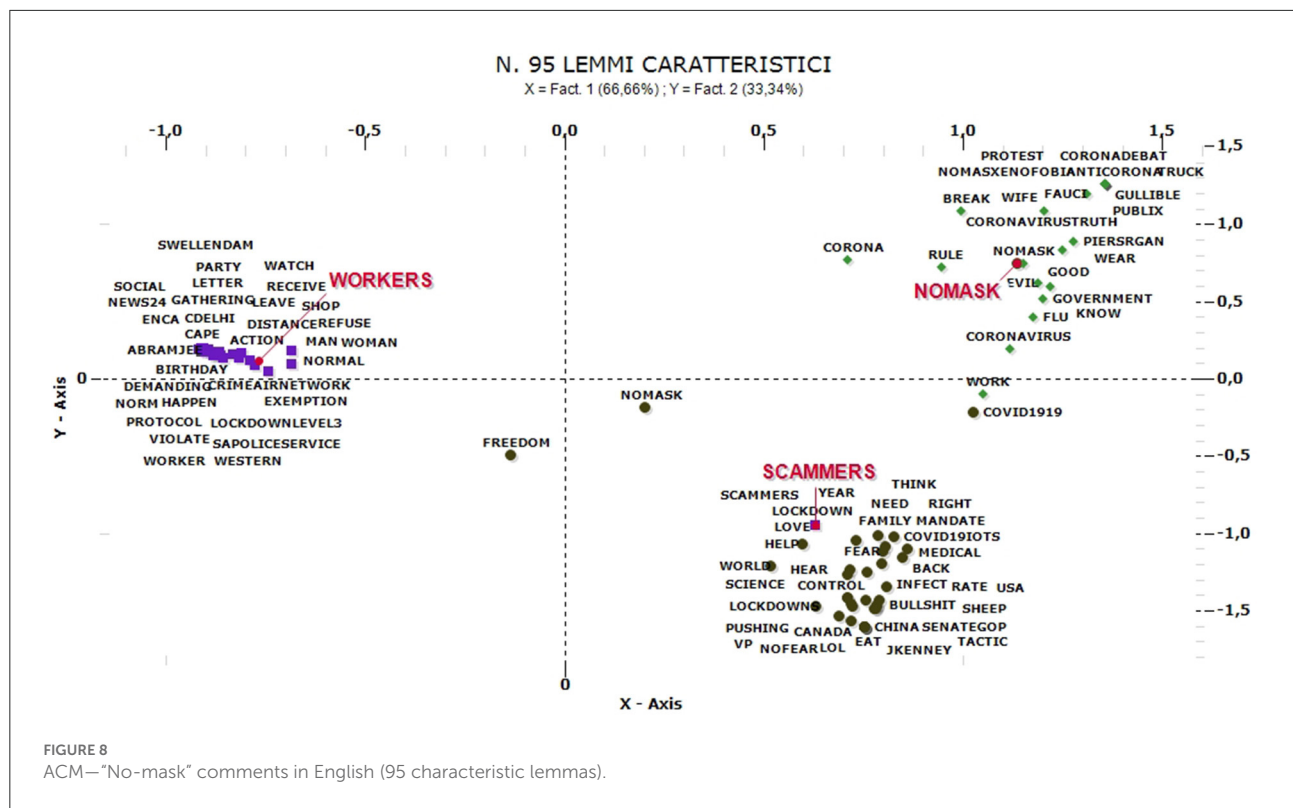
Further specificities are noted with the analysis of the English comments, where the content mainly concerns the dissent for the restrictions on freedom of movement in front of the social and relational events in which one would like to participate. The liberal matrix of dissent is evident, with protests about shop closures or against the ban on entry without a mask, but also references to the assumed uselessness of these decisions (*#maskdontwork*).

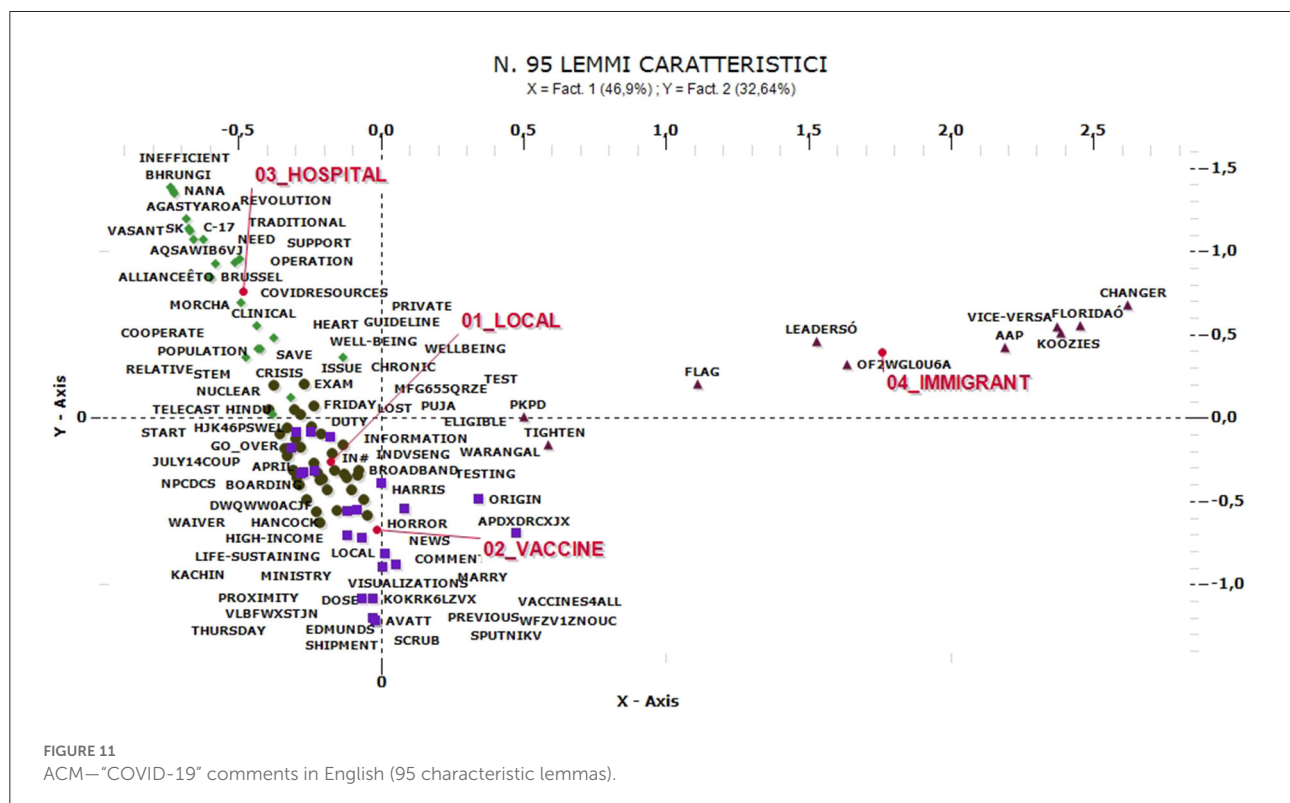
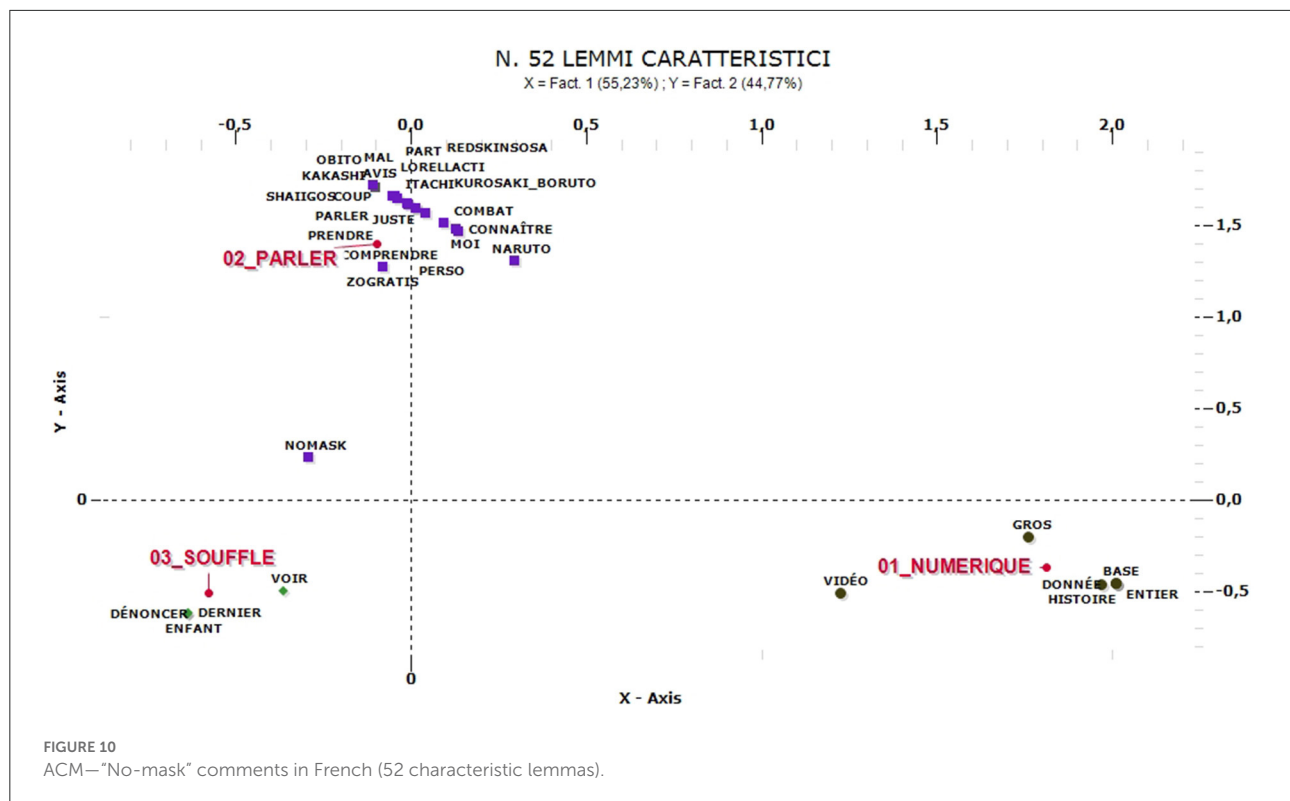
These differences emerge more clearly when comparing the clusters of contents for each context (i.e., language). This is possible thanks to the Multiple Correspondence Analysis (MCA) which, applied to lexical content, shows the association between main lemmas and periods and also the most repeated content.

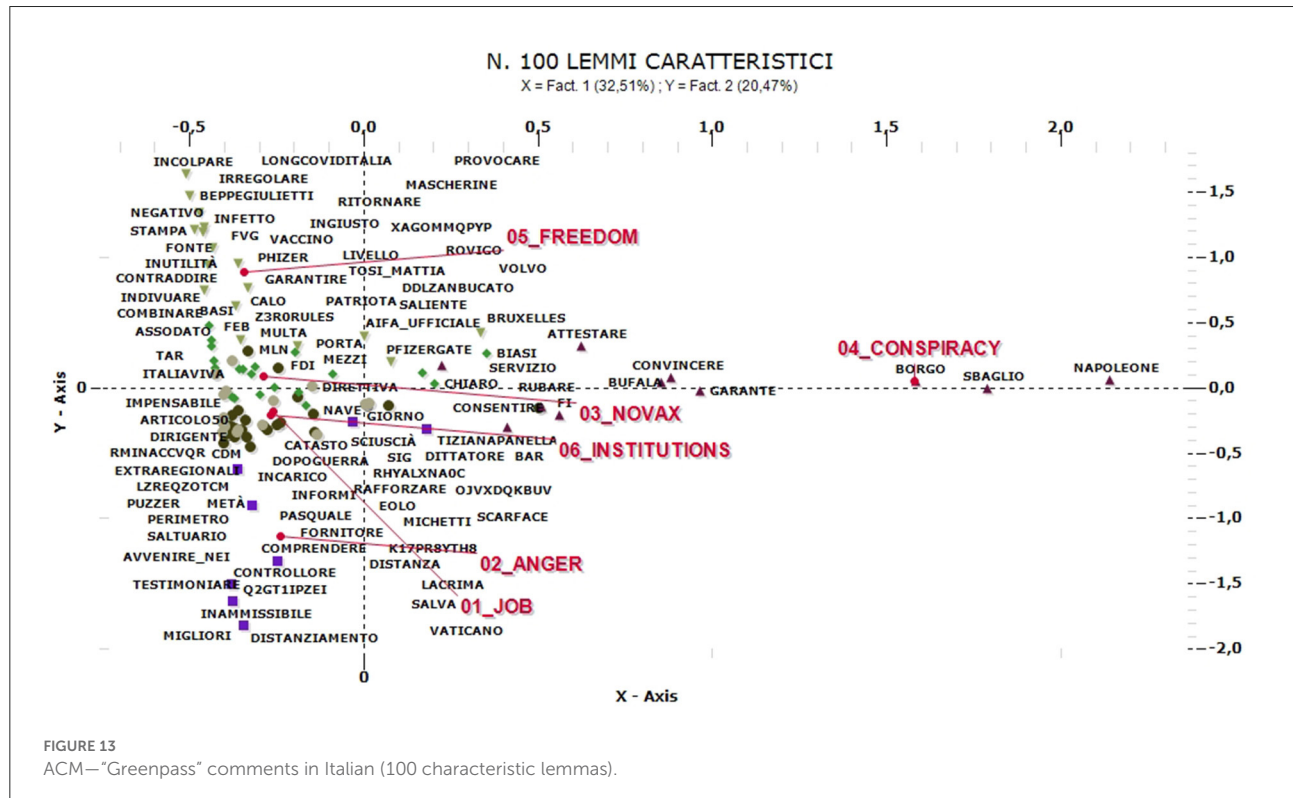
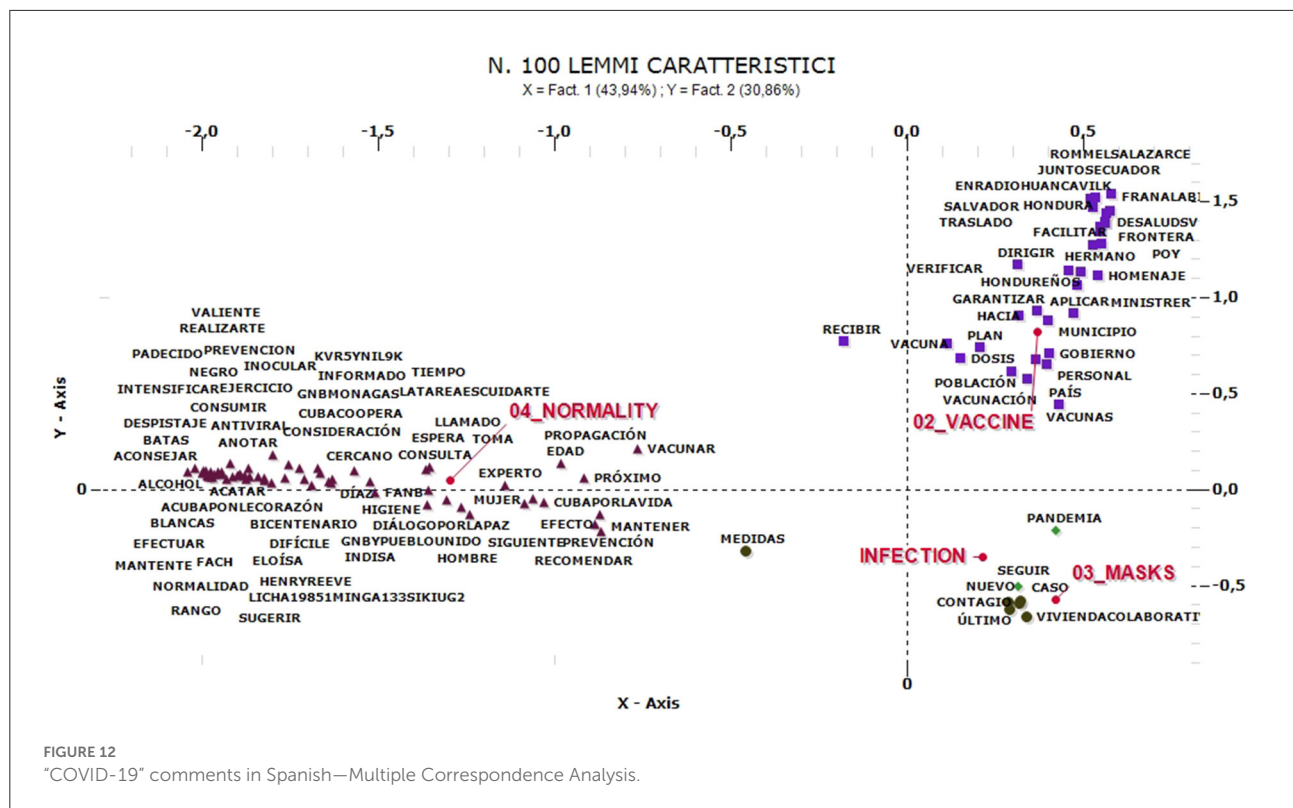
So we identify the main clusters for comments in each main language (for the “No-mask” comments, we defined three main linguistic structures in English, French and Italian). The most numerous comments are the English ones. The clusters obtained from the ACM are three and are named as: “No-mask,” “Scammers,” and “Workers” (Figure 8).

The “No-mask” group (26% of the comments relate to this cluster) is formed between November and December, when protests over freedom restrictions characterize communication. In this group there are controversial comments against restrictions and/or vaccines and opposes the cluster called “Workers” (the main one, 45% of the contents) referring to the protests against the limitations of work activities but also, more generally, to the closure of shops/movements. Many of these comments refer to a video showing a woman being kicked out of a shop for refusing to wear a mask. Comments related to this cluster, mostly from January, are associated with protests about rules, protocols and the impact on work/life/leisure. This cluster is particularly numerous and includes both protests against the containment measures/regulations for workers, and comments referring mainly to labor discipline, in particular subsidies and business support. Finally, the third cluster, “Scammers” (29%), consists of comments referring to fears of contagion and protests against public or private figures who violate the rules of distancing (parties, use of masks in public places, etc.).

Looking at Italian comments (Figure 9), the cluster named “No-mask” (19% of contents are related to this cluster) concerns mainly comments of January and February. Here appear polemic messages against the restrictions and the use of DPI, news and statistics supporting No-mask thesis. Only







this little group actually support No-mask movement. The other two clusters are against No-mask movement and/or no-vax positions: “Principe” (57%)—with ironical languages and political references (the most part, against No-mask topics)—and “Ordinanza” (23%), referred to political scandals, the misuse of public funds or real errors of assessment that caused increases in infections and number of deaths among frail elderly people. The ironic component is the most frequent, both against No-mask movement (mainly) and political personalities.

Instead, the comments in French shows a huge weight of emotional states. The analysis shows three clusters of comments (Figure 10) but the main thematic group, named “Souffle” (52% of contents are related to this cluster, mainly posted in December) is the most emotional one: it is referred to limitations and distances imposed in schools and among children even in kindergartens (*enfant* and *dénoncer*). The other relevant cluster is also the less numerous cluster is named “Numerique” (17%) and it refers mainly to fake news on data about contagion and conspiracy hypotheses, with inappropriate references to historical events as Nazism and related limitations of quite different meaning and scope (similar considerations also emerge in Italy but in relation to the keyword “Greenpass”). A further cluster named “Parler” (31%) occurs mainly in February and it is not referred to pandemic crisis at all. It includes mainly comments, discussions and debates among young people referred to pop culture and Japanese culture.

Considering the second phase of the research—centered on the word “COVID-19,” it has already been noted that these comments are very numerous and heterogeneous. Some of them (quite marginal) also refer to protests against distancing measures. These comments are, however, mostly in support of decisions aimed at reducing contagion. Restricting to European languages, the most numerous Tweets are, predictably, those in English. They are followed, however, by those in Spanish. Focusing on these two idioms, typical contents of communicative clusters can be identified.

First of all, analyzing the words in English, the reference to health fears certainly emerges (patient, pandemic, health, case, death, help, and hospital). This is the prevailing content with respect to the proposed extraction, juxtaposed with the different positions for and against vaccination and containment measures, a reference strongly associated with the Indian context, which suffered many losses and had particular difficulties in managing the emergency (support, vaccination, and mask). The reference to India, unlike other areas with similar problems, is very much present on social media and as comments in English, aimed to promote activities for the population. A third area is about information and reference to statehood (report, and State).

Reference to vaccination and health protection concerns are also widely present in the comments in Spanish, which,

however, refer to the local (*pais*) rather than the national dimension and to the level of reflection and respect for the person (*Dialogoporlapaz, persona, and medidas*).

Further information can emerge from the A on elementary contexts, through which it is possible to distinguish four thematic clusters for each idiom (Figure 11). In English, the “local” cluster prevails (32%), which refers to local statistics on infection rates distributed throughout the territory, reports and similar references and which is characteristic of May and July. This is followed by the clusters “hospital” (26%—April) and “vaccine” (24%—August), which are of obvious interpretation, and the cluster “immigrants,” which refers to planned indications for the treatment of sick immigrants or limits on access, quarantines or, again, to the risk that the presence of irregular immigrants causes an increase in contagions. These comments vary widely in relation to the reference context, from Texas to Canada. The latter cluster is specific and isolated from the others and it is not present in any other analysis but only emerges—with this centrality—in relation to the English-speaking context.

Looking at the co-occurrences, the comments in Spanish would rather seem to be mainly centered on concerns about contagion and on the issue of personal protection. These comments are clustered in four groups (Figure 12) called “infection” (33%), “vaccine” (22%), “masks” (19%), and “normality” (26%). The prevailing themes are thus clearly aligned with concerns about infection and the desire to resume a life considered normal. This is followed by heterogeneous reflections on the vaccine and there are not significant clusters with protests toward regulations and controls.

Finally, the last stage of monitoring concerns the “Greenpass” extraction key, which is associated both with issues specifically linked to the Italian polemical debate against restrictions (no-Greenpass, and no-vax), institutional references (government and Italy) and the desire of protect freedom (obligation, freedom, and impose). These elements also emerge, all of them, from the Multiple Correspondence Analysis. This second procedure shows the multi-semantic nature of the movement against compulsory certification, which is particularly stringent in the Italian context.

In fact, six thematic clusters can be distinguished (Figure 13). The cluster named “job” (16% of comments) includes tweets that deal with practical issues such as access to workplaces with a certificate or the rights of the worker after the application of the COVID-pass obligation, while the cluster named “anger” (12%) includes comments that complain about constraints and obligations using particularly aggressive language and proposing inappropriate parallels, such as references to limitations of freedoms typical of dictatorial regimes or historically known references to war events and forms of xenophobia or genocide (the same structure of communication emerged for some

French tweets belonging to the “numerique” cluster in the “No-mask” communication).

The “no-vax” cluster (16%), on the other hand, refers above all to expressions of protest by those who do not want to be vaccinated. Another cluster identified can be considered related with this one and is named “conspiracy” (25%). This includes comments referring to alleged conspiracies aimed at imposing constraints and limitations for reasons completely unrelated to health risks, seen as a non-existent or overstated threat in order to impose behaviors, political positions and uncomfortable decisions, even of economic nature (sometimes explicitly recalling the theme of health dictatorship). Similar arguments but mainly centered on the protection of rights and freedoms characterize the fifth cluster, named “freedom” (18%), which refers to topics particularly mentioned in August, while the last cluster includes institutional references (12%), with references to politicians, government and healthcare, both in polemical and neutral terms.

Overall, communication is mainly centered on forms of protest and social and political disaffection. Clusters referring to the need to work, the risk of economic crisis and political recriminations (“job,” “anger,” and “institutions”) prevail in October, while those referring to limitations as an unnecessary or unjustified constraint are present in summer (“freedom” and “no-vax” in August, “conspiracy” in September). It is interesting to note how this plethora of protests (both rational and irrational) and even instrumental motivations are characteristic of a context that, at the beginning of the extraction, was rather critical of the No-mask movement itself (now represented in the “conspiracy” and “no-vax” clusters). These are, therefore, two very different phases that drive positions and opinions decidedly far apart. Clusters with a strong polemical and emotional content are also the most numerous, followed by those referring to economic and political motivations (“job” and “freedom”).

4. Discussion

The proposed work reconstructs the debate developed on the social network twitter and related to issues associated with the pandemic crisis. Several studies have, recently, focused on both reconstructing narratives and analyzing attitudes and behaviors arising from the particular emergency conditions (Larson, 2018; Ball, 2020; Velotti et al., 2022). In addition, many works, beyond the emergency plan and specific social, political, and economic reactions, have dealt with the pros and cons associated with the spread of communication on social networks, particularly with reference to the dissemination of distorted information (Kata, 2010; Chou et al., 2018; Al-Ramahi et al., 2021; Herrera-Peco et al., 2021) and, more specifically, with regard to the risks of cognitive fallacy associated with a confirmation bias (Bessi and Quattrociocchi, 2015; Del Vicario et al., 2016).

The paper traces the main theses and considerations that have emerged in reference to the widespread perception of the pandemic crisis and different modes of reaction, identifying three specific, interdependent topics: the perception of risk and the construction of scapegoats; reactions typically related to ontological insecurity (from reference to ideologies to the spread of fake news); and the emergence of reinforcing effects of fallacious reasoning dependent on unconscious overexposure to customized and catchy messages. The latter dynamic, in particular, is studied with reference to the algorithmic management of communication on social media.

Having posed these arguments, the study seeks to reconstruct the main lines of argument of communication on social, also identifying them with respect to the characterizing periods. To this end, rather than automatically referring to the over-exposed arguments on social, it was decided to identify the main extraction keys as a result of continuous monitoring of media communication but also of communication on social. A second reason for the selection derives from the attempt to identify different forms of communication, distinguishing—specifically—three of them:

- #No-mask: a strongly distorting communication with respect to the content of institutional and health information in particular, characterizing a transnational collective movement and protest, as ephemeral as it is lively in its expansion phase but destined to be short-lived (after a few months there is an evident reduction of the reference network, at least on twitter). Comments on the social, moreover, present an ambiguous content with positions that are sometimes oriented to ridicule or irony rather than to support the ideas of reference (this is particularly the case in Italy, an area particularly affected, in the first phase, by mortality and contagion);
- #COVID-19: this second communicative form characterized the entire emergency period and still remains significant on the web; it mainly consists of comments supporting institutional and prudent messages or the institutional messages themselves, oriented to inform and spread prudent practices;
- #Greenpass: a third communication structure, is specifically prevalent in the Italian context, where control measures have been particularly incisive and long-lasting, even after the distribution of vaccines and therapies. Particularly at a time when there appears to be too much caution compared to other areas (particularly liberals) that have limited or eliminated forms of distancing and progressive closures, communication on the issue becomes particularly tight and also produces off-line forms of protest, constituting real communities of discussion if not an actual protest movement.

The three conditions of online communication reflect, in effect, three phases of action and reaction to the pandemic threat: alarm, emergency and generalized restriction of activities; protection of the population and institutionalization of the emergency; and progressive return to normality and openness (which entails increasing criticism where a condition deemed not justifiable prudence persists, even in the face of news contexts where constraints are already removed, with serious socio-economic disruptions at the local and national levels).

Finally, on the methodological level, it is possible to identify some specific advantages of the three-step procedure proposed here, which allows for the identification of messages and communications constitutive of comparison networks, minimizing the “noise” that is always present when extracting information on big data.

The analysis is circular and open. Each step confirms elements that emerge from the others so you can modify the parameters when changes in the style and structure of communication occur. Specifically:

- the extraction of the Top-10-tweets allows an in-depth analysis of a low number of relevant comments. So we quickly identify errors, problems and new topics (in February 2021 #No-mask became almost irrelevant as twitter reference);
- the network analysis tools allows us to identify the structure of communities and how they change over time, selecting the most important communities or discussions, the differences among structures of information, self-reference and communications, the presence of hubs within the net, etc.;
- the automatic content analysis on specific languages allows us to evaluate with attention the content of comments and the importance of each cluster (also in terms of debate and construction of parallel communities), comparing communication through main topics, languages and periods.

Finally, we obtain the main information related with the structure of communications, the main languages, the main problems related to information and—where appropriate—the symptoms of institutional disaffection or actual social protest. It is therefore possible, using this procedure, to identify information, indicators and narratives referable to political and social debates involving different categories of users, identifying the main sources (institutional and non-institutional, if private profiling with respect to useful information), motives, suggestions. This practice could also be useful in acquiring information for implementing social

policies or public decisions, identifying problems or reshaping structure and content of messages and information for the population.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

RD'A is responsible for the Sections 3.1, 3.2, and 4. SG is responsible for the other parts. All authors contributed to the study design and approved the final version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Interpreting the changeable meaning of hashtags: Toward the theorization of a model

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This study contributes to the international debate on the hashtag's nature and characteristics and attempts to define it as a relational social form affected by morphogenetic–morphostatic processes. To develop this interpretative proposal, this study uses the dimensions of time and agency, drawing on Twitter hashtag studies. Subsequently, the article recalls elements of cultural morphogenesis, traces the points of contact between hashtag studies and cultural morphogenesis, constructs an interpretative proposal of the hashtag as a relational social form, and arrives at the formalization of a model for analyzing the changing meaning of hashtags.

KEYWORDS

agency, cultural morphogenesis, hashtag studies, hashtag activism, Twitter

1. Introduction

Within communication research, a line of studies has developed over the last 15 years that focuses on hashtags, which can be considered a branch of research with and on big data. In a 2015 book, Rambukkana defines “hashtag publics” as a vector that generates discursive assemblages for techno-social events. The scholar claims that topical hashtags are generated from “nodes in the becoming of distributed discussions in which their very materiality as performative utterances is deeply implicated” (Rambukkana, 2015, p. 3). In this statement he refers to the *On Actor-Network* by Latour (1996), taking up the idea that “the modern understanding of the social sciences as describing some form of pre-existing substance (‘the social’) [...] drills down into and unearths their other major aspect, which looks at the process and becoming of social forms (Latour, 1996, p. 2; Rambukkana, 2015, p. 1)”. In this study, we keep in mind Rambukkana's position and expand upon it by considering audiences as relational and the hashtag as a relational social form.

Although the hashtag is nothing more than a label (tag) preceded by the hash sign (#), over time it has become much more than a tool for classifying the content of text and images conveyed through the internet, and through social media. From its appearance to today, this sign's meaning, use, and relationship with the social context have undergone a process of transformation that has opened a breach in the in terms of its function, how its use is viewed, and its morphogenetic processes. In hashtag studies, several scholars have asked themselves questions that call into question concepts already analyzed within the social sciences, and especially within the theories that deal with socio-cultural change. In fact, these scholars wonder how to look at the agency of hashtag users who, through their actions over time, reconfigure its meaning (e.g., Yang, 2016). They also question themselves on how to interpret the relationship between hashtags and the historical-social timeline, calling into question the importance of the temporal dimension, the study of the effects produced by hashtags inside and outside the platforms (e.g., Faltese, 2015; Dobrin, 2020). Attention to the socio-historical and political contexts is also necessary to understand the different emotional gradients that gather around those hashtags that arise after terrorist attacks, which gain traction in different measures, depending on their ideational content (Harju, 2019). Scholars also wonder how to interpret the presence of hashtags for which

the meaning does not change over time (classified as semantic invariants) and the presence of hashtags that instead undergo semantic transformation processes (e.g., [Bruns and Burgess, 2015](#)). Finally, an age-old question opens up, namely that of the relationship of influence between two contexts, represented here by the two environments that make up the media ecosystem: that of digital platforms, plus legacy media that we include within the definition of the digital platform ecosystem, and that of the social structure. This controversy finds its legitimacy in the socio-relational transformation processes that the advent of digital platforms has generated. Today we need to consider platforms as the new “custodians of the Internet” ([Gillespie, 2018](#)), and we are confronted with digital platforms that are “gradually infiltrating in and converging with the (offline legacy) institutions and practices through which democratic societies are organized” ([van Dijck et al., 2018](#), p. 24). For this reason, [van Dijck et al. \(2018\)](#) prefer the term “platform society” defined as “a term that emphasizes the inextricable relation between online platforms and societal structures. Platforms do not reflect the social: they produce the social structures we live in it” ([van Dijck et al., 2018](#), p. 24).

Platforms, therefore, intervene in the manner in which social bonds are defined by including forms of connection that mix social norms with the sociotechnical norms typical of online environments ([van Dijck, 2013](#)). Through this, they create a symbolic field and digital cultural practices that delimit specific ways of relating—often distinct from the old model of staying offline—which preside over new processes that signify being together ([Boccia Artieri and Farci, 2020](#)). It is within this socio-technical environment that the participatory practices of connected audiences and the development of social network sites, which have introduced additional elements of complexity to the transformation process underway in the last 10 years, need to be applied. Connective media ([van Dijck, 2013](#)) have become an almost uninterrupted presence in daily routines: they absorb a significant part of identity processes and social relationships, and they give life to a common heritage of cultural and symbolic practices, rules, and behavioral practices that contribute to settling “an accepted version of reality” and intersubjectively sharing it within the same communicative environment ([Boccia Artieri et al., 2017](#)).

Online platforms now preside over the socio-technical system within which all actors move themselves, carrying out a new intermediation function, which structures the information flow through logic—unnoticed at an experiential level and not transparent to all stakeholders—and the visualization algorithms on user timelines ([Gillespie, 2014](#); [Bucher, 2017](#)). Networked publics ([boyd, 2010](#)) usually operate in a mixture of public and private spaces, within which the exchange of information (commenting, sharing, and production of content, such as memes) finds space within the flow of uninterrupted and non-segmentable communication. What we are witnessing is, on the one hand, the rise of the platform as the dominant infrastructure and economic and socialization model of the web, and on the other hand, the convergence with social media, as platforms, in building an increasingly integrated ecosystem.

At this point it appears clear that there is a need to determine the relationship of influence on the two systems, which are affected by an irreversible integration process, assuming the hashtags and social effects produced by them and through them over time as the main node. Thus, the fact that the meaning of the hashtag changes over time is evident in the studies devoted to it. More complicated, however, is identifying a model to analyse this change that takes into account the interconnection between social structures.

We are in the presence of a dualism that fluctuates by polarizing two methodological dimensions, individualism and holism, in the analysis of hashtags intended as big (textual) data. To arrive at the formalization of a model capable of observing this change in the meaning of the hashtag, we need to:

- a) analyse studies in which this dualism is traced;
- b) analyse the time and agency dimensions of the Twitter hashtag;
- c) analyse cultural morphogenesis;
- d) clarify the points of contact between the two approaches; and
- e) develop of model to interpret the changeable meaning of hashtags.

2. Previous studies on hashtags

This section reviews studies related to hashtags and Twitter, in which the platform assumes the identity of a privileged place within which hashtags were first introduced and subsequently studied (Section 2.1.). The section also explores how the temporal dimension and the agency of hashtags on Twitter are explored (Section 2.2.).

2.1. Twitter hashtags and their meaning

Over the past 15 years, the hashtag has become a symbol and tool of connection, which, thanks to the changes in digital technologies, has become increasingly widespread within the media ecosystem. It has been the subject of numerous studies in recent years, thereby opening up different lines of interpretation. These explanations evidently originate from the concept of folksonomies ([Vander Wal, 2005, 2007](#)) intended as the possibility for users to create classifications from the bottom-up and elaborated by groups in a freer and less official manner than the institutionalized taxonomies of the scientific community. Hashtags first appeared on Twitter in 2007, and they are defined as bottom-up user-proposed tagging conventions that embody user participation in the process of hashtag innovation because they pertain to information organization tasks ([Chang, 2010](#)). Subsequently, they have been incorporated into other social media and have aroused the interest of many scholars who have developed further insights, such as hashtags as linguistic meta-functions ([Zappavigna, 2015](#)). In this context, hashtags are viewed as being able to construe a range of complex meanings in social media texts, linking them to the possibility that they offer the opportunity to mark experiential topics, develop interpersonal relationships, and organize text. There also exists the question of “hashtag publics” ([Rambukkana, 2015](#)) that interprets them as interconnected nodes within the users’ discussions which generate discursive assemblages by feeding a public discourse around a theme/event. Further, there are those researchers who stress that the proximity of hashtags to speech acts ([Benovitz, 2010](#); [Caleffi, 2015](#); [La Rocca and Rinaldi, 2020](#)) or defines them as narrative topos ([Said and Silbey, 2018](#)). The common theme of all these studies is that users develop actions in and through hashtags. One consequence of this user action is the change in the meaning of hashtags, which, starting from the literal meaning of its label attached to an event/theme, develops further meanings based on what users insert in their posts, such as text, images, or videos. Hashtags have potential, and their agency

lies in having the power and resources to realize/manifest their potential through user action. At the same time, the collective agency allows users to co-create the possible hidden meanings of the hashtag.

In hashtags, therefore, something similar happens with respect to utterances; that is, the need to consider non-linguistic elements as determinants in the attribution of meaning matures with respect to the phenomenon of semantic underdetermination (Cruciani, 2011), whereby linguistic information alone is not considered sufficient to determine a single set of truth conditions for an utterance (Searle, 1969, 1995). Thus, when it is not possible to select a single interpretation, a speaker—in linguistics—or a user—in social media—creates through their action the interpretation that satisfies them most. From this perspective, a speaker's choice of preferred interpretation is considered a legitimate means of accounting for the attribution of meaning, as the extra-linguistic context and semantic conventions associated with the linguistic form are able to set the necessary meaning. However, the sufficient conditions for determining a single meaning are not present (Cruciani, 2011). The sufficient conditions are set by the speaker's/user's interest in the situation. Hence, the need to consider user action across time and social structures.

All these factors/conditions reconfigure the meaning of a hashtag over time, and some authors have dealt with this phenomenon. Concerning the changeability of meanings, we first find the work of Colleoni (2013), who describes these meanings as empty signifiers that invite the ideological identification of a polysemic orientation. Subsequently, Papacharissi (2016) perfected this definition by considering them as signifiers that are open to definition, redefinition, and re-appropriation, and La Rocca (2020a) defines this ability of hashtags as their “possible selves”. In addition, they signify the emotional component that users attach to events, affections, or networked publics (boyd, 2010) that express participation through sentiment expression (Papacharissi, 2016). Thus, as Bernard (2019) summarizes, the hashtag is a lingua franca that, starting from the function of a thematic aggregator, develops a network of collateral meanings (La Rocca, 2020b). However, as Bruns and Burgess (2015) point out, this occurs for topical hashtags but does not occur for non-topical hashtags, and in underlining this difference, scholars highlight the role of time, user action, and the characteristics of the linked event.

Nowadays, the prevalent idea is that of “abandoning a prehistoric view” of the hashtag that regards it as a thematic aggregator and instead viewing the “now-ubiquitous hashtag” as “an iconic symbol of Twitter” that is a “powerful part of the world's cultural, social and political vocabulary” (Burgess and Baym, 2020, p. 61–62). In fact, these days, when an event, whether it is a live concert (Danielsen and Kjus, 2019) or a football match (Adedoyin-Olowe et al., 2014), is aired through the mainstream media, it is accompanied by a hashtag which is attached to the event. This helps to create a sense of community, guarantee the development of an *ad hoc* audience, and generate media hype around the event. The same process gets repeated for political (Davis, 2013), commercial (Abidin, 2016), or public health campaigns (Laestadius and Wahl, 2017) and for forms of protests or demonstrations (Gureeva and Samorodova, 2021). Depending on what is contained in its graphic form (# + label), it becomes a connection instrument for collective responses (Abramova et al., 2022), expressions of solidarity and support (Mottahedeh,

2015), and strategies of inclusion oriented toward creating a joint sense of community that is formed around it (Golbeck et al., 2017)—within which emotions are anchored (Döveling and Sommer, 2012; Döveling et al., 2018; Harju and Huhtamäki, 2021).

These street demonstrations or mainstream media events get commented on within the digital spaces, and vice versa, producing effects in both ecosystems. Thus, the hashtag surpasses the structure of techno-social platforms and interacts with the social structure; it becomes a bridge—a link between the internal and external dimensions of the platforms. This social effect produced by hashtags was also identified by Clark (2014) in a study on #NotBuyingIt, a hashtag created “to fight misrepresentations of gender in the media via Twitter” (p. 1108), specifically to denounce gender stereotypes in Super Bowl commercials. #NotBuyingIt was used, during the 2014 Super Bowl, more than fifteen thousand times to report sexist advertisements, and the messages generated reached more than 2.4 million people; as a result of its sharing, companies have been forced to acknowledge feminist criticism. Meanwhile, this hashtag feminism has collected “a multiplicity of voices that demand recognition of differences across intersections of gender, sexuality, race, and class” (Clark, 2014, p. 1109), highlighting the need to create more effective coalitions between them.

From this brief introduction, some issues that are connected seem to emerge: namely, (i) how to interpret the action of users/citizens who use hashtags on and off digital platforms and help to redefine their meaning, and (ii) how to formalize the movement that a hashtag accomplishes from the time that it is introduced to the time that it reconfigures its new meaning.

Regarding the first point, in the studies that deal with social media, especially Twitter, the actions of users have been analyzed using the concept of affordances (Rathnayake and Suthers, 2018). These refer to environmental properties, which activate or offer potential action by an agent; it is a concept born into the ecologic theory of perception (Gibson, 1979). Rathnayake and Suthers (2018) extensively analyzed affordances in digital environments—specifically Twitter—to argue that hashtags are affordances for “momentary connectedness”. According to the authors, Twitter hashtags are affordances for two reasons: (1) The platform allows for the creation of hashtags, and (2) different action types emerge through them. La Rocca and Boccia Artieri (2022) add a third reason: (3) The ability of hashtags to change their original meaning through retweets and quoting, and also their circulation outside the digital environment. This ability to change meaning (morphogenesis) or not (morphostasis) expresses the “variability” of the affordance (Evans et al., 2017). This is because “affordances are a relational construct that sit in between—but do not determine—objects and outcomes” (Evans et al., 2017, p. 41). Regarding the second point, the studies on hashtag activism have noted the changeability of the meaning of hashtags, but they have not produced an operational model capable of observing this change over time.

In the current scenario, it is necessary to take into consideration that we are confronted with the collapse of contexts due to the fusion of digital platforms and social structures; additionally, we are dealing with a user action that develops collective agency over time, which may be able to generate a transformation (morphogenesis), both in relation to the meaning of the hashtag and in terms of social consequences, or not produce any effect (morphostasis). Therefore, the aim of this study is to examine these phenomena and identify

new interpretations. In order to achieve this objective, we propose the following: (i) a review of the studies that deal with time and agency in Twitter hashtags and (ii) an assessment of the points of contact between what emerged in these studies and what has been proposed by the sociological theories of social change. We are attempting to graft and add value to what has previously traced within the theories of social change in hashtag studies.

2.2. Time and agency in Twitter hashtags

Hashtag analytics show that time and agency are important aspects to consider in order to outline a new vision of hashtags and their role. Agency and hashtags' temporal dimensions are linked to the characteristics of the social media platform. On Twitter, features are represented by mentions (@), quotations, retweets (RT), and uploads inside the tweets (links, photos, images, and emojis). @mention or @reply have become a key feature of Twitter as a tool for conversations and socializing, and their usage enables the creation and maintenance of a network between users. The recirculation of messages creates visibility through hashtag use that we need to understand. Therefore, working on these platforms and analyzing public spaces open to peer discussion has become fundamental for monitoring trends that revolve around issues of public interest. As Bruns and Stieglitz (2012) explain, many retweets occur when natural disasters or crisis events occur (Bruns and Burgess, 2015), and they fall largely into a category best described as "breaking news" or "rapid information dissemination". A large number of retweets can be attributed to a specific conversational practice on Twitter: gatewatching (Bruns, 2005). This is an activity performed by citizens in real time to disseminate, share, and comment on news that originates from media outlets on social media platforms during acute events that generate an *ad hoc* community.

Thus, certain events produce a high percentage of retweets and certain other events/hashtags do not generate an online conversation flow (Bruns and Stieglitz, 2012). Depending on the theme, Twitter users adopt different conversational and relational models. It can be argued that "these distinctly divergent and stable patterns in user activities for different hashtag use cases indicate various conceptualisations by users of the hashtag community that they are either seeking to address or participate in" (Bruns and Burgess, 2015, p. 21). It is alongside these considerations that the hashtag can begin to take on new traits composed of symbolic elements and structural constraints: the former represented by their reference to meaning and the latter by digital platforms and network dynamics. The *ad hoc* audiences generated through the conscious use of the relational social form hashtag assume the traits of the relational public theorized by Starr (2021, p. 2), who argues that "the public depends not only on what individuals think but on how they associate and are linked with one another and develop mutual awareness and recognition". In his study, Starr enhanced the concepts proposed by Tarde (1969), such as the intersubjectivity of the public, then activated by journalists in two ways: "first, by awakening connections among their readers, who were simultaneously learning about the same stories, and second, by triggering in-person interaction, 'the conversations of the day'" (Starr, 2021, p. 2). These definitions fit perfectly into the dynamics created by the users on Twitter, for example, the use of hashtags to monitor issues of public interest

and not to simply disperse information, or the flock of retweets that breaking news can generate.

Bruns and Stieglitz (2012) argue that hashtags linked to a crisis, event or a television program (topical hashtags) are much more likely to induce information sharing that engages and disseminates other information conveyed by URLs, photographs, and continuous retweets compared to what occurs in the case of hashtags with generic content and meaning (i.e., non-topical hashtags such as #mom, #party). Conscious hashtag and feature use is affirmed on Twitter to the point of developing the capacity for collective action on specific topics/events (Sharma, 2012; see also Bonilla and Rosa, 2015; Jackson and Foucault Welles, 2015; Rambukkana, 2015; Lindgren, 2019; Jackson et al., 2020; Olmedo Neri, 2021). Based on this, we can distinguish between topical and non-topical hashtags (Bruns and Burgess, 2015) and expand on the differences between them:

- Topical hashtags are related to themes and/or unforeseen events that can generate *ad hoc* audiences that use them consciously to create influence inside and outside the digital ecosystem by expressing awareness of themselves as activists and the strength of their actions. This enables a reconfiguring of the meaning of the event for which they were generated and their literal significance. This change is observable during a given period.
- Non-topical hashtags have a generic meaning not directly related to topics and/or events on the agenda or in the public attention. They do not generate an *ad hoc* audience but reference the denotative meaning in the historical-social context.

Topical hashtags can develop a redefining, reflective, and intersubjective action that acts on themselves and the external context of social media platforms. Therefore, this dimension can be expressed as follows:

- Reconfiguration of the symbolic meaning of the object/theme/event to which the hashtag is linked. This action is due to the conversational flow that users activate on the platform and which, similar to brainstorming, leads people to think about the event that generated them, showing their connective and relational capacity.
- Reconfiguration of its narrative meaning. This action occurs through the process of metamorphosis; that is, users' action produces the literal meaning of the hashtag over time by unfolding the temporal dimension.

Yang (2016) analyzed the narrative agency in the case of #BlackLivesMatter and defined it as being generated by online activism, thereby defining it as the outcome of an action by individuals who link a social or political claim under a common word, phrase, or hashtag. The temporal unfolding of these messages, mutually connected in networked spaces, provides the shape and strength of a narrative agency. One can consider the form of discursive protests on social media under the use of #BlackLivesMatter, a hashtag generated in response to the acquittal of George Zimmerman in July 2013 in the fatal shooting of African-American teen Trayvon Martin, which produced a protest movement both on the streets and social media networks. The same mechanism operated for #Ferguson, which appeared in response to the police shooting of Michael Brown on 9 August 2014 in Ferguson, Missouri. Within the first week of Brown's death, millions of posts with the

hashtag #Ferguson appeared on Twitter alone (Bonilla and Rosa, 2015). From these uses, we can perceive the “power of digital activism in shaping public discourse” (Yang, 2016, p. 13). To explain the characteristics of the narrative agency, Yang used existing theories in literary studies and psychology, crossing the narrative and processual dimensions of stories and the subjective construction of reality by individuals through the narrative of what happens to them every day, thus emphasizing intersubjective reflexivity. In the study of social movements, these narrative and procedural characteristics have already been highlighted by other theorists. For example, Steinmetz observes that “narrative thus has a beginning, a middle and an end, and the movement toward the end is accounted for by conflicts, causal explanations and the sequence of events” (Steinmetz, 1992, p. 497). Campbell (2005) defined rhetorical agency as the capacity to act: to have the competence to speak or write in a way that will be recognized or heeded by other community members. Drawing from these studies, Yang identified the strength of the hashtag in the narrative agency explaining it “as the capacity to create stories on social media by using hashtags in a way that is collective and recognized by the public” (Yang, 2016, p. 14). This narrative agency results from a collective action—which, due to its characteristics, can be defined as a corporate agency—conducted by a relational audience that develops over time and through human interaction. The consequences of action and interaction affect changes in the object and subject over time. This is the case analyzed by Jackson and Foucault Welles (2015), who show how the action of users is able to generate counter-narratives. The hashtag they analyzed is #myNYPD launched by New York City Police Department in April of 2014 as part of a public relations campaign and with the aim of inviting citizens to share photographs of officers captioned with the hashtag #myNYPD. “What started as a public relations campaign quickly turned into an online protest as thousands of citizens appropriated the #myNYPD hashtag to highlight instances of police brutality, abuse, and racial profiling” (Jackson and Foucault Welles, 2015, p. 1). Thus, what began as a public relations campaign morphed—through user action—into a form of media activism. The two scholars rightly define this appropriation and overturning by users of the original meaning of the hashtag #myNYPD as a hijacking that generates counter-publications and counter-narratives. As Blevins et al. (2019) have already pointed out, social media offer significant opportunities to disrupt and redirect dominant and oppressive narratives through conceptual and ideological hashtags. Using these hashtags, affective publics (Papacharissi, 2016) relate “the meaning of these events to their own lives and framed these occurrences as relatable to a broader array of personal experiences and incidents” (Blevins et al., 2019, p. 2). This has an impact in terms of hashtag usage patterns and spikes and broadening the meaning of the hashtags themselves.

Narrative agency can also be found in Dobrin’s (2020) study on #MeToo that emerged in response to the sexual harassment scandal involving the high-profile Hollywood producer Harvey Weinstein. The study examined the cultural importance of digital activism and the hashtag, emphasizing its symbolic role in the emerging myth around the movement through its narrative use by producers (Dobrin, 2020). Examining the hashtag’s representation and mechanics under the cultural dimension allows us to read it as a cultural object that perpetuates the phenomenon’s political agenda in the digital public sphere and bridges personal and collective experiences as the hashtag transforms and reconfigures the identity

of the movement outside the digital environment. Dobrin’s approach is culturalist, and the analysis highlights how the collective use of the hashtag has, over time, contributed toward changing the identity of the movement. Another effort in the analysis of narrative agency performed by Twitter hashtags is the one described by Dawson (2020), again for #MeToo. The scholar focuses on the role that narrative plays in the emergence of cultural movements and identifies a new narrative phenomenon created by the technological affordances of Twitter, which he defines as “emergent storytelling”. To explain it, he highlights the dynamic forces that circulate in and through Twitter, “the interplay of narrative cognition with stochastic viral activity and the invisible design of social media algorithms; and the varying rhetorical purposes that narrative is put to in public discourse about viral movements” (p. 9).

This review of studies helps us to understand a few important aspects:

- Despite being just a word, a hashtag has much more power than the word representing it.
- Its physiognomy changes through human action and interaction, and
- Time, understood as the use of hashtags over time, is an essential element to understand its origin, development, change, and impact on social structures.

These effects, which are derived from hashtag use, are possible because of affordances (Gibson, 1979; Hutchby, 2001) of the platforms, the dynamics of digital environments, and many-to-many communication modes. However, according to the indications emerging out of hashtag activism, we additionally need to start considering the effects produced outside the digital platforms and the manner in which what is external and internal to the platforms have merged into the dynamics produced by hashtags. According to a review of studies, these dimensions are relevant for topical hashtags. The research dimension develops alongside this content–contextual dimension where scholars attribute meaning to these elements and the semantic and semiotic reconfiguration of the hashtag. As Burgess and Baym (2020) explained, the hashtag has become a ubiquitous symbol that enters language, social, political, and cultural contexts; one must deal with multiple dimensions that must, in some way, make their link explicit. For example, Faltesek (2015) argued that the temporal question of public hashtags exists only because of the attention and recirculation attributed by the event that generates them. Faltesek recommends paying “particular attention to the temporality of their circulation as part of an unpredictable flow of messages that is both tightly controlled and beyond control at the same time. This practice of reading, thinking and engaging must take place in the real-time of the researcher since the traces left by hashtag are a poor substitute of the phenomena itself” (Faltesek, 2015, p. 84).

Faltesek linked time to the collection and interpretation of hashtags and to the historical-social timeline and events that generated them. He released them from their strict links to digital and research functions on social platforms and instead anchored them to a cultural and social dimension. He drew a distinction between (i) *kairos*, which is a “rhetorical moment or situation”, a moment of an indefinite period in which “something” special happens and (ii) *chronos*, which refers to chronological and sequential time. On Twitter, the first—*kairos*—cannot be determined solely at an

individual level because it is represented by read or unread tweets or by the significant contexts that the elements of polysemic digital communication allow by linking to hashtags. Instead, they must be sought in the temporal (and social) context within which networks were generated from the hashtags and in which they are located and operate by activating an *ad hoc* public that follows specific hashtags, tweets, retweets, and uses them in combination with other hashtags. The approach developed here goes beyond Faltesek's considerations and stresses this temporal dimension because it allows us to identify the ability of agents to modify the meaning of a hashtag (morphogenesis) or to leave it unchanged (morphostasis).

Vicari (2017) studied the flow of tweets posted over two sample periods, namely 14 April–13 June 2013 and 24 February–23 April 2015, linked to the declaration by actress Angelina Jolie that she would undergo preventive surgery as a carrier of the #BRCA gene mutation. Vicari highlighted the “need to look at the life story of issue-based Twitter streams to fully understand the changing role of social media platforms in enhancing old and new power structures underlying discursive practices” (p. 2).

Furthermore, Bruns and Stieglitz (2013) highlighted the importance of working with temporal metrics in the analysis of tweets which allow a breakdown of the total dataset by time. Their strategy involves considering the timeframe of the event analyzed to identify the time unit of interest; therefore, “for hashtags relating to short-term events (from live sports to television shows), minute-by-minute analysis might be appropriate; for longer-term activities (such as election campaigns or unfolding crises), day-by-day timeframes may make more sense; for long-term phenomena from brand communication to military conflicts even a month-by-month analysis may generate useful results” (p. 99). This approach to temporal metrics seems to be related more to *chronos* than *kairos* and allows the analysis of the change in the meaning of the hashtag to remain accessible over time.

Nonetheless, Faltesek, Vicari, and Bruns and Stieglitz showed the importance of the temporal dimension: The first by linking it to the interpretative processes of the historical social context; the second to the dimension of analysis of the tweets, which must develop diachronically; and the third by linking it to a web-scraping strategy and the calculation of metrics. In a recent article aimed at bringing out the nascent traits of research using hashtags, La Rocca and Boccia Artieri (2022), working on Vasterman's (2004, 2005) theories about media hype and Pang's (2013) on social media hype, conclude that “The introduction of these elements—of time or period, of storm or engagement, of interdependence or lack of relationship between media and social media hype—builds a framework through which to interpret of the research results” (La Rocca and Boccia Artieri, 2022, p. 9). They suggest considering these two elements, because they identify the importance of the hashtag and what it links to on and off the platforms.

Previous authors' studies provide the opportunity to understand how crucial it is to observe over time—a time that we define as the “relational time” to clarify that it is the time during which the agency occurs—the construction of a relational frame of reference, from the intersection of different planes along which the collective agency manifests itself in social structures and its effects of changing the hashtag's meanings.

Therefore, hashtag analysis cannot ignore contextualization for sporting events, crises, natural and environmental disasters (topical hashtags), or generic hashtags, such as #mom, #work, and

#food (non-topical hashtags), as they always carry an interpretative meaning and dimension continually linked to the social context. The difference observed between topical and non-topical hashtags is the time frame that researchers give themselves as a reference point for tracking its evolution. In topical hashtags, meaning changes occur within a short period and are observable; in non-topical hashtags, meaning changes take place over a long time and requires analysis of how the concept to which the hashtag refers is understood in different socio-cultural systems, specifically in terms of temporality and spatiality. Regarding spatiality, consider #mom or #food and their implication in a European context or the evolution of a signifier in the same context but different centuries. Therefore, before starting the interpretative process—a posteriori—of a hashtag, it is necessary to specify the meaning of the “word” in that culture. Second, by reconstructing the meaning connected to the hashtag, we can indicate how much they differ from the current use, if they align with it, or how much they contribute toward redesigning its morphology. This implies that in analyzing hashtags, researchers acknowledge they are complex social entities (La Rocca and Boccia Artieri, 2022) alongside two dimensions: hashtag as a “sense-making practice” and as a “propagation-effect practice”. Therefore, there is a conceptual dimension/category that descends upon the hashtag a priori and is represented by its literal meaning, and this is followed by reconstruction, a posteriori, of the meaning and effects co-created by the users' actions. Considering a change in meaning over time requires looking at the hashtag itself differently. This process would have practical repercussions on research design, requiring a specific model to interpret the changes.

3. Emergence of the hashtag as a relational social form

The examination of studies related to issues concerning the actions of hashtag users reveals the consequent possibility that their meaning could be reconfigured. It also highlights the fact that this effect needs to be observed over time and that it manifests itself inside and outside the digital environment, broadening the way we view the hashtag. For this reason, we propose a new interpretation which originates from the idea that hashtags can be considered as a relational social form. Evidently, the change that has taken place within the media ecosystem plays a fundamental role in this proposal, because today, as already pointed out at the beginning of this article, we are confronted with digital platforms that are “gradually infiltrating in and converging with the (offline legacy) institutions and practices through which democratic societies are organized” (van Dijck et al., 2018, p. 24).

It is from this convergence that the need to identify new dimensions of reference for the hashtag emerges. It is about considering how the meaning of a hashtag changes according to interconnection logic. This interconnection is systemic, because it not only concerns social structures, but it also concerns the possibilities of action by the users/citizens and the hashtag itself. These are the motivations that lead us to look to sociological theories dealing with social change to find theoretical frameworks capable of focusing on this process of changing the meaning of the hashtag. The concept of change seems to make sense only when related to something, that is, when there is a change with reference to an already given or existent order. Rocher (1973) essentially defines change as a collective

phenomenon, which concerns the collectivity or a part of it, and which consequently involves the conditions, ways of life, and of thinking of an individual. This consideration is applicable also to hashtags and to the dynamics underlying the change of meaning both in topical and non-topical hashtags. Social change needs factors and conditions to take place (Rocher, 2004, p. 379) claims that “the historical actions of human beings take place through a great number of conditions, factors, constraints that more or less favor the attainment of human goals. Some of these factors are attached to the individual and human action, while others are external to the individual”. A factor of change is a strong determinant of social change itself. This means that a factor can be considered an element of a given situation, that for the simple fact of existing or for the action it performs, provokes, or produces a change (Rocher, 1973). Instead, conditions are the elements which favor or inhibit, feed or slow down, encourage or delay the influence of one or more factors of change. There are, therefore, structural or material and cultural factors; the former include demographic, technological, and economic infrastructural factors, and the latter cultural and ideological ones. In the analysis we carry out here, the structural factors are identified as products of the platforms and their relational and market logics. The cultural ones are instead to be found in the network dynamics of the users, which show their effects within and outside the digital ecosystem.

Here, we assume hashtags are a subject of observation for themselves, their function, and their social effects, linking them to a temporal dimension and the results produced by a collective agency. We then interpret hashtags as a manifestation of a new form of social relationship because they move within two environments—the digital platform ecosystem and other social structures—interacting with the structural dimensions and connections (*re-ligo*) of both, and with the different references of meanings that are generated progressively (*re-fero*), thereby creating a reciprocal action that generates a third party, namely hashtags, as a relational social form.

The hashtag as a relational social form is an “emerging property” generated by the interaction of users/citizens—inside and outside digital environments—behaving like “corporate agents” (Archer, 1995) who organize their actions in a formal or informal way (Karlsson, 2020) to reach their goals. The result of their actions is defined as a “corporate agency” and gradually manifests itself as a structural transformation or morphogenesis. This perspective allows us to highlight that the hashtag is determined by a strong semiotic charge for the word that forms it, represented by the power of sharing. This power is determined by using hashtags and the gratification received while generating and regenerating them. The regeneration of the meaning of hashtags is determined by the circulation process that places the ownership of the connotation into the hands of those who share them, thus developing a network of collateral meanings and actions which produce a morphogenesis.

Here, we have begun to outline the elements that allow us to consider the hashtag as a relational social form, which means that it is possible to think that a grafting of the relational approach could be practiced on it. Accordingly, it is possible to read hashtags through lenses that are certainly not new but can instead be considered vintage.

In the first section of this work, the reader was introduced to the notions of time and agency in Twitter and to how they produce effects inside and outside the medial ecosystem. In other words, the reader understands how they produce social change. We

now wish to outline the aspects of cultural morphogenesis (Section 3.1.). We are looking for a theoretical matrix capable of explaining the change inside the hashtag. One that is linked to the hashtag’s signification processes and to the external changes it produces in the social system.

We define this application of social change theories to hashtag studies as vintage glasses because they were produced at least 20 years before the present moment, and they are “grafted” because we are joining two theoretical perspectives that belong to different fields. The definition of hashtags as a relational social form—outlined above—is based on the relational approach (Archer, 1996; Donati, 2011), on the social relationship (Donati, 2006), and on the decline of the morphogenetic sequence to social forms (Donati, 2006). Furthermore, this grafting that we are practicing provides us with a key to understanding the gradual change in the meaning of the hashtag, allowing us to insert it within the cultural morphogenesis.

3.1. Cultural morphogenesis

The concept of change makes sense only when it is related to something—therefore, an *a posteriori* compared with an *a priori*—that is, when there is a change concerning an already given or existent order. The same consideration can be made for the meaning of the signifier and the signified in hashtags: (1) the signifier’s change is assessed by considering the transformation in the content conveyed and collected by the hashtag, (2) and the signified’s change is the impact of the collective action on the hashtag’s meanings and its effect on the theme/event/movement from which it originates. The concept of change makes it necessary to refer to a context or system and to the already existent dynamics, which can be internal, external or interrelated.

In essence, the same “problem” that arises in sociological theories arises within hashtag study and analyses, i.e., whether it is the agency that produces a change in the social system or whether social structures act on individuals.

Archer emphasized the dualistic relationship between structure and action stigmatizing the previous approaches as unidimensional theorisations characterized by a conflation, a fusion upwards, downwards or toward the center of the issue i.e., individual versus society. It is an old and a thorny dilemma, interpretable in an almost Hamletic sense, that is, whether the change is to be attributed to structures, to the individual or the action. In the untangling of this dilemma, traditional “conflationists” have opted for one or the other option from time to time, putting aside the idea of the possibility of a sociological dualism, in which the different aspects refer to different social reality elements. The interrelations and interconnections between these properties and capabilities are the core of non-conflative theories whose characteristic is that these aspects need to be related rather than led back and absorbed into each other. In this opening, non-conflative theories can explain hashtags’ change. The essential aspect of Archer (1995) analytical dualism, that is, the morphogenetic-morphostatic approach, offers the basis for observing the morphogenesis of hashtags. Archer proposed the morphogenetic-morphostatic approach based on the understanding that society is similar only to itself, and the fundamental task is to understand how social forms derive from human action

exactly as social beings derive from social forms (Archer, 1995, p. 255).

Incorporated into the context of transformation, change and mutation, this approach of morphogenesis and morphostasis makes an analytic distinction between action and structure, unable to claim that human beings create the structure but affirming that they reproduce and transform it. Social structure is always a given when referring to *intentional human action*; the social practice has a restructuring effect, which can be the starting point of a new cycle of action and change.

The essential aspect of this approach, which considers cultural and communicative change, is that it enhances analytical dualism as the criterion used to analyse structure and action, and it recognizes its existence for the analysis of cultural systems and socio-cultural interactions. The analysis of cultural change includes four equivalent propositions based on the identification of properties belonging only to cultural systems and that do not melt down into the characteristics typical of socio-cultural interaction. Hence, there is a morphogenetic cycle of cultural conditioning, cultural interaction and cultural elaboration in which cycles are considered constant and the final product of the elaboration of cultural system contributes to the creation of logical and necessary internal relations between the components of the cultural system itself, creating a new cycle of cultural change. Archer's approach also concerns cultural systems and socio-cultural interactions, offering the basis for observing the morphogenesis of hashtags as *emergent properties* determined by the interaction of a group of individuals belonging to a certain social structure that already contains its own cultural and value-driven orientation. Archer (2007, p. 39) claimed "constituted as human beings are, the world being the way it is, the interaction between the two is a matter of necessity".

To explore this interaction, we must determine the conceivable properties capable of producing any kind of causal effect attributable to the social systems considered together with individuals and which, in any case, are an influence independent from them. When proposing this approach, Archer analyses these issues as they have been tackled by social realists and institutionalists. We accept the morphogenetic approach that emergent properties are different from the evident and long-lasting patterns of social life because they are not observable characteristics of the structural domain as "institutional models", "social organizations" and the "socio-economic classes" (Archer, 1995). However, they are not observable characteristics of the cultural domain because of their heterogeneity, represented by a mix of aggregations, people and positions. Furthermore, this heterogeneity is inevitable because it emerges from the observation of events that are collected and categorized, and it incorporates a series of contingent regularities based on a series of undifferentiated sources. The unity possessed by the event categories and structures is given by the observer who categorizes them as objects of observation. Hence, considering the internal and necessary relations between the elements as constitutive of an emergent property means separating them from external and contingent relations.

There are numerous emergent properties in society, namely structural, cultural and action-related. Each is irreducible to the others, being relatively autonomous and long-lasting. Another fundamental element is the one linked to the primary dependence of the emergent structural properties on material resources. This idea

implies that the latter makes the emergent properties what they are and without them, the properties would not exist or possess the causal influence they are characterized by Archer (1995).

When we state that structural emergent properties cannot be reduced to individuals and are relatively long-lasting, we must distinguish between them and their unexpected consequences. What distinguishes them is that the unexpected consequences are defined as "aggregated": even if the effects produced are important, they can be broken up and disaggregated into a sum of individual actions. Hence, emergent structural properties are not determined by additive actions but are an expression of internal and necessary relations between real collectivizes and their relations with external entities.

Culture and its emergent properties can be similarly outlined to the structure and emergent structural properties. Therefore, in analytic dualistic terms, the elements of the cultural system are pre-existent and autonomous, which identifies them as different entities from the meanings perceived and attributed by the actors in the moment. This distinction is possible because there are logical relationships between the objects that make up the cultural system while causal relationships exist between the social agents (Archer, 1995).

In the cultural system, it is easy to understand that the systematization of beliefs, symbols and artifacts has been carried out by previous thinkers; the architecture emerging from this systematization reveals a logical relationship between the parts, which can also be based on independent interaction. In contrast, the attribution of causal relations depends on agents.

Analytical dualism, therefore, consists of distinguishing and defining the cultural system (CS) and the level of socio-cultural interaction (S-C). Components in the model are ideas (CS) and human beings or persons (S-C), respectively. Thus, "the level of the Cultural System is ruled by logical relations and the socio-cultural interactive level by relations of causality rooted in human intentional agency" (Halas, 2017, p. 124).

Culture is a human product, and it escapes the control of its creators. Therefore, the CS contains constraints in addition to new possibilities. It introduces new issues linked to relations between emergent entities, between the physical environment and between human agents. This statement has been criticized and could lead to an *aporia*; however, Archer's creation of a temporal framework determines the appropriate context to identify such emergent properties. In this way, CS properties do not depend on what happens at an S-C level because at a time defined as T_1 , the logical relations are independent of the causal ones. All CS elements have escaped from the control of their creators and can develop reciprocal logical relations independently of what people think, feel or know about them (Archer, 1995). It can also happen that in a future moment—considered as the product or passage from T_2 to T_3 —the agents' actions will have a significant impact on the universe of the CS to be inserted in the register of the latter (T_4). If this incorporation takes place, this new register or CS can escape again from the control of its creators who will immediately develop logical and reciprocal relations with the previous ideas (Archer, 1995).

If we insert hashtags and their changing action into Archer's analytic dynamism, the change appears as an emergent CS property expressed by the interaction of individuals and groups with the existing socio-cultural system. The property emerges

from a pre-existing system of cultural values and results from a concatenation of events observed in their regularity, thereby creating a new cycle and expressing a morphogenetic capacity to react to a given system. Being connected to events, it is not a theory, but a phenomenon destined to endure the time required to accomplish the tasks it was created for and capable of producing a new bifurcation that can result in a morphostasis or morphogenesis.

4. Touchable points

A question which arises is whether it is possible to graft the relational approach onto hashtag studies in order to create a new manner of reading hashtags. Before proceeding with a graft, it is necessary to study the conditions of engraftment and one of them is represented by the affinity or, in this case, the proximity of the themes and approaches.

Moving from Archer's morphogenetic-morphostatic model (M/M), we have three stages: (1) at T_1 , there is an existing structure, which is the result of past interactions between different agents; (2) at the period T_2 - T_3 , there is an interaction between agents connected to the structure in question; and (3) finally, the outcome at T_4 can either be that the structure is reproduced (morphostasis) or transformed (morphogenesis). The stages can be represented as cultural conditioning $\rightarrow$ social-cultural interaction $\rightarrow$ cultural elaboration, thus stressing the interplay between structure and agency. There are two different types of agents in this model, "primary agents, the agency that results in structural reproduction or morphostasis, and corporate agents, the agency that results in structural transformation or morphogenesis" (Karlsson, 2020, p. 46).

Hence, we believe the same morphogenetic-morphostatic process can characterize the change underlying the signifier and the signified in hashtags. To support this statement, it is necessary to explain the points of contact between morphogenetic cultures and morphogenic hashtags.

1. First, consider Archer's claims in *Culture and Agency: The Place of Culture in Social Theory* (Archer, 1996). Culture is a part of SAC (structure, agency and culture); thus, it forms one of the constitutional layers of the social order alongside structure and agency (2015, p. 155). The author contends that there is no hierarchical order between these three elements as they are constitutive of the phenomena that belong equally to the micro, meso and macro levels of social reality where networks of social relations are inherent and continuously reconstituted in time through morphogenetic cycles. Furthermore, Archer states, "if structure and culture do have relative autonomy from one another, then there is the interplay between them which it is necessary to explore theoretically" (Archer, 1996, p. 27). Connective media (van Dijck, 2013) are an uninterrupted presence in daily routines: they absorb a significant part of identity processes and social relationships and give life to a common heritage of cultural and symbolic practices, rules and behavioral practices that contribute to settling "an accepted version of reality" intersubjectively shared within the same communicative environment (Boccia Artieri et al., 2017). Online platforms now preside over socio-technical systems within which all actors move, performing a completely new intermediation function that structures the relational flow through logics that are not yet fully understood. This is confirmed by other studies (Goel et al., 2015; Benkler et al., 2018) which were used by Starr (2021, p. 15) to show the nature of relational public and underline how "mass communications" and "social networks" have converged in the analysis of contemporary media.
2. Second, according to Archer, culture, despite being autonomous and not subject to the social structure, plays an essential role in revealing the mechanisms of social change. Culture does not act alone or automatically but through the reflexive agency of actors who can articulate the principles of this morphogenic change as they are conscious of its ideational orientation (Archer, 2012, p. 33). This process recalls the mechanisms based on the formation of *ad hoc* publics created around hashtags which produce social effects. The SAC model proposes to view culture as a realm of properties and powers that are in constant interplay; in other words, a realm of cultural dynamics (Archer, 1996, p. 101) where the hashtag as a cultural product (e.g., Dobrin, 2020) finds its reason to be inserted and observed in this model. The analytic distinction in the SAC model allows us to develop a morphogenetic approach to the study of culture based on the following facts that: (1) ideas are *sui generis* real, (2) idea sharing is contingent and (3) idea interplay from the level of the CS and the level of S-C interaction leads to a new morphogenetic cycle phase called cultural elaboration (Archer and Elder-Vass, 2012; Archer, 2017, p. 163) that is useful in the development of a morphogenetic-morphostatic hashtag model (model M/M-H). We need to clarify the use of the term "idea" inside the SAC. For this, we review other authors starting with Popper (1978). Notwithstanding other views (Porpora, 2015), we are interested in Archer who conceptualizes that culture is inside the CS and it is ideational; however, it is used in various ways on the S-C level because people believe it is "a repertoire of ideas for construing the situations in which they find themselves" (Archer, 2017, p. 155). Studies on hashtags are based on sharing a set of denotations that become part of the situation's definition which is evident in the change of the signifier and the signified of a hashtag and the action performed by *ad hoc* publics that transform the sign # and its label into a socio-relational form.
3. Consider that the M/M model has been criticized and improved (Karlsson, 2020); despite the open debate in the ambit of social theory, it allows us to combine two disciplines that are working at the individual action level and on the change that is determined on a social form (i.e., the hashtag), which is capable of moving out of one environment to contaminate another. Thus, it is possible to claim that at T_1 , a hashtag is inserted on platforms and inevitably has a relationship with the social system. The meaning at time T_1 is determined by the social context. At T_2 - T_3 , there is a relational interaction between the agents connected within the definition of *ad hoc* publics. At T_4 , its meaning is reproduced (morphostasis) or transformed (morphogenesis). Topical hashtags can fall into the morphogenetic approach because they change over time. Meanwhile, hashtags that are not topical can undergo a morphostatic process due to their not changing the meaning in a specific period. However, in the morphogenesis-morphostasis assessment, we must specify the observation period. Furthermore, in this case, in the morphogenesis-morphostasis assessment, we need to specify the time span of the observation. T_2 - T_3 can be observed under the lens of "transitional temporality [that]

identifies the capacity for agents to alter the rate of change between events and even to prevent or bring about events by speeding up or slowing down transitions” (Hirschman, 2021, p. 49). This concept remains valid whether the morphogenesis takes place or the morphostasis occurs because as Hirschman (2021, p. 49) explains, “(f)or scholars pursuing research under the banner of transitional temporality, the journey [...] remains important even if the destination is unchanged”. This type of temporality emphasizes the agency between, rather than during, events. It is a form of temporality that acquires as the object of observation the unfolding “of some local process that was in turn set in place by some prior contingent process. In other words, transitional temporality is at least roughly compatible with eventful temporality, but it focuses on the periods between events rather than the events themselves” (2021, p. 52). Within it, the research questions seem to be the same as those asked by the scholars of hashtag studies, that is, what is the speed with which the change takes place and the hashtag is spread; in what way do the systems on which the hashtag has an impact accept or reject the instances that are vehiculated through it and when do the instances vehiculated through the hashtag determine a real change.

4. The M/M model considers the influence of the temporal variable which is fundamental in hashtag studies (Bruns and Stieglitz, 2013; Faltese, 2015). First, reasoning on the temporal issue of hashtags makes us reflect on their internal dimension, represented by the fact that they are contained and used within the structure of proprietary platforms. Therefore, their external dimension is connected to events emerging from a socio-structural context. Hashtag time is the intersection between a digital dimension (internal and soft) and a socio-structural (external and hard) one. These two dimensions determine the peculiarity of the nature of time that takes shape with and through space and experience. However, hashtag time is the time of oblivion and non-oblivion because a hashtag survives if it circulates, that is, if it is used; otherwise, it goes unheeded and becomes a frill inserted in a short text. The time of a hashtag reveals its importance: if it succeeds in passing from T_1 to T_2 and T_3 , in other words, if it finds strength in the interaction and releases the agency in the sharing, then, it is an expression of interest. If it reaches the T_2 and T_3 phases, the hashtag enters the morphogenetic circle through a corporate agency.
5. The centrality of the cultural dynamic problem in morphogenesis is another element that favors the inclusion of hashtag changes in this approach. As explained above (see point 2), Archer’s approach considers culture as a set of properties and powers that are constantly interacting and full of cultural dynamics. At the basis of this cultural dynamism, appointing is essential because the nominal forms used in language to categorize reality appear to substantialise or even reify it (Elias, 1978, p. 112). Topical hashtags are considered *de facto* as socio-relational forms and reify reality by categorizing it. This is evident in some studies that examined hashtags as a linguistic act (Benovitz, 2010; Caleffi, 2015; Rambukkana, 2015) and as pertaining to a shared semantic field. In some studies, the hashtag has been associated with the illocutionary act of Searle’s theory (Searle, 1969) and his works on the construction of reality (Searle, 1995). We can consider a hashtag as a speech act (La Rocca and Rinaldi,

2020) because the way in which we indicate “things” and the words we use determine what we know, what we maintain as an idea and what we give a representation of. However, we must take into consideration another element, namely that the hashtags that we use on Twitter intrinsically include digital characters made of bits that pass from one state to another very quickly. The core of the issue is exactly the following: in the passage from one state to another one, we digit, tweet and retweet the hashtags until they perform certain functions, but these functions are always related to the observer. It is only because the observer knows how to interpret a hashtag and what it recalls that we can claim that a hashtag contains information in itself. As Searle explains, in speech acts, there is a sense of intentionality independent from the observer (intrinsic intentionality), a sense of intentionality extrinsic to the observer (extrinsic intentionality) and then a third form of intentionality, i.e., the metamorphic one. This distinction made by Searle is without doubt relevant when one needs to extract the meanings of hashtags and their re-modulation in the various uses by social media users. Hence, we always need to distinguish between the literal use of the hashtag’s intentional concepts, the literal use that describes intentional states intrinsic or independent from the observer and the literal use that describe intentional conditions so visible only to the observer. These two literal applications of intentional notions should be, in turn, distinguished from the metaphorical applications of intentional notions. Searle’s clarification is fundamental in that it is impossible to have an intentional state without having several others. Indeed, the intentional state presuppose beliefs, values and wishes, and we can consider them as a web in which every intentional state works. In other words, the intentional state determines one’s conditions of satisfaction only for its position and relation to all the others on the net or in social media. The entire net of intentionality works only because there is a background, i.e., a field that makes it possible for the detailed elements of the net to work adequately. Such a background does not consist of further beliefs added to the net itself but rather of a habitus, shared social practices and ways of being correlated to it in some way. For these reasons, the hashtag becomes a semantic umbrella, a polysemic connector and a collector of emotions that are always correlated but which also extend and redesign the nuances of sense and of the original meaning.

5. Discussion: Toward an interpretative model

If the SAC model is merely a toolkit to assist in the study of social and cultural dynamics (Halas, 2017, p. 124), then what we are outlining here is essentially a toolkit to study and analyse hashtags. The reasons M/M-H is a toolkit are evident when one works with hashtags, in other words, when they become research subjects. To work with and on hashtags, following the indications of the M/M-H model, we must consider the *a priori* meaning of the hashtag (H#) and measure if the interaction has produced—*ex post*—a change in the signified and in the signifier, that is, in the hashtag (h#) form itself. We then indicate using H# the *a priori* meaning of the hashtag (#) and with the h# form indicating that which unfolds through the interaction.

The formalization is:

- If # at T_1 is = a # at T_4 , then the morphostasis is $H\#$
- If # at T_1 is $\neq$ a # at T_4 , then the morphogenesis of $H\#$ in $h\#$
 $\Leftrightarrow T_2-T_3$ human interaction
- if $T_{1\text{signifier+signified}} \neq T_{4\text{signifier+signified}} \wedge H\# \neq h\#$

Hence, at T_1 , we have $H\#$, which possesses a predated signifier and signified. If at T_2-T_3 , the signifier and the signified of # change through interactions, we have a morphogenetic process indicated by $h\#$, which allows us to evaluate how the signifier and the signified of # have changed at T_4 . If the interaction at T_2-T_3 does not determine a change in the signifier and the signified of #, then at T_4 , we register a morphostatic process. The temporal journey of hashtags develops along a relational temporal dimension.

Indeed, the remodeled hashtag ($h\#$) can be considered as a reality *sui generis*, which shapes a full and embedded social relationship comprising a symbolic dimension (*re-fero*) and structural ties (*re-ligo*). This result emerges through the action of a relational public, which is an “open-ended network of actors linked through flows of communication, shared stories and civic or other collective concerns” (Starr, 2021, p. 21). The definition of hashtags eliminates their analytic dilemma because it is possible to trace in their being a socio-relational form of all the elements that allow them to embrace the morphogenetic cycle and reveal their morphogenesis. Hashtags are an expressive-communicative-social form that belongs to the dynamics and ideas of the CS, and they unfold their changes in the interaction happening within the S-C system. As Archer outlines, we recognize that a hashtag ($H\#$) transforms inside the S-C, showing at T_4 $h\#$ (see Figure 1). The relational public acts along a relational temporal dimension creating a transformation in the hashtag’s meaning. Thus, the hashtag reports complex relationships.

Additionally, we recognize that in every new cycle, hashtags can be unlike the previous ones. This scheme moves along three fundamental acquisitions: awareness of the relational public, the relationality of hashtags and the expression of the agency.

The introduction of the relational temporal dimension as the interpretative key of the temporal cycle highlights how actions always have a predated direction—they move within and along with a social structure—while changes and transformations occur when we move in that direction. These transformations can be rapid, and during the unfolding of these actions, we must consider the agency. The relational temporal dimension provides a lens to understand the agency outside the events’ context and how it may help explain the timing of events. This permits us to examine changes taking place inside the hashtag by showing us how they develop through a process of interactions that reveal the intentionality of the relational action of the public connected online.

The definition provided here for remodeled hashtags contains a few concepts developed by Donati (2006, 2011) and they always move within the relational approach (Donati and Archer, 2015). Thus, it is possible to develop an approach capable of highlighting the hashtag’s reality as an emergent relational phenomenon. The premise is based on the fact that a hashtag exists if at least one of its basic relations exists, that is, its relationship with the structure (external and hard) and with the digital dimension (internal and soft) which together make up the potential net where it can be created and survives. Even if hashtag studies have not framed this relation within the morphogenetic process, they recognize how these relations change. The hashtag’s social dimension consists of the relations it comprises, and which are formally represented inside the M/M-H model as follows:

- $T_{1\text{signifier+signified}} = \vee \neq T_{4\text{signifier+signified}}$

The social aspect found in hashtags is the result of human actions performed on platforms by users, but as human beings, they move between the agency and structure and that is what generates a morphogenetic cycle characterized by structural conditioning $\rightarrow$ social interaction $\rightarrow$ structural elaboration.

According to Donati (2006, p. 112–113), relations at various levels of this cycle are as follows:

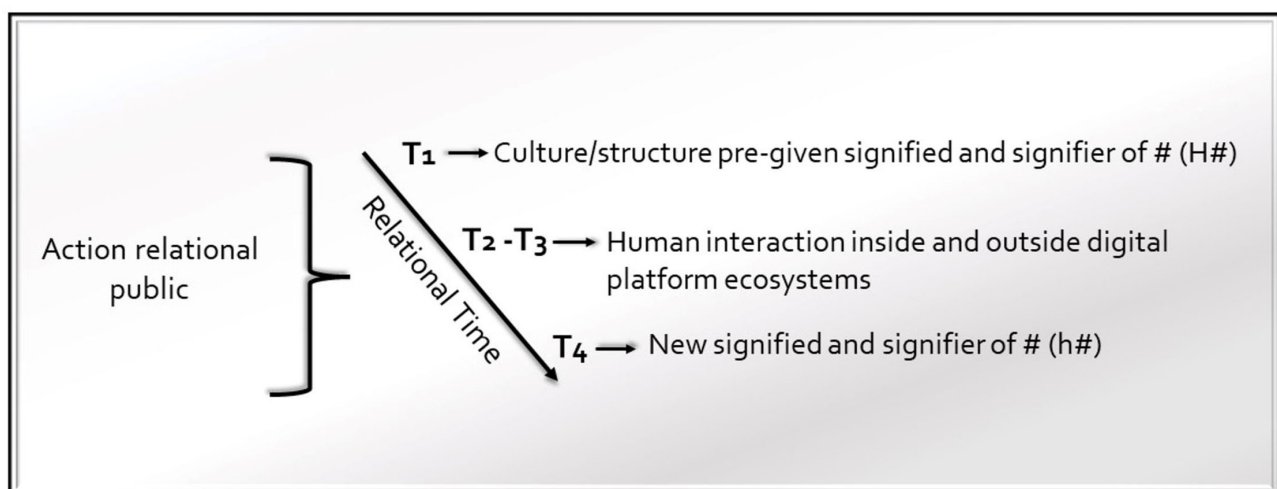


FIGURE 1
Morphogenetic-morphostatic model of hashtags (M/M-H).

TABLE 1 The dimensions of a hashtag as a relational social form.

Relations	c) Reference of sense (re-fero)	d) Reference of ties (re-ligo)
a) Intersubjective	Empathic and intentional sense, symbol reference	Ties created through mutual expectations, relationality, communication and digital platform ecosystems
b) Structures	Sub-cultures, social expectations	The expectation of social system (e.g., public institutions, networks, mainstream system, social movements)

Reworking starting Donati's scheme (2006).

- a) Intersubjective relations, both empathic and communicative, constitute the hashtag as a social form replete with meaning as a polysemic connector and an agency toolkit.
- b) Relational structures, namely the ties created by the sub-cultures and expectations of the general social system they belong to, constitute its socio-relational form.

These relations must be considered in their dual nature:

- c) As a reference of sense, therefore, symbolic and intentional, we find the *re-fero* relational dimension elaborated in the intersubjectivity that occurs in the context of the sub-culture of individuals who interact by developing their relationality.
- d) As mutual ties, thus, as a *re-ligo* relational dimension that forms in the reciprocal expectations of communication and expectations of other sub-social systems (e.g., mainstream media) with the associated institutions they represent (e.g., public authorities or movements).

Based on the above analysis, these dimensions are relatively autonomous and interdependent. By combining these two couples (a-b, c-d), it is possible to outline the social dimension of hashtags from which they gain their connective strength and morphogenetic capacity (see Table 1).

(1: a-c) A hashtag has an empathic and intentional sense addressing the symbols it is made up of as a social form replete with meanings created by its users as relational public.

(2: b-c) A hashtag is an encounter between sub-cultures that represent and actualise its meanings as a meeting/clash of different social expectations. Thus, it becomes a claim maker.

(3: a-d) A hashtag is the creation of ties through mutual symbolic and communicative interactions.

(4: b-d) A hashtag is an answer to the expectations of other institutions in society.

The hashtag-h# is a complete social relation that emerges as a phenomenon produced by the interaction between all the components it comprises in the moment in which they are specified in the cultural code typical of hashtags, that is, connecting within and outside the digital platform. Both predated signifiers and signified that undergo a process of transformation are implemented through the reflective action of the relational public.

6. Conclusion

As is evident from its present appearance, the meaning, use and relationship with the social context of this symbol have transformed, thus breaching the manner of its working considering its use and morphogenetic processes. Several scholars concerned with hashtag

studies have raised questions that dispute a few concepts that have already been analyzed within the realm of social sciences, specifically within those theories that deal with socio-cultural change. In fact, these scholars wonder how to closely examine the agency of users of a hashtag, reconfigured its meaning through their actions, and over time (Yang, 2016) question themselves on how to interpret the relationship between hashtags and historical and social timelines. Additionally, they have raised doubts about the importance of the temporal dimension in the study of the impact of internal and external changes on the dynamics of platforms that scholars are able to launch (Faltese, 2015; Dobrin, 2020). Furthermore, they reflect on ways to interpret the presence of hashtags that do not change their meaning over time and are classifiable as semantic invariants and the presence of hashtags that instead undergo semantic transformation processes (Bruns and Burgess, 2015).

This study is part of the debate on the nature and characteristics of the hashtag, and we have tried to define it as a relational social form affected by morphogenetic-morphostatic processes with the aim of interpreting the power of social connection and change that it produces on technological platforms and social systems. To develop this interpretative proposal, the dimensions of time and agency were presented as examined in hashtag studies based on Twitter. Subsequently, some elements of cultural morphogenesis were recalled and traced and these elements, which are the points of contact between hashtag studies and cultural morphogenesis, were discussed. Finally, an interpretative proposal of the hashtag as a relational social form was constructed.

In this study, we formalized a model to examine the hashtag as a relational social form that operates on social media platforms and within contemporary social structures. This model allows the operationalisation of a hashtag because a hashtag becomes a social entity whose characteristics can be specified within a research design. Therefore, researchers can identify *a priori* the conceptual dimensions of a hashtag and subsequently, in the data analysis phase, understand how much and under which processes the meaning of the hashtag has changed and the effect it has produced on its signifier. The model's limit is that it stops at a theoretical level, and it can also be linked to the limits of the relational approach. The limits of the relational approach postulate that culture is a human product and that it too escapes its creators to act on them. This means that the cultural system contains not only constraints but also new possibilities, and it also introduces new problems related to the relationships between emerging entities, between these and the physical environment and between these and human agents. However, Archer (1996) already inserts a temporal scheme in her theorizing that allows her to identify the possibility of determining the appropriate context for identifying the emergent properties of each type, and this is also what we have established in the present study. Furthermore, the objective with which we have used this

approach here is to proceed toward an integration of all those elements necessary to observe the change in the meaning of a hashtag.

Compared to the first limit set out in this study, we will need to verify through research if it can be empirically tested; although the studies in which text mining and topic modeling are applied already signal a gradual change in the topics of discussion. In this sense, the formalization of this model can help the researcher to focus on this cultural change through the meanings built around a theme/event. The practical application of this model in the research would represent the welding phase of the graft we have discussed in this paper.

Author contributions

Both authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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The link between reported cases of COVID-19 and the Infodemic Risk Index: A worldwide perspective

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In this brief report we followed the evolution of the COVID-19 Infodemic Risk Index during 2020 and clarified its connection with the epidemic waves, focusing specifically on their co-evolution in Europe, South America, and South-eastern Asia. Using 640 million tweets collected by the Infodemic Observatory and the open access dataset published by Our World in Data regarding COVID-19 worldwide reported cases, we analyze the COVID-19 infodemic vs. pandemic co-evolution from January 2020 to December 2020. We find that a characteristic pattern emerges at the global scale: a decrease in misinformation on Twitter as the number of COVID-19 confirmed cases increases. Similar local variations highlight how this pattern could be influenced both by the strong content moderation policy enforced by Twitter after the first pandemic wave and by the phenomenon of selective exposure that drives users to pick the most visible and reliable news sources available.

KEYWORDS

COVID-19, Twitter, Infodemic Risk Index, selective exposure, content moderation

Introduction

The COVID-19 pandemic crisis has turned the issue of (mis)information creation and circulation into a major cause of public concern. As the crisis unfolded, it has become clear that the actual rise of COVID-19 infections has been anticipated by large waves of potentially unreliable information that sowed mistrust and confusion in the public opinion (Gallotti et al., 2020). As people's behavioral response to a pandemic crisis is a crucial factor of success (or failure) of public health prescriptions (such as wearing masks), circulating misleading information and undermining the credibility of public health authorities can cause considerable damage and disrupt to a large extent the effectiveness of policy measures.

Such a loop between information acquisition and processing and adoption of more or less effective health-related behaviors may be at the core of different country performances in mitigating the outcomes of the global pandemic. For example, the spread of click-bait content or the prevalence of non-specialist, misleading opinions over those of scientists and public institutions on key public health matters are two dangers that are looming behind the COVID-19 communicational crisis

(Damian and Gallo, 2020; O'Connor and Murphy, 2020). A key challenge that the pandemic poses to our society is therefore ensuring that correct, easily digestible information is received by citizens as a reliable guide to health-preserving choices (Zarocostas, 2020). Social media platforms are fully part of this process. As it has been shown, online conversations have a big impact upon the construction and perception of social reality, leading people to experience emotions without awareness (Kramer et al., 2014) and influencing the opinions of millions (Bond, 2012).

A fundamental key aspect of infodemic waves—i.e., an overabundance of information that makes it difficult for the majority of the public opinion to distinguish between reliable and unreliable sources—is their enormous pervasiveness both in news media and in the public's search for information (Eysenbach, 2002, 2009). When the COVID-19 crisis struck, the whole media ecosystem underwent an initial shock. Being a very powerful public attention pointer, COVID-19 quickly became the central topic of global conversations at any scale (Sacco et al., 2021). However, the rewards associated to the promotion of viral content by media outlets (Bakir and McStay, 2018), and the consequent incentives related to the trading of highly visible digital content for advertising and persuasive communication (Graham, 2017), has inevitably pushed the creation and circulation of sensationalistic, unreliable information able to capture the attention of large numbers of online users (Donovan, 2020). As a result, in the first months of 2020 a huge number of scientific hoaxes flourished and were disseminated on the web (McGinty and Gyenes, 2020).

Nevertheless, after the initial shock, extended surveys have partially changed the whole picture, showing how, faced with a serious crisis and potentially deadly threats, people were compelled to search and trust the information held by news sources considered reliable and familiar (Nielsen et al., 2020; Altay et al., 2022). Our research seems to confirm these findings. By analyzing a very large and heterogeneous dataset our results reveal the existence of a general negative correlation between the Infodemic Risk Index and reported COVID-19 cases, when considered both at global and regional scale. Significant local variations are however observed across different geographical macro-areas affected by the pandemic. Indeed, comparing the cases of Europe, South America, and South-eastern Asia, we have been able to highlight different co-evolutionary paths according to different local conditions.

Methods

Data collection

This article is based on the analysis of Tweets collected across 187 countries between 22nd January and 31st of December 2020. We automatically collected Twitter data from the Twitter

Streaming API by selecting tweets containing terms associated with the COVID-19 epidemic, the virus that causes it and the city where it was first discovered (coronavirus, ncov, #Wuhan, COVID19, COVID-19, SARS-CoV-2 and COVID). The Streaming API limits our analysis to a random sample of 1% of the total number of tweets circulating. This limit has been reached, for the keywords we selected, on February 25th 2020. Starting from that date, only a random subsample of about 4M tweets/day are collected. All tweets are then processed in order to identify the country of origin and the type of news circulating. The identification for the country of origin is straightforward for a small fraction of ~0.8% of the total, for which the user shares the coordinates of the location from which the tweet has been posted. To extend this identification, we consider the user's self-defined location and derive the user's area of origin through a geocoding service. After specific filtering, this method allows us to associate about 50% of all tweets to a country of origin. Our data collection is possibly affected by a selection bias, as Twitter's user population skews the analysis toward well-educated males. In addition, by cross-checking with the news reliability database, this bias can be further exacerbated by an overrepresentation of users tweeting in English, as English web domains are better classified in the databases we aggregated. However, in Gallotti et al. (2020) it has been shown how, regardless of these possible biases, our methodology is appropriate to study the evolution of the COVID-19 infodemic in both time and space. In particular: i) the recall rate of tweets associated with the COVID-19 topic is higher than 16% and probably ranging in the 40%-60% range in the earlier days of the pandemic; the temporal patterns observed on the tweets whose provenience is from the U.S.A. as identified *via* geocoding services match those observed from tweets whose exact coordinates fall within the American territory: the results of the misinformation analysis appear robust to Twitter's policies to promote authoritative content by prioritizing the visibility of official sources.

News enrichment

To identify the type of news circulating, we cross-check the URL shared in tweets with a database that aggregates different sources and categorizes the reliability of news web domains. To create the database we collected a list of manually checked web domains from multiple publicly available databases, including scientific and journalistic ones. Specifically, we considered data shared by the sources listed in:

- Zimdar, M. My fake news list went viral but made up stories are only part of the problem. The Washington Post (18 November 2016).
- Silverman, C. Inside the partisan fight for your news feed. BuzzFeed News (8 August 2017).

- Fake News Watch (2015). Retrieve from: <https://web.archive.org/web/20180213181029/http://www.fakenewswatch.com/>
- Politifacts guide to fake news and what they peddle. [Politifacts.com](https://www.politifacts.com) (20 April 2017).
- The black list. La lista nera del web. Bufale.net (2018). Retrieve from: <https://www.bufale.net/the-black-list-la-lista-nera-del-web/>
- Starbird, K., Arif, A., Wilson, T., Van Koeveing, K., Yefimova, K., and Scarnecchia, D. (2018). Ecosystem or Echo-System? Exploring Content Sharing across Alternative Media Domains. *Proceedings of the International AAAI Conference on Web and Social Media*, 12(1). <https://doi.org/10.1609/icwsm.v12i1.15009>
- Nielsen, R. K., Fletcher, R., Cornia, A., and Graves, L. (2018). Measuring the reach of “fake news” and online disinformation in Europe. (<https://reutersinstitute.politics.ox.ac.uk/our-research/measuring-reach-fake-news-and-online-disinformation-europe>)
- Grinberg, N. et al. Fake news on Twitter during the 2016 US presidential election. *Science* 363, 374–378 (2019).
- Media Bias/Fact Check (<https://mediabiasfactcheck.com/>).

We found a total of 4,988 domains, reduced to 4,417 after removing hard duplicates across databases. Note that a domain is considered a hard duplicate if its name and its classification coincide across databases.

A second level of filtering was applied to domains which are classified differently across databases (e.g., xyz.com might be classified as FAKE/HOAX in a database and as SATIRE in another database). To deal with these cases, we adopted our own classification method, by assigning to each category a “Harm Score” between 1 and 9. When two or more domains were soft duplicates, we kept the classification with the highest Harm Score, as a conservative choice. This phase of processing reduced the overall database to 3,920 unique domains.

The Harm Score classifies sources in terms of their potential contribution to the manipulative and mis-informative character of an infodemic. As a general principle, the more systematic and intentionally harmful the knowledge manipulation and data fabrication, the higher the Harm Score (HS).

A third level of filtering concerned poorly defined domains, e.g., the ones explicitly missing top-level domain names, such as .com.org etc, as well as the domains not classifiable by means of our proposed scheme. This action reduced the database to the final number of 3,892 entries.

Infodemic Risk Index

The Infodemic Risk Index (IRI) represents an estimate of the relative exposure of users to unreliable information. To estimate the exposure to unreliable news (Eu), we aggregate the number of followers who are potentially reached by tweets

containing unreliable news. Conversely, the exposure to reliable news (Er), is obtained by aggregating the number of followers potentially reached by tweets containing reliable news. The IRI is finally computed as $IRI = Eu/(Er+Eu)$. See Gallotti et al. (2020) for further details, in particular on how analyzing an indirect measure of exposure using followers is largely equivalent to estimating exposure using actions (retweets, replies, quotes).

Correlation and regression analysis

The regressions presented in this article have been made using the *statsmodels* python library. We performed logarithmic regressions [$y = \log(x)$], as this curve has been seen to maximize the Akaike Information Criterion against possible alternative forms (linear, power law, logistic). Akaike is normally chosen since the alternative curves are characterized by different numbers of parameters. Curves with more parameters naturally adapt better to data, but are more prone to overfitting. Akaike considers this in a weight that accounts for the likelihood of a model considering the degrees of freedom. For this data, the Akaike weights were: logarithmic 4.933530e-01; linear 2.959338e-01; logistic 1.053566e-01; power law 5.690409e-136. The Spearman correlations and associated *p*-values are computed using the *scipy* python library. The Spearman correlation has been chosen as it is robust in the analysis of quantities ranging across several orders of magnitudes.

Results

Finding 1: World countries most affected by COVID-19 have lower infodemic risk.¹

At a worldwide level (see Figure 1), we found a weak anticorrelation between reported cases of COVID-19 and index of infodemic risk. This link is all the more evident as the size of the countries considered in the sample increases: in fact, a larger size of the population implies a larger number of cases and also a larger statistical base to accurately and extensively count the impact of COVID-19.

Finding 2: The negative correlation between IRI and cases in South-Eastern Asia appears to be strong. The Spearman-r index is equal to -0.42 and the associated *p*-value is 0.23.

¹ To test the increased correlation of IRI vs Number of Uncorrelated Cases without rescaling by local population we repeatedly (2000 times) sample 100 random countries among those analyzed that had population data correctly indicated by the OECD for the year 2020. In figure “IRI vs. *p*-value” of the Supplementary material we plot the *p*-value of the Spearman correlation for P.C. and total cases against the Infodemic Risk Index. In only 12.5% of the samples the *p*-value is smaller using the per-capita number of cases, while in 24.2% of samples the *p*-value associated with the total number of cases is lower than 0.05.

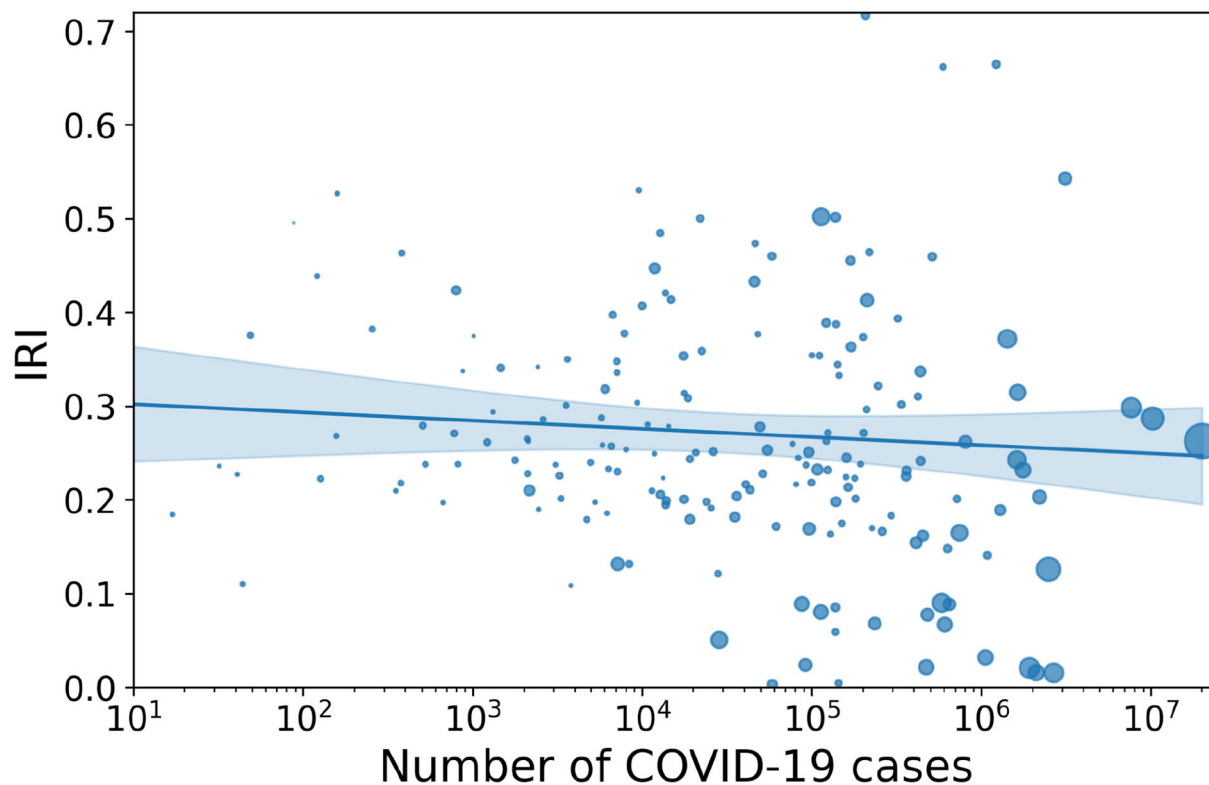


FIGURE 1

Correlation between IRI and total number of COVID-19 cases worldwide. Description: scatterplot showing a moderate but significant anti-correlation between COVID-19 cases and IRI across the 177 countries considered (Spearman- r is -0.16 and the p -value is 0.033). The correlation is strongly reduced as compared to the early days of the pandemic as analyzed in Gallotti et al. (2020), where Spearman- r was -0.33 and the p -value is 0.0009 . The regression curve shown here and in all graphs is a logarithmic regression, which was selected using an Akaike criterion against a linear and a logistic regression. The shaded area represents the 95% confidence interval, and the size of the circle represents the number of Tweets collected. Two countries (Peru and Kosovo) are not visualized in the plot as they have $IRI > 0.9$.

South-Eastern Asian countries present from the beginning of the pandemic a marked difference in the pattern of infodemic risk. The IRI directly reflects the extent to which each single state in the region has been exposed to the pandemic waves (see Figure 2). Once the initial crisis stabilizes and the cases increase all over the region, even in the less risky countries there is a general increase of possibly harmful contents circulating in the Twittersphere (see Supplementary material).

Finding 3: The negative correlation between IRI and cases in Europe is as strong as in South-Eastern Asia. The Spearman- r index is equal to -0.50 and the associated p -value is 0.007 .

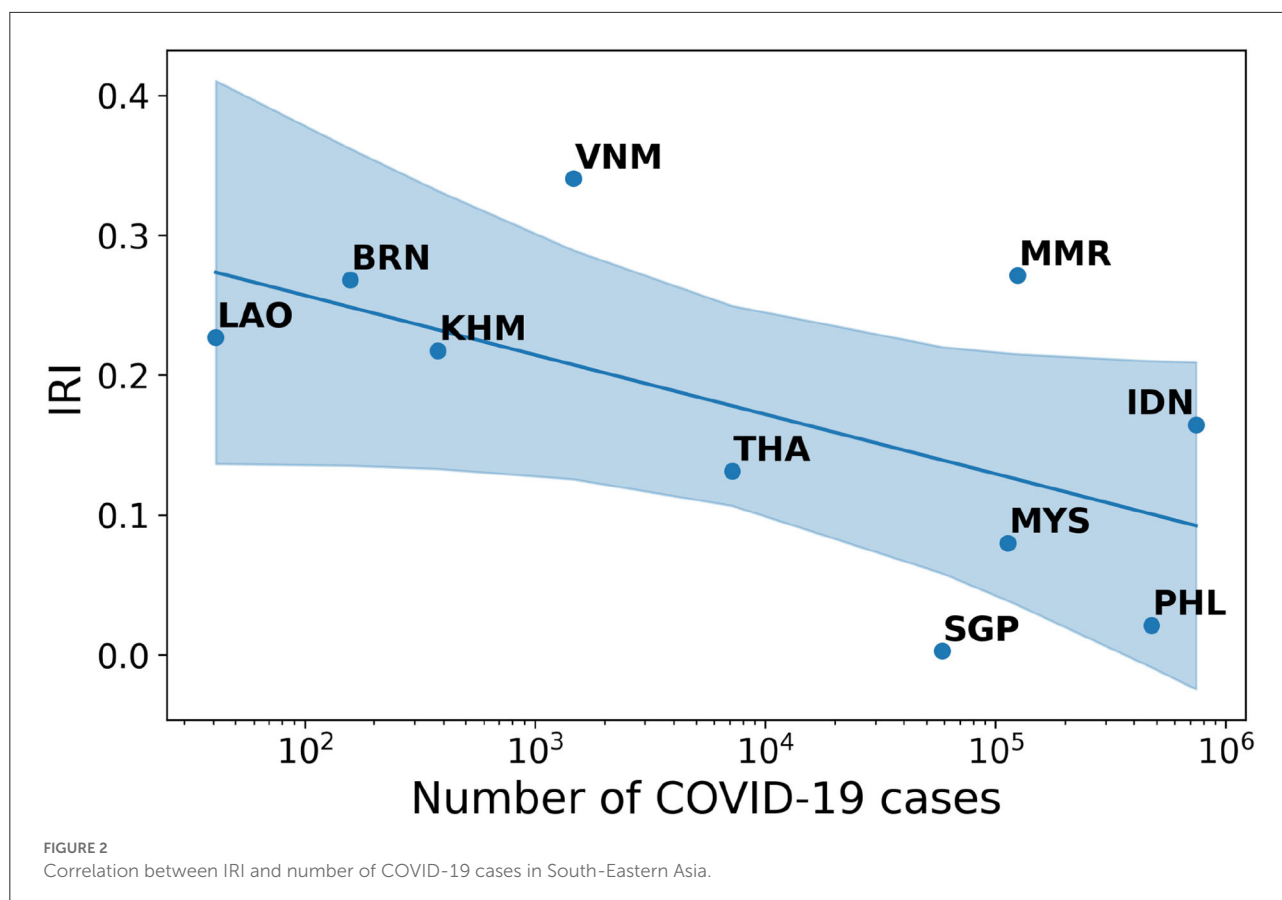
Unlike Asean countries, in Europe the first wave of pandemic has been anticipated by a big, generalized surge of infodemic risk. As the number of cases increases, particularly in the most affected countries, the IRI visibly decreases (see Figure 3). This phenomenon could be observed in all countries that are gradually affected by the waves of infection and remains stable over time (see Supplementary material).

Finding 4: The correlation between IRI and cases in South America follows a positive pattern. The Spearman- r index is equal to $+0.46$ with an associated p -value of 0.13 .

Finally, in South America the evolution of the relationship between IRI and COVID-19 cases directly reflects the trend of the pandemic (see Supplementary material). With an increase in the number of cases, countries experience an increase in disinformation content circulating on Twitter (see Figure 4).

Discussion

From its very beginning, the COVID-19 crisis immediately raised concerns for risks generated by a possible infodemic of inaccurate information and how social media users would have dealt with it. In this brief report using the Tweets collected through the Infodemic Observatory's and the COVID-19 cases reported by Our World in Data, we analyzed the co-evolution of the Infodemic Risk Index and the pandemic from January 2020 to December 2020. Our findings describe a worldwide pattern of ongoing anti-correlation between Infodemic Risk Index and the reported cases of COVID-19. This relationship clearly emerges as the size of the countries in the sample increases: larger country population implies a larger number of cases and a larger statistical basis to assess the impact of IRI and COVID-19.



Each of the macro-areas examined shows a distinctive pattern of its own. South-eastern Asian countries present, from the beginning of the pandemic, a marked difference in infodemic risks as compared to other countries. Furthermore, their IRI directly reflects a specific country's exposure to the pandemic waves. However, once the initial crisis stabilizes and the cases increase all over one region, even in the less risky countries there is a general increase of possibly harmful contents circulating in the Twittersphere. For example, unlike the Asean countries trends, in Europe the first wave of pandemic is preceded by a big, generalized surge of infodemic risk. As the number of cases increases, however, and particularly in the most affected countries, the IRI visibly decreases. This phenomenon could be observed in all countries that are gradually affected by the waves of infection and remain stable over time. Finally, in South America the relation between IRI and COVID cases is proportional to the trend of the pandemic: as countries experience an increase in the number of cases, a corresponding increase in misleading content circulating on Twitter follows.

The negative correlation trend identified at a global scale can be partially explained by two different characteristics of the online and communication environments recorded since the onset of the pandemic. The first is the so-called selective trust or selective exposure phenomenon observed by Altay et al. (2022).

Our data support such a theory: as the pandemic grows, citizens and the broader media ecosystem seem to be driven to pay more attention to reliable sources such as mainstream media. This effect could be further strengthened by an information cascade phenomenon, which is very common in Twitter. Indeed, the knowledge communities related to COVID-19 that populate Twitter are extremely hierarchical and mutually disconnected (Sacco et al., 2021). Therefore, a shift toward more reliable sources by the top and middle influencers of these communities could trigger a cascade effect on the entire flow of information regarding COVID-19.

Another possible reason behind the IRI decrease is a stronger focus on moderating conversations about COVID-19 by social media. This process may have been accelerated by the U.S. election—which triggered several monitoring projects regarding the politicization of COVID-19 issues (Chen et al., 2021)—with possible spillovers worldwide. For example, in the case of Indonesia, we could observe how most of the trolls and bots polluting the conversation in the early months of the pandemic were promptly removed from Twitter (Sacco et al., 2021).

As for the differences in patterns across the macro-regions, they may depend on two different factors. The first, and most obvious, are cultural differences that determine media consumption habits and attitudes toward the pandemic.

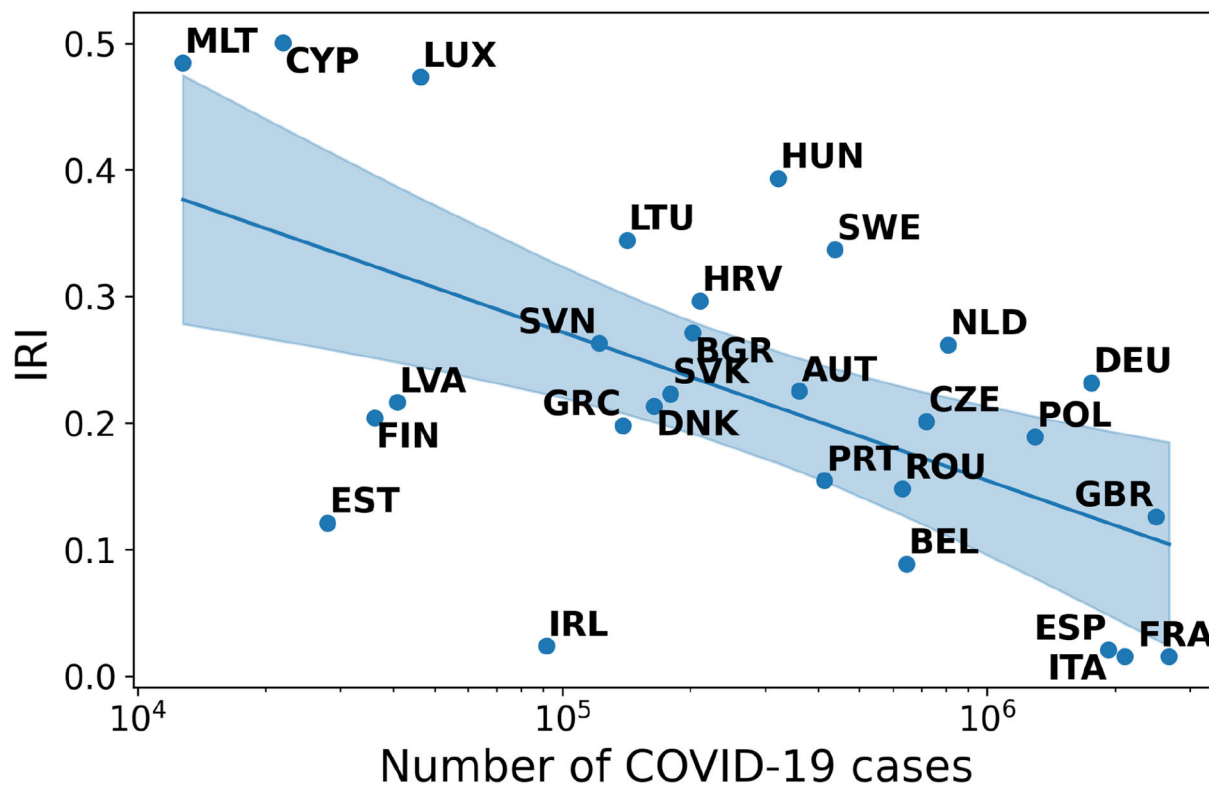


FIGURE 3
Correlation between IRI and number of COVID-19 cases in Europe.

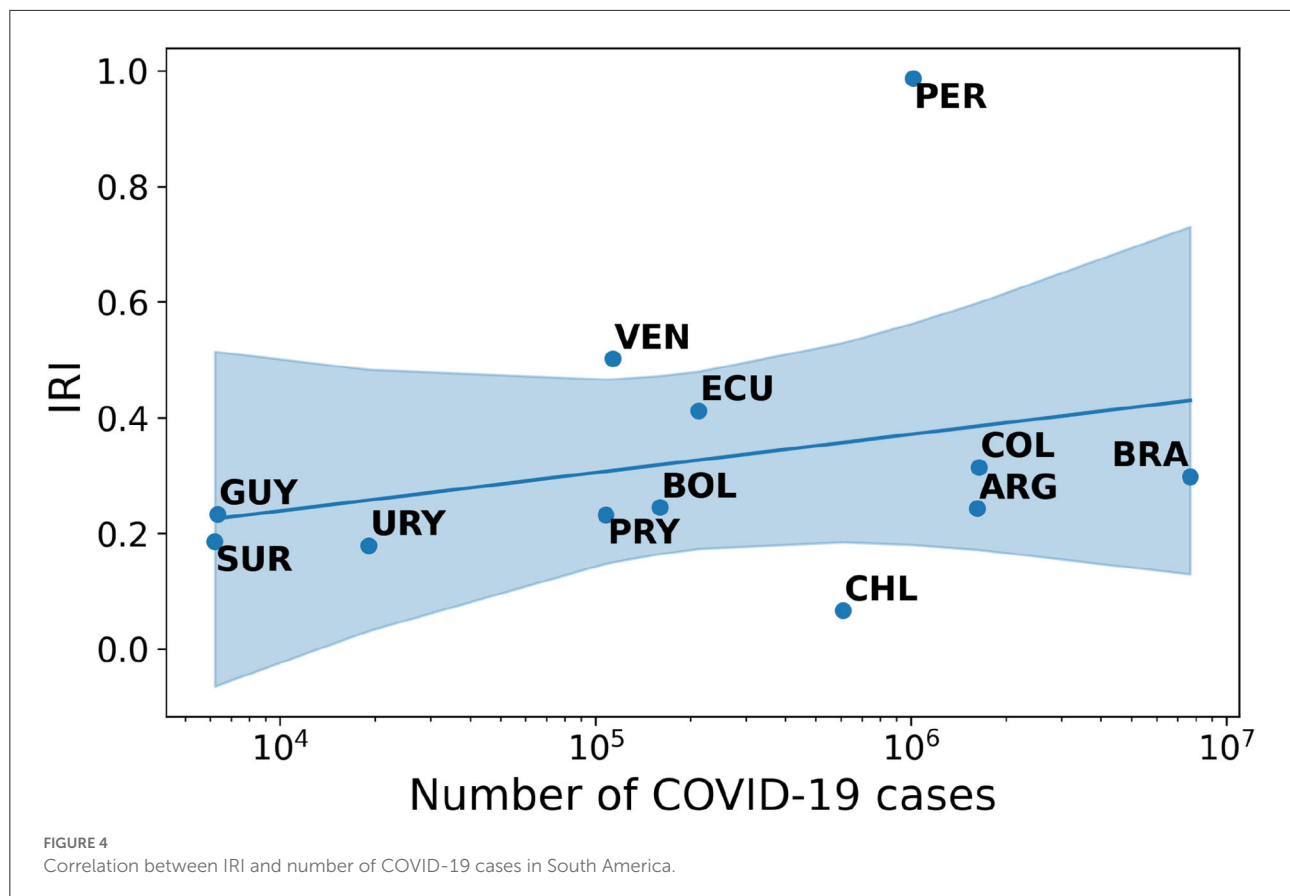
In fact, as suggested by Gelfand et al. (2021), different cultures at national levels may have a big influence upon individual behavioral responses to COVID-19. A second factor relates to the politicization of the COVID-19 topic, and this would explain, for example, the positive correlation trend in South America. Indeed, a direct consequence of information manipulation strategies used by populist leaders, such as Bolsonaro (Ricard and Medeiros, 2020), can reinforce the sharing of misinformation. On the contrary, the bottom-up movements of fact-checking emerged in countries such as South Korea (Chang et al., 2021) could have impacted in its circulation reduction.

To sum up, our findings advance scientific literature on the infodemic in two different and complementary ways. First, as claimed by other empirical measures of Twitter (Yang et al., 2021), our results highlight how the effort on content moderation might have helped to drastically reduce the spread of COVID-19 misinformation. Second, our report supports the idea that when social media users face high health risks these very same users are compelled to search and trust information held by reliable news sources (Nielsen et al., 2020; Altay et al., 2022).

Finally it is important to conclude with a postilla regarding the methodological limitations of our research. As it is well

known, the demographics of Twitter users are biased toward well-educated males (65 percent of Twitter users) between the ages of 18 and 34 (58 per cent of Twitter users, according to Statista GmbH). Our results therefore have to be interpreted keeping such demographic limitations in mind. Another important limitation is the necessarily restricted choice of hashtags which, although carefully designed, inevitably miss those parts of the social media flow that are not tagged according to the most common signifiers. However, it is important to consider that to the current state of knowledge there is no way to build a potentially unbiased, representative sample of the public opinion at the regional, national or global level, and to track its time evolution for relatively long periods. It will however be important to expand these methods to cover several social media at once, whose combined demographics and trend topics allow the coverage of different portions of the public opinion.

Our results are just a first step in understanding the loop between communications and the COVID-19 epidemic. Nevertheless, the recorded decrease for the Infodemic Risk Index as COVID-19 cases rise implies that pandemic-related misinformation can be successfully dealt with and that understanding the social and behavioral mechanisms behind its diffusion are essential building blocks for a successful misinformation curbing strategy.



Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: <https://covid19obs.fbk.eu/#/>.

Author contributions

FP, RG, and PS designed the research and interpreted the results and wrote the brief report. RG collected and analyzed the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsoc.2022.1093354/full#supplementary-material>

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A quintuple helix model for foresight: Analyzing the developments of digital technologies in order to outline possible future scenarios

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The challenge of contemporary society is that of planning possible paths for the future. In the current scenario of hyperconnection, men and technologies and human and artificial intelligence are intertwined in such complex ways as to generate multiple possible futures up to the limit of the capacity of imagination. In particular, it is precisely the frontier of digital and technological changes that obliges social actors and socio-economic institutions to know how to intercept the dynamism of the transformations taking place, supporting the ability to imagine a desirable future, which goes in the intelligent direction of sustainability, of wellbeing and the ethical responsibility of one's actions. In this perspective, the reflection on the so-called future studies is inserted, which becomes a necessity, especially in times of change: If the rhythm of change increases, we need to look further, but future studies are also a philosophy of thought because the future is already part of our present life in the form of anticipation of the future; and this is all the more true as social changes are improvised and systemic complexity increasingly turbulent. Based on these statements, this study aims to analyze how the triple helix model—or rather the quintuple helix model—can be a reference paradigm for social and technological forecasting in a systemic attempt to look at the future of science, digital technology, society, economy, and their interactions, in order to promote social, economic and environmental benefits. From the social perspective, the model could provide guidance to improve the anticipatory profile of organizations and communities, helping to understand—in a short time—what the present actions will be: Predict, discover, and anticipate united in active participation, communication, knowledge, and action become so essential in the processes of production, as in the past it was the accumulation of capital, and also the ethical sensitivity begins to play an increasingly critical role.

KEYWORDS

future, foresight, forecast, digitalization, organizations, quintuple helix model, triple helix

1. Purpose of the study

To face the social, economic, and cultural effects of the pandemic, social and political institutions around the world have been investing all available resources for 2 years and working on the implementation of recovery plans and tools (think Next Generation EU) to overcome the crisis and make the planet greener, more digital, and more resilient.

In this frenetic project of rebirth, there is a greater effort and a greater will to ensure a better future for the next generations; at the same time, however, there also emerges a bitter reflection on the fact that the pandemic has caught us completely unprepared, discovering all our fragility.

We, therefore, need to ask ourselves about the mistakes that have been made so far and the lack of reflection with regard to the consequences of our actions on the environment, the misuse of technology, consumption, and waste.

These questions, and many others, re-propose the need to think about the future in a long-term perspective, picking up the signals and helping to design more resilient policies in the face of systemic shocks: In other words, today more than ever, it is necessary to invest systematically and synergistically in future studies (Arnaldi and Poli, 2012; Poli, 2019, 2020a,b,c).

Future studies become a necessity, especially in times of change (Barbieri Masini, 2012): If the rhythm of change increases, we need to look further (Berger, 1964), but future studies are also a philosophy of thought because the future is already part of our present life in the form of anticipation of the future, and this is all the more true as social changes are improvised and systemic complexity increasingly turbulent (Luhmann, 1990).

Based on these considerations, this study aims to analyze how the triple helix model (Etzkowitz and Leydesdorff, 1995, 1998, 2000, 2001, 2003; Etzkowitz, 2004, 2008; Leydesdorff, 2005, 2006, 2008, 2010, 2013, 2021)—or rather the quintuple helix model (Carayannis and Campbell, 2009, 2010, 2012; Carayannis et al., 2012, 2016)—can be a reference paradigm for social and technological forecasting, in a systemic attempt to look at the future of science, technology, society, the economy, and their interactions in order to promote social, economic, and environmental benefits (Tegart, 2003).

From a social perspective, the model could provide guidance to improve the anticipatory profile of organizations and communities, helping to understand in a short time what the consequences of the present actions will be.

From the point of view of technological application, the challenge is in understanding possible technological developments and in outlining possible economic, social, and market impact scenarios.

In particular, the misuse of technology, the digitization of many living and learning environments, and the collection, management, and analysis of huge data raise many ethical and social issues; concerns about data security and privacy have been highlighted, as well as the more substantive issues about the influence and control that these technologies can have on people's lives. These risks can undermine citizens' confidence in these technologies and in the institutions and companies that use them (Amaturo et al., 2022, p. 636).

The systemic structure of the model, its internal dynamism, the monitoring action, and the feedback mechanism—without which the same general system would disappear, so much so as to talk about *teleonomy of the system* (Paparella, 2014)—are the basic preconditions for talking about foresight spaces and finding stable systemic solutions to very complex situations (Dubois, 2000; Leydesdorff, 2008, 2021). The model thus structured, in short, would help to strengthen the contribution already made by the Science and Technology Studies on the need to apply the paradigm of co-evolution between society, science, and technology: The change, in fact, is never only technical or social but is always socio-technical, that is, resulting from the interaction between the social sphere and the

techno-scientific sphere (thus highlighting the problem of the ethical technology assessment).

An overview, albeit brief, of the impotence of future studies will be offered below, followed by a description of the operation of the triple helix and quintuple helix model, trying to use the model as a possible driver to favor not only spaces of knowledge and innovation but also foresight and in particular technology foresight: The challenge is to systematically organize reflection on possible future scenarios to anticipate or prevent the most impactful consequences from an ethical–social point of view.

2. The importance of thinking about the future

Although the reflection on the future is a constant in human history, the systematic attention toward the study of the same develops starting from the 50s and 60s of the last century, undergoes an interruption with the energy crisis at the beginning of 1970 and relives a new impetus (which still lasts today) in the late 70s and early 80s (Arnaldi and Poli, 2012). With the awakening of attention to this type of study and research, their contribution has been underlined not so much in the prediction of specific events as in the possibility of indicating alternative paths toward the future.

This is an opinion not shared by all scholars but supported instead by the intellectuals of developing countries: The latter believe that thinking about the future is a means of overcoming the present and giving life to a different world closer to one's expectations. It is an approach that leads to making value choices that can be different in each culture (Kothari, 1975).

The complexity of the available alternatives is closely connected to the existence of different values based on different cultures and, consequently, to the presence of divergent worldviews. “[...] The possibility that the future is actually open depends simultaneously on the acceptance of belonging to a culture, including the set of values that characterize it, and the recognition of a plurality of cultures and visions of the future (Barbieri Masini, 1982, 1994)” (Arnaldi and Poli, 2012, p. 14, *my translation*; Facioni, 2019).

As Barbieri Masini (2012, p. 13–22) explained well, thinking about the future responds to three main motivations that continuously intertwine with each other: Thinking about the future is a need, thinking about the future is a choice, and thinking about the future is a way of structuring our way of thinking.

Thinking about the future is a need that makes itself felt, especially in times of great change. Berger (1964), supported “the importance of studying the future using the image of a car launched at great speed: the higher the speed, the farther the headlights must illuminate in order to avoid obstacles” (Barbieri Masini, 2012, p. 14, *my translation*).

Thinking about the future and studying possible futures also corresponds to a choice that every person, or society, must make in the present. Talking about choice means asking questions: Is it right to worry about the future? Should we worry about the consequences of our actions in the future and the impact that predictions about this same future can have on the present? Or, since the future is unknown, is it not better to worry only about the present? Precisely, this last question poses a central problem of reflection on the future: While aware of living in a world resulting from revolutionary changes, we continue to see the future as something essentially similar to the

present. “It is a clear cognitive illusion: *we know* that things have changed enormously, but *we believe* that tomorrow will not be so different from today” (Poli, 2019, p. 7, *my translation*).

Here, we come to the third motivation that the challenge of looking at the future through studies is also that of turning it into a way of thinking that shapes our soul and allows us to give meaning to our lives, our daily actions, and our decisions. Therefore, to overcome that cognitive obstacle which resides in the incapacity of common sense to intercept the future. Thinking about the future and glimpsing today what will happen tomorrow means getting out of the tranquility of repeating the ordinary and accepting to consider other possibilities (Poli, 2019) that are already part of our life in the form of anticipation of the future.¹

2.1. Evolution of future studies

It was 1943 when the German Flechtheim inaugurated future studies with the term *Futurologie*, with the aim of eliminating wars in favor of a peaceful state, stabilizing population growth, eliminating hunger, misery, oppression, and the exploitation of natural resources (Flechtheim, 1943; Poli, 2012).

Berger is another author who deserves to be mentioned and who is considered to have developed the French version of social forecasting: *perspective*. Berger notes that the constant acceleration of technological and social changes weakens any effort to extrapolate forecasts, starting from the analysis of previous situations. His great contribution was to understand the importance, not so much of how to better predict the future as of how to prepare to face an ever-changing world and how to choose the actions capable of leading us toward the objectives we consider most preferable (Cournand and Lévy, 1973). The transition from forecasting in the strict sense to preparing for the challenges of the future shifts the emphasis from the greater or lesser correctness of the forecasts to the ability to face up to new developments and realize the values that are considered significant. Forecasting as an extrapolation from the past is no longer sufficient and is being replaced by the ability to orient oneself in real-time, to choose reference values, and above all, to make proactive decisions aimed at implementing the desired changes. For Berger, the future was hinged on the present.

Another important contribution dates back to the 1960s with the studies of De Jouvenel (1967), who introduces the distinction between *facta*² (*facts*) and *futura* (see text footnote²) (*futures*) and argues that noting that the sciences deal with facts, respect to which information and data can be collected. Anything that has not happened yet, anything in respect of which there is no data to be analyzed, does not fall within the purview of science. In other words,

this means that there is no science of the *futura* and if *facta* are elements of reality, the *futura* is nothing but unreal.

Bell's introduction of the category of “disposition” makes De Jouvenel's distinction between *facta* and *futura* less elementary (Bell, 2003, p. 76). This is a significant step forward because dispositions, unlike the *futura*, do not have the nature of cognitive artifacts, but are real facts: Those facts that could occur if the right circumstances were to occur.

In this sense, then the *futura* becomes a particular type of fact, that is, those facts that are possible even if, at the moment, they are not actual. The dispositions that interest future studies are obviously not so much dispositions of a physical nature but dispositions as the ability to change on the part of individuals, groups, and entire societies. The key to accepting the need to study futures is knowing how to consider these capacities as real, whether they have already been expressed by some effective transformation or are still latent and possibly ready to manifest themselves when the conditions are ripe. Even if not all possible futures have the nature of dispositions, the fundamental step forward made by Bell helps to understand that future, present, and past are linked together, that there are structures that connect them, and that they exist even when they are not explicitly active. Not all of reality is fully unfolded before our eyes; there is also a reality that exists but is not yet operational.³

Among other things, relationships and social events are bound by a series of rhythms of different natures and duration, not only directly social but also physical and biological. Whether visible or not, natural rhythms form the background from which social connections and relationships emerge that also present aspects that vary from the perfectly visible to the totally implicit. The different rhythms do not proceed in isolation from each other but interact in many different ways. Even if we cannot change the physical laws of nature, we are nevertheless able to exploit them to our advantage: When we build a road, a bridge, or when we divert a river, we change nature by using the laws of physics to our advantage; when we select and modify the functioning of fruit trees, we alter nature by using the laws of biology to our advantage, or, at least, we think we do it to our advantage (Poli, 2012, p. 31–32).

In light of what has been previously briefed,⁴ it can be concluded that the three main areas of the theory of the future are as follows: predictions, discoveries, and anticipations. In his aforementioned book *Lavorare con il futuro*⁵ Poli (2019), Poli clearly illustrates the differences between these dimensions (Poli, 2019, p. 11–18). Forecasting activities, in the strict sense, include the use of different types of formal models that provide indications of the progress of certain trends (inflation, the unemployment rate, climate change, etc.). The forecasting models work in light of some possible fundamental assumptions that condition their validity. For their creation, we rely on the behavior of variables considered decisive in the definition of a certain area, which guarantees reasonable forecasting reliability.

The most evident limitations of econometric type forecasts, for example, are represented by the fact that these forecasts work for

1 “This conjunction between knowledge, imagination and will, goals and dreams, is frequently found in the thinking of intellectuals in developing countries. For example Concheiro (1984), inspired by the poets and scientists of the past, believes that society can be described not only through its history, but also through its projects. This way of reasoning and adapting by reflecting on the future, will be necessary for men tomorrow more than today, when they will be forced to live in a world of ever more rapid and interdependent changes” (Barbieri Masini, 2012, p. 15, *my translation*).

2 In Latin language.

3 For more information, see the studies on latents, including Rummel (1975–81) and Bloch (2005).

4 For further information, see Poli (2012, p. 23–35).

5 For the English version see: Working with the future. Ideas and tools to govern uncertainty (2019). Milano: Bocconi University Press.

rather short time windows together with the further constraint which corresponds to what the author calls the principle of continuity: “the idea that the system we are talking about, will continue to function much as it has until now” (Poli, 2012, p. 12, *my translation*).

The same argument can be made for other types of forecasts, such as climate forecasts which instead adopt very long time windows⁶ of up to 100 years; also, in this case, there is a basic assumption that, as before, corresponds to a principle of continuity: It is the constancy taken for granted of the laws of physics.

These first two types of models are both serious, robust, and solid, anchored on sophisticated scientific and methodological knowledge. The problem is that one might also be interested in intermediate time windows and discontinuities, surprises, and novelties.

When dealing with intermediate windows and changes (but also with qualitative data and unreliable information), it is necessary to take a different perspective.

This is how we go from prediction to discovery.

Understanding the distinction between futures in the singular and futures in the plural is the first step in understanding how predictions and discoveries differ. First of all, it is necessary to start from the awareness that something can always be done to try to understand how events could develop; it is possible to discover some possible futures that help keep in mind different ways in which reality could be articulated. Central in this circumstance is, therefore, the passage from the singular of future (almost as if it were our only possibility before us) to the plural of future (things can go in different ways, if we see them, we can try to prepare ourselves and not get overwhelmed from the news).

The moment we move from an implicit idea of the future to an explicit idea of the future, the value of the same discovery emerges: Seeing the ways in which situations can evolve allows us to try to prepare ourselves, but the clarification of the possible futures linked to their discovery also has a clear ethical relevance: If social actors, institutions, and organizations see what could happen, they cannot then avoid taking responsibility for what they will or will not do.

In summary, the difference between forecasting and discovery lies in the constructive modality adopted to make futures explicit: In the case of forecasting, *futures* are constructed as repetitions of past experiences, while in the case of discovery, futures also contain authentic innovations and discontinuities (Derbyshire and Wright, 2017; Tuomi, 2019). The third dimension of future theory concerns the question of how to translate models into decisions and actions. This node is very critical as a future exercise that does not translate into practice is a failed exercise. Therefore, translation into action is not incidental.

The anticipation consists of two elements: A modern one and its translation into action. Forecasts are nothing more than a model and only tell us what could happen; seeing what might happen and changing one's behavior accordingly is a case of anticipated activity. Certainly, the best-known definition of anticipation is the

one proposed by Rosen (1985), according to which an anticipating system is a system that contains a predictive model of itself and/or its environment, in such a way as to be able to take his decisions in the present moment in light of the prediction that something could possibly happen in the future.

Anticipatory behavior is more robust than reactive behavior. Reactive strategies are often expensive and inefficient (consider all the costs incurred to stem the COVID-19 pandemic⁷). Therefore, every single actor and even more every single economic, political and cultural organization needs to reflect and understand that there are many different ways of anticipating because it is necessary to find from time to time the most suitable ones for one's situation, understanding the cognitive and social constraints that filter and condition the translation into action of a model.

In all types of reality, the phenomenon of anticipation is widespread. All varieties of life have an anticipatory character: society and its structures are anticipatory; the brain and the mind work in advance, and even some of the non-living and non-biological systems can be anticipatory. For this reason, studies on anticipation have been carried out in numerous disciplines ranging from philosophy, physics, biology, psychology, semiotics, and social sciences. With particular reference to the latter, it should be remembered that Schütz (1960) developed applied phenomenological optics to the social sciences. For the Austrian scholar, we do not live simultaneously in different contexts of meaning: the thematic system, the interpretative one, and the motivational one. Due to the way the motivational system works, actions are typically structured by two kinds of opposition: that between my actions and the actions of others and that between future and past actions. Future actions are interpreted according to the key “in order to”, while past ones are understood according to the key “because of”. The former are elements that shape the action from within, while the latter requires reflexive acts on actions already carried out.

Riegler (2003) and Leydesdorff (2008, 2021) (the latter, together with Etzkowitz, developed the triple helix model) have applied the idea of anticipation to social systems. Actions are always elements of larger projects which in turn draw on different reservoirs of knowledge. One of the most familiar components of knowledge is the reservoir of typical expectations, which can become actual under typical circumstances and predetermine typical actions.

Social systems often try to cope with a new situation by replacing its details with familiar activities and behavioral structures that show a high degree of predictability, to try to keep the situation under control, to be able to anticipate its outcome; in this sense, therefore, even new experiences can be familiar with respect to their typology.

In the last 30–40 years, important experimental data have demonstrated that all the axioms of the expected utility theory have been violated by real subjects in experimentally controlled situations (Berthoz, 2004). Agents are not ideal or idealized decision-makers but, on the contrary, real agents who can make mistakes, for many reasons: social pressure, the tendency to agree with others, the influence exerted by hierarchical structures, the role of emotions, the desire to be right, the way problems are represented.

⁶ The point is that the nature of the window does not depend only on the technical properties of the model but also on the phenomenon being observed. What is needed is a window long enough to bring out significant changes: A shorter window fails to bring out the changes underway, and one that is too long overlaps the risk of confusing different cycles of change.

⁷ In the text *Incertezza, futuro, narrazione* (2020), the author Emiliana Mangone addresses some issues that emerged in an emergency form with the COVID-19 pandemic, such as the perception of risk and the future, communication and storytelling, responsibility, etc. (Mangone, 2020).

All this suggests the importance of updating programs on how to make decisions, especially if these concern education, the economy, digitization, and investment in technology.

2.2. Technological choices and anticipation

Technological forecasting has experienced real global flourishing in recent decades. If in the 50s and 60s of the last century, this type of forecasting activity found its fundamental justification in need of the Defense Industry and had its main promoter in the Rand Corporation; starting from the 70s, it is the economic sector and justifying and stimulating the implementation of forecasting activities, in support of industrial planning (Arnaldi, 2012).

Today the techniques of anticipation that have science and technology as their object are promoted to respond to some trends of growing importance that characterize the global economic vision. In contrast, the increase in competitive pressure on organizations and territories, the growing budget constraints which limit public expenditure, the consequent need for a more efficient allocation, the public dimension of science, the ethical consequences of the application of technology or the excess of digitization (Martini and Vespasiano, 2017); all this makes scientific knowledge and technological developments the subject of debate and criticism. Conversely, the elaboration of policies must take into account the increase in the complexity of decisions caused both by factors of a general scope such as the interaction between systemic levels, the diversification of the actors involved in the elaboration and implementation of policies, and by specific characteristics of different technical-scientific fields, such as the integration between different technologies and the emergence of multi- and inter-disciplinary scientific fields (Martin, 1995; UNIDO, 1999; Tegart, 2003), the interdependence and existing trade-offs between different policies, the pervasiveness of technology in all areas of human life (Grupp and Linstone, 1999), the danger of the so-called technological singularity, that is, that point where technological progress accelerates so much as to overcome the ability to understand, control, and predict typical of humans (Kurzweil, 2005).

All these issues highlight how over time, there has been a gradual loss of centrality of the technical dimension in favor of increased attention to the context, understood in the broadest sense, of innovation. For some time now, the term *Future-Oriented Technology Analysis* has identified and summarized this change and the broadening of the horizon (Cagnin and Keenan, 2008).

Based on the considerations just expressed, the following pages will be devoted to the analysis of the triple helix model (as a driver of socialization of innovation and knowledge). We will then pause to analyze how the same model, in its extension to five helices, can stand as a candidate for supporting change and broadening horizons, favoring the creation of an increasingly *Future-oriented Technological Analysis*, demonstrating the importance of future studies and the ways in which we can develop the information needed to shape it.

3. A space of knowledge and foresight: The triple helix model

“The research and innovation system has undergone profound changes of an organizational, sociological, and managerial nature

over the last century, particularly in the most industrialized countries, finding itself interacting more and more strongly to promote knowledge and economic development. The academy, not always voluntarily, has progressively permeated itself with values, organizational models, and social roles typical of the entrepreneurial and financial system, becoming a key element in innovation policies all over the world, both as a source of new technologies for start-ups and existing industries (Etzkowitz, 2008)” (Martini and De Luca Picione, 2022, p. 438). For its part, the industrial system has also re-evaluated the importance of the university, rediscovering the need to recover the leverage of academic research and the R&D sector to promote innovation and competitiveness after years in which the cost of labor, the protection of the markets or the weakness of the currency, have unfortunately represented much more effective levers of competitiveness (Calderini, 2005).

Furthermore, it is argued that the “complex relationship between the organization of knowledge and technology could be better addressed with a federal approach, that is, with the decentralization of power to universities and research centers, thereby strengthening the possibility of an evolutionary self-organization from below” (Viale, 2001, p. 58, *my translation*). As Etzkowitz says, “this involves carrying out continuous experiments on the relationship between science, industry and government, in order to find the right fields of application for the innovations of the future: the Endless Frontier model is gradually replaced by that of the Endless Transition” (Etzkowitz, 2008).

The environmental and selective constraints of the global market, in contrast, and the implications deriving from the generation of new technological and digital knowledge on the other, have increased the effect of calling for an integration between the three actors of the university, the enterprise, and of the government.

In fact, the initially bilateral relations between government and business and between university and business have transformed over time into trilateral relations of the university–business–government type, thus creating the emergence of a three-vector development model.

This relational mechanism is useful for triggering and sustaining development dynamics based on innovation and technical progress, better known as the sociological metaphor of the triple helix model (developed for the first time by Etzkowitz and Leydesdorff, 1995, 1998, 2000, 2001, 2003); moreover, it wants to be the sociological expression of a new socio-economic-political order based more and more on knowledge.

As Luhmann would say, the “social-world system” becomes more and more complex than the biological one, and just two helices are no longer enough, but the need arises to involve other actors: The latent presence of a third dimension can reduce the related uncertainty to the interaction of the first two actors.

This new model has the same elementary actors of the Sabato triangle (Hatakeyama and Ruppel, 2004) and of the National Innovation Systems (Freeman, 1987, 1995; Lundvall, 1992, 1998) but foresees a different dynamic of relations between them. In fact, the actors here are not static—since they are continually in a state of transition—and the succession of interrelations develops according to a spiral model that presents different types of relations between the

public sector, the private sector, and the university, depending on the level of capitalization of knowledge.

In other words, the supporters of the triple helix highlight that the relationships that were valid in the past between government, industry, and universities are still valid today, but with the formulation of a new institutional model characterized by the presence of specific groups, who meet and confront each other to solve the new problems posed by economic and social changes and which could give a significant boost to the study of social and technological forecasting, in order to be able to anticipate its consequences in social, economic, and ethical terms.

The evolution of this model is through three phases, as shown in Figure 1. The premature version of the triple helix (I) can be displayed with three independent circles connected by dashed lines. The three spheres are defined as communication subsystems that interact through market operations, technological innovation, national governments, and related interfaces.

In a more developed version of the triple helix (II), the three independent circles are connected by solid lines, representing intermediary organizations such as technology transfer offices or legal offices. In this study, the three spheres are institutionally defined and maintain a certain autonomy but interact through strong, well-defined boundaries.

The advanced version of the triple helix (III) appears in the shape of three overlapping circles with the internal communicative core, represented by a small circle superimposed on the three intersecting circles. The three institutional spheres, in addition to carrying out their traditional functions, also assume the role and perspective of the others (think of universities that can play quasi-governmental roles as local organizers of innovations).

“In the Triple Helix (IIIa) configuration the three helices share a common ground indicated by *i*. Under certain conditions, however, this overlap can also become negative. This eventuality is represented in the Triple Helix (IIIb) configuration, where the center becomes a cavity that can be considered as a negative entropy within the system. This system works, over time (*t*), in terms of different communications with respect to its interfaces. When all the interfaces communicate, we can suppose the birth of a hyper-cycle that integrates the systems in a differentiated way. Integration is not unique because there is no center where it can develop; this is why, in this situation, properties of autopoiesis, selection and re-differentiation will be necessary” (Leydesdorff, 2006, p. 402, 403).⁸

On a more in-depth reading dimension, the model also postulates that “the triple helix circulation occurs on macro and micro levels. Macro circulation moves among the helices while micro circulation takes place within a particular helix. The former creates collaboration policies, projects, and networks while the latter consists of the outputs of individual helices. Lateral social mobility, the introduction of expertise from one social sphere to another, can

8 Relationships between subjects trigger a spiral of development, the dynamics of which imply a “vertical evolution and horizontal circulation”. “The extension of bilateral university-industry relations to trilateral university-industry-government relations was essential, since the model of a hypercycle is only meaningful in the case of three (or more) subdynamics. The hypercycle provides a metaphor for the supra-individual dynamics that give intersubjective meaning to the meanings provided by the carrying cycles. In other words, the emerging next-order-level ‘overlay’ can contain a meta-representation of the individual representations and their interactions. This meta-representation in the hypercycle feeds back as a regime on the underlying dynamics which evolve historically along trajectories” (Leydesdorff, 2021, p. 23–24).

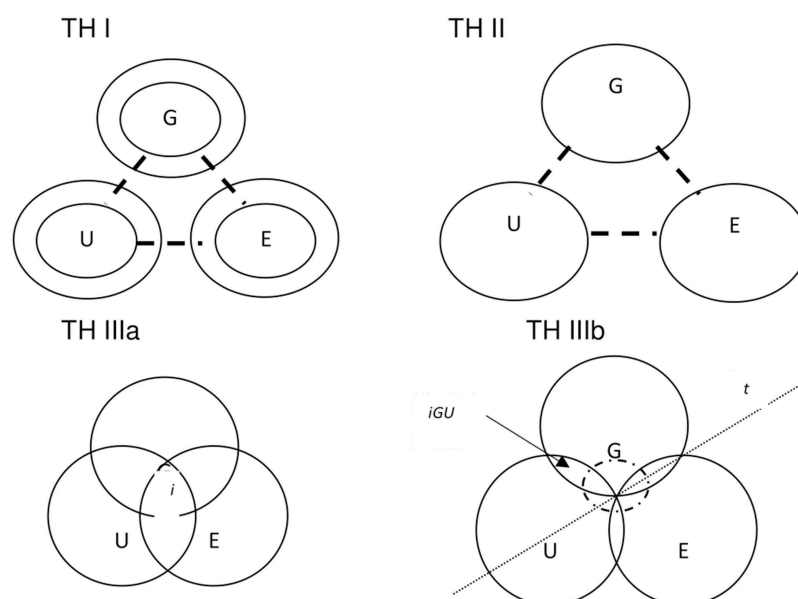


FIGURE 1

Evolution of triple helix model (TH I, TH II, TH III). Source: Our elaboration by Etzkowitz (2008) and Leydesdorff (2008). G, government; E, enterprise; U, university; i, common ground; t, time line.

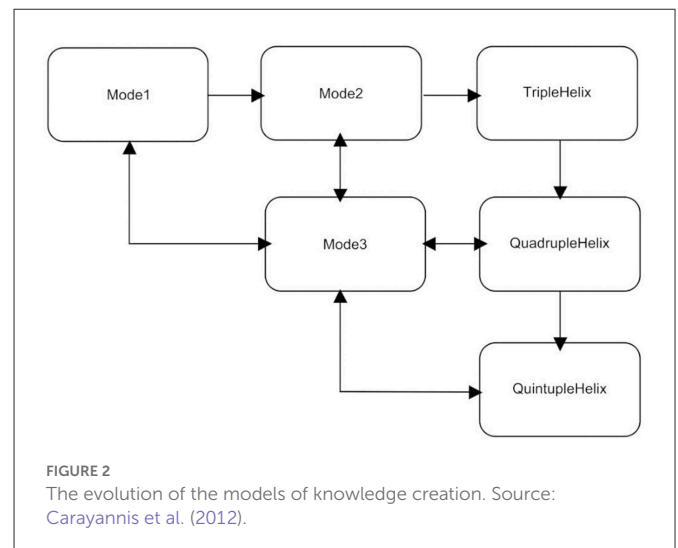
stimulate hybridation invention and innovative of new social formats. Horizontal circulation is thus more likely to have a radicalizing effect than vertical circulation with its inherent conservative bias. Vertical circulation occurs through upward movement of individuals within an institutional sphere typically through recruitment of new persons of talent from lower strata, revivifying an elite” (Etzkowitz, 2008, p. 21).

More specifically, “the actors represent the micro level, within which the evolutionary characteristics of the model are clearly visible. The performances of the actors bring together roles and models that involve various and different cultures, previously separated: university researchers become entrepreneurs of their own technologies; entrepreneurs work within universities and related technology transfer offices; public researchers invest their time working within industries; industrial and university researchers manage regional agencies responsible for technology transfer. The meso level is represented by the institutions: it is that level that organizes production and makes use of technological knowledge. It can be divided into three sub-categories: hybrid innovation agents (high-tech spin-offs, venture capital); the innovation interfaces between businesses and research; the innovation coordinators, responsible for the coordination and management of the various phases of the innovative activity. Finally, the rules represent the macro level, which essentially has the function of guiding political incentives: the actors will make decisions in compliance with the regulatory framework and the tax incentives already available (think of the legislation on property rights)” (Viale and Ghiglione, 1998, p. 3; Martini and De Luca Picione, 2022, p. 440).

4. The quintuple helix model: Paradigm of future studies and digital technology foresight

As stated in Martini and Vespasiano (2015, p. 79–85), knowledge represents the key to success in sustainable development. In other words, it is increasingly convinced that nation-states that focus on the progress of society, on greater competitiveness of the economy, and on a better and sustainable quality of life, must apply the resource of knowledge. In this way, the knowledge resource is transformed into the “most fundamental resource” (Lundvall, 1992, p. 1), with the quality of a “knowledge nugget” (Carayannis and Formica, 2006, p. 152). Knowledge, as a resource, is created through creative processes, combinations, and productions in so-called “models of knowledge” or “models of innovation” and thus becomes available to society: “we can also call it the creativity of knowledge creation” (Carayannis and Campbell, 2010, p. 48). Typically, innovation models do not include an end-to-end view. Most of the innovation policy is focused on the ability to innovate and on input factors such as R&D investment, scientific institutions, human resources, and capital. Such inputs often act as a proxy for innovativeness and correlate with intermediate outputs such as patent counts and outcomes such as per capita GDP. While this type of analysis is generally indicative of innovative behavior, it is less useful in terms of discriminatory causation and what drives successful strategy or public policy interventions (Yawson, 2009).

This situation has led to the development of new frameworks for the innovation system, and we want to refer here specifically to the six currently existing models of knowledge creation and innovation



creativity (Figure 2 and Carayannis and Campbell, 2012; p. 13–28; Carayannis et al., 2012, p. 2–3; Carayannis et al., 2016).

The previous models developed for measuring innovation are many and varied; they are linear in nature and neglect the interrelationships between the various indicators and metrics. Science investigations are often articulated in an input–output framework: Inputs are invested in research activities that produce outputs. This framework is purely an accounting framework based on the expected economic benefits of science. Indeed, most of the existing methodologies for measuring innovation are driven by research and practice in the fields of accounting, economics, human resource management, intellectual property, etc. All previous revisions of these models have focused on company-level analysis with an accounting, economic or strategic lens, and most of these models have not been applied directly to the assessment of national innovation systems. However, many empirical research studies and institutional policy frameworks refer to the key elements of these models in their conceptualization. However, the main gap identified in the literature with these new national innovation policy portfolios is the linear nature of the presentation, just like previous innovation models.

The “core model” is the triple helix which is a valid socio-economic mechanism, where the relational networks (enterprises–universities–governments) get together to produce social values from knowledge. The analytical examination of this model shows that the critical point is the quality of the social capital nets, starting point to set up, sustain and manage the triangulation we are discussing. The triple helix governance, while pushing the communication and the relationships among the territorial actors, favors the forms of collective learning and facilitates the economic and cultural exchanges necessary for the development and social inclusion. The dynamics of the triple helix want to promote an innovative atmosphere, encouraged by all actors (Leydesdorff, 2005): In fact, every actor assumes roles and tasks uninterruptedly, reformulating the agreements with the others. At the same time, these interrelations are also realized inside every single actor, reformulating continuously structures, characteristics, and objectives.

As we have already seen, “in the dynamics of the Triple Helix the role of socialization is very important; in other words, we emphasize the importance of social capital networks. In fact, social capital

facilitates the diffusion of a climate of trust and this collaboration makes learning (individual and organizational) simpler and more effective, which in turn generates intellectual capital, innovation, and competitiveness. An elevated intellectual capital could create greater job opportunities, to decrease unemployment rates, and favor social inclusion (Livraghi, 2003, p. 108). A greater active participation of all the members of society to the productive processes, a smaller social exclusion could favor the formation of social capital, revitalizing and recomposing internal relational dynamics to the circuit of the Triple Helix. From there it comes a virtuous circle of development and social well-being" (Martini and Vespasiano, 2011, p. 179).

However, the triple helix model cannot be considered a closed model to apply to the perfection of any local context: It demands continuous territorial adjustments and integrations because every context has its net of the relations—weak and strong—that give form and substance to the relative social capital.

As Bagnasco (2006) explained, it is a sociological problem: The territories are various, the social, cultural, and economic pre-existence are ballast to the development programs and their various abilities to create nets of social capital, and institutionalized confidence can be powerful motors in order to accelerate the realization of development programs.

These reasons have led other authors to adopt new perspectives, imagining and proposing models of N-tuple helixes: In addition to the three helixes—government, business, and university—they have also included the helix of (public) civil society and the helix of the natural environment.

In this way, the triple helix model was first transformed into a quadruple model through a public subsystem based on media and culture (Carayannis and Campbell, 2010; De Oliveira Monteiro and Carayannis, 2017). The purpose of this extension is to include the public and civil society as a fourth subsystem. Media-based audiences support not only the dissemination of knowledge but also the dissemination of culture with its values, experiences, traditions, and visions for the promotion of the knowledge society (Carayannis and Campbell, 2009, p. 217–227).

The quintuple helix finally stresses the socio-ecological perspective of the natural environments of society. Social ecology focuses on the interaction, co-development, and co-evolution of society, and nature. The goal of the quintuple helix is to include the natural environment as a new subsystem for knowledge and innovation so that “nature” becomes established as a central and equivalent component *of* and *for* knowledge production and innovation. “The natural environment for the process of knowledge production, and the creation of a new innovation is particularly important because it serves for the preservation, survival, and vitalization of humanity, and the possible making of new green technologies; and humankind, after all, should learn more from nature (especially in times of climate change)” (Carayannis et al., 2012, p. 5).

To analyze sustainability in a quintuple helix and to make sustainable development determination for progress, therefore, means that each of the five described helices has a special and necessary asset at its disposal, with a social (societal) and academic (scientific) relevance for use as follows:

(a) The education system (U): This first subsystem defines itself in reference to “academia,” “universities,” “higher education systems,” and schools. In this helix, the necessary “human

capital” of a state is formed by the diffusion and research of knowledge;

(b) The economic system (I): As the second subsystem, this consists of “industry/industries and focuses,” “firms,” services, and banks. This helix concentrates on the “economic capital” of a state;

(c) The natural environment (E): It is the third subsystem, and it is decisive for sustainable development and provides people with a “natural capital”;

(d) The media-based and culture-based public (P): The fourth subsystem integrates and combines two forms of “capital”. On the one hand, this helix has, through the culture-based public (tradition, values, etc.), a “social capital”. On the other hand, the helix of the media-based public (television, the internet, newspapers, etc.) also contains “capital of information” (news, communication, and social networks);

(e) The political system (G): This is the fifth subsystem that is also of crucial importance because it formulates the “will”, where the state is heading in the present and future, thereby also defining, organizing as well as administering the general conditions of the state. Therefore, this helix has a “political and legal capital” (ideas, laws, plans, politicians, etc.) (see Carayannis et al., 2012, p. 5–6).

A system with five helixes is not linear; it is a web of interrelationships, different systems, niches, and paths that come together to sustain life. This new model extends the traditional linear chain model to the innovation process and broadens it to incorporate all aspects of society, academia, government, industry, public, and natural environment, thus creating a comprehensive National Ecological System of Innovation.

With this new framework, the focus remains on the organizational level, metrics, and measurement tools. To fully understand the innovation process, it is important to focus on interaction and relationships. People, organizations, and knowledge institutions rarely innovate alone, and innovation emanates from cumulative processes of interactive learning and research.

This means that the system must simultaneously refer to its elements and the relationships between these elements. Relationships may be seen as carriers of knowledge and interaction as processes in which new knowledge is produced and disseminated.

The key issue facing many organizations face is how they can promote effective innovation using organizational support mechanisms. A theoretical integration is needed to link organizational context with innovation and to consider strategic future orientation as an important action parameter for decisions about innovation and change. For these reasons

1. Organizations play the most important role in the innovation system;
2. Organizations innovate in interaction with other organizations and with the knowledge infrastructure;
3. The ways organizations innovate and learn reflect national innovation systems; and
4. Organizations belonging to different sectors contribute differently to innovation processes.

Based on these statements, the thesis that arises here is how the quintuple helix model can be a paradigm of future studies and technology foresight in the systemic attempt to observe the future

of science, technology, society, economy, and their interactions in order to promote social, economic, and environmental benefits. From a social perspective, the model could provide guidance to improve the anticipatory profile of organizations and communities, helping to understand in a short time what the consequences of the present actions will be. From the point of view of technological application, the challenge is in understanding possible technological developments and in outlining possible economic, social, and market impact scenarios. In particular, the misuse of technology, the digitization of many living and learning environments, and the collection, management, and analysis of huge data raise many ethical and social issues; concerns about data security and privacy have been highlighted, as well as the more substantive issues about the influence and control that these technologies can have on people's lives. These risks can undermine citizens' confidence in these technologies and in the institutions and companies that use them (Amaturo et al., 2022, p. 636).

To support our thesis, some considerations concerning the defining aspects of this field of investigation are necessary.

It may be useful to start between technological forecasting and technology foresight, considering the following as the most representative:

1. Technological forecasting is the probabilistic estimate of future technological transfers and their consequences in the various technological and non-technological fields (Jantsch, 1967);
2. Technology forecasting concerns the creation of new technologies and the incremental and/or discontinuous change in existing technologies (Porter et al., 1991); and
3. Technology forecasting has been defined as a process of data collection and analysis aimed at predicting the future characteristics of useful techniques, machines, and procedures (Shillito and De Marle, 1992).

As Arnaldi (2012, p. 122–123) explains, reading these three definitions allows us to highlight some main characteristics of technological forecasting, such as the centrality of dynamics within the technical–scientific field in terms of the creation and transformation of technical devices and systems; the importance of assessing the economic, political, and social consequences of new technologies and their diffusion; the formalization of predictions relating to science and technology, to be understood in terms of probabilistic statements relating to the future, with a relatively high level of confidence.

These characteristics highlight two aspects related to technological forecasting. The first tells us how the relationship between scientific progress and technological development, in contrast, and society, on the other, remains anchored to an idea of the social impact of technology whose development is mainly traced back to internal dynamics of the techno-scientific sphere and its impacts are largely understood according to the essentially technology-driven vision; in many analyses of technology transfer, many aspects that are not directly internal (such as environment, social systems, and society) are defined in terms of consequences of technology transfer and not considered *a priori*.

Furthermore, traditional forecasting has the ambition to anticipate the most probable evolutionary paths of technologies and

their impacts, assuming that this possible future can be connected in a linear way to the present. Otherwise, foresight attempts to overcome the typical rigidities of conventional forecasting and, therefore, constitutes an important evolution of technological forecasting. Some more recurring definitions of foresight tell us that:

1. It has been defined as the systematic attempt to observe the future of science, technology, economy, and society in an attempt to promote social, economic, and environmental benefits (Tegart, 2003);
2. It is the systematic process aimed at exploring the future in science, technology, and the economy of society in order to identify strategic areas for research and enabling technologies that offer the greatest probability of producing the greatest economic and social benefit (Martin, 1995); and
3. It is a process aimed at a better understanding of the forces that shape the long-term future that should be considered in policymaking, planning, and decision-making (Martin, 2010).

At this point, the characteristics that distinguish technology foresight from technological forecasting appear clearer. First, the process dimension of forecasting is emphasized: Not so much the formulation of a probabilistic statement as a learning process related to the future constitutes the heart of the foresight approach.

Second, foresight does not aim to anticipate evolutionary courses that are more probable but tries to systematically explore the alternative futures that emerge from the different possible configurations of factors and choices in the present. Finally, “this connection between anticipation and decision together with the recognition of the complexity of the interactions between different technical-scientific and social spheres justifies an effort of consultation and interaction between the scientific community, users of the innovation and decision-makers, both for cognitive purposes - through the use of interactive and participatory methods to produce anticipations - and of mobilization - to encourage the construction of new social networks capable of operating according to the identified visions and making the choices envisaged” (Arnaldi, 2012, p. 124, *my translation*).

Hence, then, the opportunity to translate these observations into the quintuple helix model, as follows (Figure 3):

The systemic structure of the model, its internal dynamism, the monitoring action, and the feedback mechanism—without which the same general system is missing, so much so that it speaks of the *teleonomy of the system* (Paparella, 2014)—constitute the fundamental prerequisites for talking about spaces of foresight, to find stable systemic solutions to very complex situations (Dubois, 2000; Leydesdorff, 2008, 2021) and to implement *Future-Oriented Technology Analysis* (FTA).

In particular, we can expand the roles and functions of the previously identified helices as follows:

1. University (U): Develop new methodologies to reduce uncertainty in prospective; develop social foresight but also technological forecasting and technology foresight approaches;

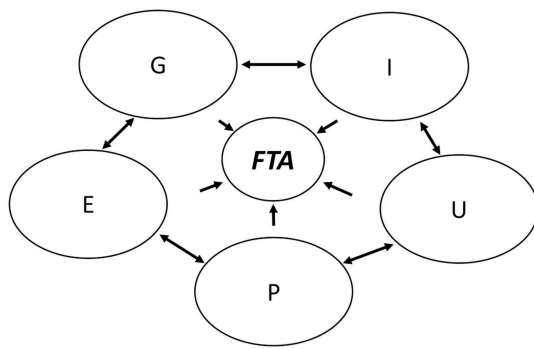


FIGURE 3

A quintuple helix model for foresight. Source: author's calculation. G, the political system; U, the education system; I, the economic system; P, the media-based and culture-based public; E, the natural environment; FTA, future-oriented technology analysis.

2. Government (G): Make science and innovation policy more rigorous, transparent, and scalable; develop a technology assessment (TA) that is an analytic and democratic practice that aims to contribute to the formation of public and political opinion on societal consequences of science and technology;
3. Industries (I): Establish better connections and communications in order to accelerate innovations based on academic research; the public reaction and adoption matrix of innovative products should be useful in designing pathways for future innovation in products/processes (technology foresight);
4. Public (P): Highlight new bottom-up discoveries and innovations that improve social welfare, for example, eco-innovation; in addition, the media-based public supports not only the diffusion of knowledge in a state but also the culture-based public with its values, experience, traditions, and visions, which promotes knowledge; and
5. Environment (E): For the process of knowledge production, foresight on the natural environment is particularly important because it serves for the preservation, survival, and vitalization of humanity and the possible making of new green technologies (Chouaibi et al., 2022).

In this new configuration, the importance of TA should be underlined which is never just a tool or a specific type of policy analysis but is also part of the technology management policy in society, so much so that under the broad umbrella of TA there are also activities that go beyond simple analysis and instead structure part of the processes (Schot and Rip, 1996).

The recognition of the complex interactions between technology and society has meant that the object of the evaluation activities has changed over time, passing from the centrality of the technological element, of a specific technology, of a group of technologies to later problems related to the whole context of innovation. "The integration with the institutional processes of technical-scientific decision, the emphasis on the social context of technological innovation, the adoption of a more sophisticated

vision of the relations between technology, science and society have supported the progressive distancing of the TA from its traditional expert-based version, toward a greater involvement of stakeholders and the public in the evaluation process. Definitions such as participatory TA, constructive TA, interactive TA share the idea of influencing the innovation process by promoting the action of citizens and stakeholders in the technological decision and including from the beginning the social aspects in the design of the technology thanks to an interaction timely with users, suppliers and various interested public" (Arnaldi, 2012, p. 126, my translation).

If foresight has always been understood as a tool to support national innovation systems, today TA is also increasingly oriented toward seizing the opportunities of future technological developments rather than preventing their undesirable effects.

But in any case, foresight and TA respond to the same questions and the same social needs and there is no reason not to believe that the typical sociability of the interaction space between development actors (helices) can translate into a vast field of anticipatory analysis of technology, that is to say, a *Future-oriented Technology Analysis* (FTA) based on knowledge, consensus and innovation spaces with some specific goals:

1. Orientation to the future without considering it predetermined;
2. The participation and enhancement of a plurality of actors;
3. In-depth knowledge of the phenomena, which also allows us to evaluate the consequences of the chosen paths;
4. Multidisciplinarity, for understanding the social and technical systemic complexity; and
5. The orientation to action: from forecasting based on historical data to a vision capable of anticipating changes.

5. Conclusions: Research limitations/implications

The great advantage of a multi-helix model is that it makes sociability possible (Simmel, 1983) which, as Ardigò recalls, is "a sort of cunning of reason that pushes humans to open up to others, to continuously intertwine reciprocal actions and communications" (Ardigò, 1988, p. 46, my translation).

Sociability makes the creation of a virtuous circle of development and social wellbeing possible: "facilitating the spread of a climate of trust and collaboration makes easier to create new collaborative forms for the socialization of knowledge, intelligence and technology transfer processes typical of a territory, with the natural consequence of foreseeing possible future scenarios and having a significant impact on the processes of generation and accumulation of intellectual capital, innovation and competitiveness. This type of relational governance favors collective learning forms and to make easier the economic and cultural exchanges necessary to the development and the social inclusion" (Martini, 2011, p. 137, my translation). However, there are also critical observations. If from a theoretical perspective, the not-centric dimension is guaranteed, the situation is the opposite in a practice plan. It is possible to say that the university covers an important detail in the model: It is considered the main source of production of scientific knowledge, and it has enormous responsibilities in terms of the spread and circulation of knowledge.

In this way, the university transfigures itself toward a model that is defined Hybrid University (Etzkowitz and Leydesdorff, 2001), assuming entrepreneurial nature and strengthening the relationship with the system of the enterprises: So that the third mission of the university is to contribute to economic development and social wellbeing, through technology transfer processes but above all through social and technological forecasting approaches (Etzkowitz, 2004; Etzkowitz and Viale, 2010).

If this is true, the technology forecasting policy could be considered the tool to promote sustainable and ethically responsible social construction processes of knowledge and innovation.

However, the technological transfer can represent a tool of application of the triple helix when in the generation of an innovative enterprise (product, service, process) technical–scientific feasibility; economic–financial feasibility, and government financial support are realized at the same time, that is with the active presence of scientific talents, managerial competences, and financial support.

For these reasons, it is important to observe the technological transfer and technology forecasting from a sociological point of view, and this finds an obvious justification in the growing attention that social dynamics are assuming in the possibilities of scientific production and technological application. Cultural, organizational, and economic differences require the ability to establish relationships between partners based on the need to imagine scenarios and consequences of actions, on the perception of fairness in exchanges, on the goal of generating a mutual profit and, therefore, useful to all parties involved. “In fact, is now famous the tendency of the research to develop itself through the involvement of more and more complex nets of actors. These favor the processes of innovation and valorization of the existing social and scientific relations, and that support the formations of new relations among subjects not gotten used to enter relationship among them. To this is joined that the network organizational system favors the sharing and the transfer of scientific and technological knowledge and concurs a more effective trade exploitation of the scientific discoveries and a wider spreading of the research output” (Martini and De Luca Picione, 2022, p. 443).

In this perspective, the role of a fourth and a fifth actor is inserted: the public and the natural environment. In their comparisons is necessary to reflect on the problem of the credibility of what to transfer, on the quality ethics of the involved actors, on the sustainability (environmental, social, and economic) of the modalities with which it is moved and, therefore, on the format to use in order to lead to good outcome the innovative communication. The convictions of Leydesdorff and Etzkowitz reside in the fact that the triple helix model was repeatedly subjected to ‘experiments’: with the aid of “relevant data” they demonstrate the success or otherwise of the applicability of the model in one or more local contexts. They are not opposed *a priori* to N-tuples evolution, but they require effort to demonstrate how society and nature can initiate and support models of the quintuple helix.

In a discussion that focused on bringing “society” or “the public” back into the model as a fourth helix, Etzkowitz and Leydesdorff (2003) argued that the helices represent specialization and codification in function systems that evolve from and within civil society. As Leydesdorff (2013) recalls, a multifaceted society

is no longer coordinated by a central nucleus but functions in terms of interactions between variously coded communications. Money, for example, can be considered an excellent example of a symbolically generalized means of communication (Parsons, 1968): It allows us to pay without having to negotiate the price of a commodity. Power, truth, trust, and affection are other “performative” media (Luhmann, 1995). Therefore, in a knowledge-based economy, one should not only optimize the conservation of “wealth from knowledge” but also support the generation of new research questions starting from social and economic needs. Variety is required in the different dimensions of triple or N-tuple helices so that differently coded discourses can select upon each other and interact (Ashby, 1958). One may wish to move beyond the triple helix model with three relevant selection environments, but every further dimension requires substantive specification, operationalization in terms of potentially relevant data, and sometimes the further development of relevant indicators (Leydesdorff and Sun, 2009).

The answer to Carayannis on the issue is that development must be understood within a systemic framework that cannot be separated from the role of society and the natural environment. “The Quintuple Helix innovation model (Carayannis and Campbell, 2010) bridges social ecology with knowledge production and innovation. Here, the natural environments of society and economy not only challenge, but also encourage and inspire knowledge production and innovation. In the approach of the Quintuple Helix innovation model, the ‘natural environments-of-society’ are being identified as opportunities for driving further and excelling the sustainable development and coevolution of knowledge economy, knowledge society, and knowledge democracy” (Carayannis et al., 2012, p. 9).

Therefore, in this context, only a complete and solid “innovation ecosystem” will be able to guarantee that entrepreneurial drive and that capacity for innovation necessary to continue to compete successfully on international markets and help stimulate economic growth. The objective is essential to ensure the development of “real forms of reciprocity of social capital and not of a general willingness to cooperate and trust” (Pizzorno, 1999, p. 381, *my translation*).

Thanks also to the contribution of Science and Technology Studies, all the observations made so far on the effectiveness of the quintuple helix model underline the need to integrate not only technological innovation into the reference context but, in a reflective perspective, the anticipatory analysis of technological innovation. To this must necessarily be added an “ethical evaluation of digital technology” which consists in overcoming the traditional linear logic of impact, applying the so-called paradigm of coevolution between science and technology, which recognizes the open and hybrid character of change, which is, therefore, not technological but socio-technical, that is to say resulting from the integration and mutual influence of the two spheres of social and techno-science.

The diffusion of ICT and the strong digitization of many socio-economic–cultural spaces challenges the researcher and society to reflect on the known implications of their development and their application (among the many, think of the digital divide or, in the worst cases, technological drift) but also to be cautious about unforeseen and not yet known consequences (in these cases, many

refer to the precautionary principle) (Buffardi, 2020). Indeed, it is clear that scientific and technological developments necessarily produce unintended consequences, which are very often the result of collective decisions rather than individual actions (Martini and Vespasiano, 2017, p. 71–72); “and it is not sufficient to build an ethics of science and technology on the basis of the image of a scientist who intentionally wants to create a Frankenstein. Rather, an ethical structure is required that addresses both the aspect of unintentional collateral consequences (as well as evidently the intentional ones) and that of collective and not just individual decisions” (von Schomberg, 2007, p. 5).⁹ Thus, this is even more true if we consider that in a world of “technical apparatuses” the ontological reversal between means and ends, subject and object takes place¹⁰: Man finds himself being the means, a raw material, for the indefinite perpetuation of the technical-economic development and, therefore, he becomes the medium between the world of apparatuses and the natural world.¹¹ From a philosophical point of view, this leads the technique to become the subject of history, to the point that the technological world is transformed into a de-ideologized world. Consider, for example, also the concept of experience, which in this vision undergoes a profound modification: “if experience is the result of a conceptual elaboration of sensible data, to quote Kant, the technique has intervened by modifying the conceptual structures and the limits of our sensitive perception and our imagination. It is the problem of the supra-liminal that is to say the discrepancy between our imagining and representing the world and our producing by provoking it” (De Stefano, 2013, p. 117, *my translation*).

The awareness and acceptance of the mutual techno-science relationship make it possible to adopt a dynamic approach to exploring the interaction between morality and new technological solutions, thus making it possible to construct evolutionary scenarios of possible techno-scientific controversies, highlighting both the reasons for the possible arising of a dispute but also the processes that can lead to its closure.¹²

⁹ In this regard, Beck's reflection is interesting when he speaks of unaware or unknown non-knowledge and intentional non-knowledge, considered as the “cause” of the threat to humanity (Beck, 2008, p. 190 et seq.).

¹⁰ Even in the reflections of Arthur (2009), the autonomous character of new technologies emerges, understood as combinations increasingly similar to something organic rather than mechanical (even if their ability to act is not equivalent to the freedom to choose that action: Freedom, in fact, provides that all the alternatives are co-present and that they possess an attraction, such as to induce the definitive choice).

¹¹ Consider that processes are currently being studied on how to “build computational architectures inspired by the human model, that is to say networks of silicon electronic components organized however as brain architectures”. It is evident that in this perspective *the future is biomimetic* (Cingolani, 2014, p. 74–75).

¹² A particular case of ethical technology assessment is the Vision Assessment, “the evaluation of visions” on future technological innovations. The Vision Assessment considers the visions themselves as a problem of ethical evaluation, which in this case does not concern the impacts of a present or future technology but the implicit and explicit assumptions about the present that the visions carry (Grunwald, 2007). Indeed, the persuasive capacity of visions makes them an important tool available to the various social actors to guide innovation processes. “These visions must be evaluated cognitively and ethically for their content and their evaluation must place the visionary

Predict, discover, and anticipate united in active participation, communication, knowledge, and action become so essential in the processes of production, as in the past it was the accumulation of capital, and also the ethical sensitivity begins to play an increasingly critical role. The most pressing question, then, is to re-examine the issues of efficiency and social equity, shifting the focus on individual freedoms (Sen, 1990), if you want to manage knowledge in an intelligent manner to the benefit of all (Martini, 2011, p. 207–208).

Probably, the usual planning tools are no longer enough: New tools are needed, and a different mindset, in particular, is needed. It is necessary to have the ability to develop scenarios and create anticipatory strategies in companies, in public administration, in the third sector, and in society as a whole.

Thus, we need to promote a real *Future Literacy* that responds to the need to transform human governance to use the future more efficiently. It is not just about how to prepare for potential crises or how to overcome great challenges: It is about moving beyond the dependence on the certainty illusions and the fragility that this certainty creates.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

The author confirms sole responsibility for the study conception and design, analysis and interpretation of bibliographic sources, and manuscript preparation.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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anticipations within a series of alternative futures, the comparison of which helps to bring out the scientific hypotheses and assumptions underlying them, the social actors who are protagonists and those who are excluded, in order to make them the subject of a transparent democratic debate” (Arnaldi, 2012, p. 129, *my translation*).

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Drawing a pandemic vulnerabilities' map: The SoNAR-global Vulnerabilities Assessment digital and its output

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This paper describes the process, advantages and limitations of a qualitative methodology for defining and analyzing vulnerabilities during the COVID-19 pandemic. Implemented in Italy in two sites (Rome and outside Rome, in some small-medium sized municipalities in Latium) in 2021, this investigation employed a mixed digital research tool that was also used simultaneously in four other European countries. Its digital nature encompasses both processes of data collection. Among the most salient is that the pandemic catalyzed new vulnerabilities in addition to exacerbating old ones, particularly economic. Many of the vulnerabilities detected, in fact, are linked to previous situations, such as the uncertainties of labor markets, having in COVID-19 to the greatest negative effects on the most precarious workers (non-regular, part-time, and seasonal). The consequences of the pandemic are also reflected in other forms of vulnerability that appear less obvious, having exacerbated social isolation, not only out of fear of contagion, but because of the psychological challenges posed by containment measures themselves. These measures created not mere discomfort, but behavioral changes characterized by anxiety, fearfulness, and disorientation. More generally, this investigation reveals the strong influence of social determinants throughout the COVID-19 pandemic, creating new forms of vulnerability, as the effects of social, economic, and biological risk factors were compounded, in particular, among already marginalized populations.

KEYWORDS

COVID-19, qualitative methodology, social vulnerabilities, urban health, digital methods, social determinants of health

1. Introduction

In 2021, the European funded social sciences network for preparedness and response to epidemics, SoNAR-Global, undertook a five country, qualitative investigation of social, economic and health vulnerabilities as a consequence of the COVID-19 pandemic. The goal of this new initiative was to examine the complex, interacting factors that shape COVID-19 vulnerabilities in Italy, France, Germany, Malta, and Slovenia. In addition to characterizing COVID-19 vulnerability and resilience, this newly funded study highlighted the need for community involvement, and the potential role of the social sciences in strengthening public health responses to epidemics (<https://www.sonar-global.eu/>).

The Censis Foundation and Sapienza University of Rome conducted the Vulnerability Assessment among 200 individuals in Rome and outside Rome, in small towns in Lazio. We report here both the findings of this Assessment which then formed the basis for the Community Engagement activity and their co-translation with multiple stakeholders into new strategies for allocating public response resources more effectively and efficiently.

This article reports on the activities and results of the Vulnerability Assessment conducted in Italy as part of the SoNAR-Global project, also due to its interest in the use of digital methods. The results of the Community Engagement will be the subject of a further publication.

The concepts of Vulnerability and Community Engagement are particularly amenable to a systematic social sciences analysis of the impacts of infectious diseases on lived experiences in real world contexts, because they address individual, social and contextual factors shaping exclusion and resilience (Kaufman et al., 2003; Jeleff et al., 2019). As reported in a recent literature review, some historical and structural factors (i.e., history of marginalization, institutionalized racism and discrimination, trust in the public policy) and other aspects of vulnerability are important elements of the challenges faced by communities.

The concepts of Vulnerability Assessment and of Community Engagement are considered by a large area of study, yet lack clearly agreed upon definitions, and uses of the terms vary across disciplines, even if they recently benefit from an increasing interest in social science, public health disciplines, research programs, government bodies, and NGOs projects (Osborne et al., 2021a). They are broadly related to the recognition of the social, cultural and political nature of the diseases: the power of a disease is rooted by a number of aspects not directly related to the medical dimension itself and explain the generation of forms of vulnerabilities that impact on a general community risk (Janes et al., 2012; Stellmach et al., 2018). While the concept of vulnerability includes aspects can contain a multitude of factors that impact on ill health, Community Engagement can be defined as a related practice that “seeks to utilize social networks to mitigate threats to infectious diseases” (Osborne et al., 2021a). The practice of Community Engagement aims to reach those groups that experience disease more than others (Southall et al., 2017). This is a reason why a “successful Community Engagement may therefore address those vulnerabilities associated with differing historical, social, political, and economic worldviews and situations” (Osborne et al., 2021a).

Community Engagement has been defined by Brunton et al. (2017), who outline concepts related within Community Engagement as a strategy adapted to each unique community in an utilitarian term, if it is used to boost participation in or agreement with an intervention, or as social justice if it helps to focus on inequalities. This identification with a strategy is shared with a large number of international projects and practices, such the WHO'S risk communication and community engagement (RCCE) strategy, which underline the importance of including socio-behavioral analyses for Community Engagement efforts (WHO, 2021).

Few clear and comprehensive guidelines for Community Engagement exist on the base of different perspectives and actors involved in the process that help understanding what constitutes Community Engagement. UNICEF proposes a set of minimum quality standards and indicators that answers the demand for a cohesive approach to Community Engagement in

the context of global public health priorities, proposing a clear definition of Community Engagement followed by four domains (core Community Engagement standards, standard supporting implementation, standards supporting coordination and integration and standards supporting resource mobilization) and 16 areas for understanding Community Engagement in practice (UNICEF et al., 2020, p. 12).

On the other side, the concept of vulnerability can be analyzed from its uses in the study of infectious disease. It is composed by an individual (biological) vulnerability and by a vulnerability of systems or structures (Ezard, 2001). Such as resilience, vulnerability is not fixed state, but it occur for various reasons and a number of them can be redirected to social determinants of health (Wilkinson and Marmot, 2003; Marmot and Wilkinson, 2005; Marmot et al., 2008; Wilkinson and Pickett, 2010; World Health Organization, 2013; Marmot, 2014, 2015; Wilkinson et al., 2017; Napier and Volkmann, 2023). One of the study already concluded on the same topic as this in the one of Linder et al. (2018) on urban diabetes, as a part of the Cities Changing Diabetes program (<https://www.citieschangingdiabetes.com>), on which other studies have been run in Rome and Milan (Italy) (Nicolucci et al., 2019). Linder et al.'s study identify social and cultural aspects of vulnerability and how they differ across different types of community members. They use the changes between groups to argue for responses that are adapted to “composite vulnerability, that is, vulnerability that encompasses social, neighborhood and individual-level attributes” (p. 2).

Measuring vulnerability or using it as a strategic concept within Community Engagement could offer theoretical paths from the social sciences to conquer a place in the research and practice of Community Engagement globally. On this we refer to *The Rapid Assessment of Vulnerable Populations: a 'barefoot' Manual* (Napier, 2014).

As this literature overview shows, studies examining vulnerability and resilience within their community contexts share important characteristics, especially in terms of assessing levels of local engagement, meaningful social participation, and agency and individual empowerment. In addition, establishing how these may be positively impacted by intersectoral collaboration is an additional benefit of the approach outlined herewith (Osborne et al., 2021b). The present study contribute to the mentioned literature adding an important dowel to the scenario of the use of social sciences to analyze the diffusion of diseases and the development of new complex forms of vulnerabilities. The present research bring some new perspective not only because social factors become central to analyze the impact of Infectious diseases during the pandemic course, but also because the Community Engagement—although this last practice is not investigated by the paper—has been applied as the main strategy to assess vulnerabilities and to find solutions.

2. Materials and methods

The Vulnerability/Resilience Assessment, developed as a method by David Napier and Anna-Maria Volkmann of University College London, is a field-based tool for systematically collecting and analyzing heterogenous data relevant to the lived experiences of those made health vulnerable by a variety of compounding and often local risk factors. With this tool, data is collected on individual knowledge of and experiences with formal and informal aid and

assistance. Alongside measuring standard vulnerability indicators (degree of isolation, capacity to manage health, trust in government, etc.), the tool identifies specific tipping points that limit or enhance health agency. Within the SoNAR-Global project framework, the Vulnerability/Resilience Assessment tool was adapted to address consequences of the COVID-19 pandemic (Napier, 2014; Ministero della Salute, 2020; Lenzi, 2021; COVID-19 Surveillance Group, 2022).

The first step consisted of carrying out 200 1–3 h closed- and open-question interviews. These were distributed across population categories suspected to be most adversely affected by the pandemic. The selection of the population and the number of interviews were selected on the bases of previous methodological steps of the SoNAR-Global and of other researchers conducted by the same group (Napier, 2014). The principle controlling the numbers of interviews derives from our years of Vulnerability/Resilience Assessment work in Cities Changing Diabetes project and other Vulnerability Assessment projects, which have demonstrated that we usually reach saturation for any “case definition” (being a set of shared risks working together in the lived experiences of our interviewees) once we have carried out no fewer than 10–15 detailed Vulnerability/Resilience Assessment for any given “case definition.” The team suggested some initial social or occupational categories whom we hypothesized had been adversely affected by the pandemic and its control measures, although we did not fix the number of interviews to be conducted for each category.

Our recruitment strategy was designed to build on these categories to identify hidden vulnerabilities has listed and collected in Table 1. Following the identification of initial participants, we used snowball sampling, requesting that initial participants put us in contact with others they considered to be as, or more, adversely affected by the pandemic than themselves. Though this type of sampling does not lead to statistically representative samples, it nonetheless provides an excellent exploratory technique, especially when trying to identify specific populations that traditional survey techniques fail to access.

Seventeen trained interviewers carried out the 200 interviews (190 of which were usable), administering to each interviewee two questionnaires (a quantitative and a qualitative one) in Italian. We conducted these extended interviews in Lazio, where 100 interviews were carried out in Rome and 100 outside Rome, in small to medium-sized rural municipalities.

An initial, closed-question survey yielded demographic, socioeconomic and health data on each participant, whereas the detailed qualitative interview guide investigated three general thematic areas:

- the public and private Service Domain, in which detailed information is gathered regarding which services are used or not used, and the decision-making practices that impact knowledge and utilization patterns;
- the Community Domain, which focuses not only on social integration, but on the ability of communities, local advocacy groups, and particular stakeholders to mobilize, nourish, and harness social capital;
- and the Vulnerability Domain, which aims both to demonstrate how vulnerability is produced when the compounding of otherwise heterogeneous risk factors seriously limits health agency, and to characterize the ways in which, and the *ab nevis* through which health agency might be restored.

TABLE 1 Respondents by type of initial vulnerability (absolute values and %).

	a. v.	val. %
Lonely people	31	16.3
Seniors over 70	15	7.9
Families with disabled or non-self-sufficient elderly/disabled/people with Down syndrome, etc.	9	4.7
People with chronic disease	50	26.3
Families with children up to 14 years/single-parents families	26	13.7
Students in DAD	21	11.1
People in precarious housing	13	6.8
Earthquake victims	7	3.7
Nurses	8	4.2
Caregivers (professional)	7	3.7
Caregivers (familiar)	10	5.3
Teachers	2	1.1
Deniers about COVID	8	4.2
People with psychological problems	8	4.2
Transgenders and non-binary	2	1.1
Women victims of violence	2	1.1
Families with financial difficulties	30	15.8
People with familiar trouble (in difficult divorce process)	6	3.2
People who have had COVID or long COVID	16	8.4
Smartworkers	24	12.6
Show business workers/dealers in penalized sectors	17	8.9
Unemployed	21	11.1
Precarious workers	42	22.1
Workers temporarily suspended from work with partial wages (<i>Cassa integrazione</i>)	13	6.8
Immigrants	12	6.3
Total	190	100.0

All interviews were recorded and transcribed. All participants provided written informed consent, in compliance with EU Regulation 2016/679. The ethics committee of the Policlinico Umberto I of the University La Sapienza of Rome approved the Italian study with App. 6340 on 26/05/2021.

One salient feature of our methodology concerns the online conduct of the interviews. In order to comply with anti-COVID measures, most interviews were carried out online, using platforms such as Zoom or Teams. This necessity entailed a new way of conducting the interviews that did not impede their execution or impoverish the results. Indeed, the online conduct proved effective in producing richly detailed narratives.

The data obtained were processed using SPSS (28 version) processing software to analyze the closed response questionnaire, and NVivo software (1.5.2 version), a computer assisted qualitative analysis software (CAQDAS—Computer Assisted Qualitative Data Analysis Software), which allowed for the coding and organization of information. From this coding we conducted thematic analysis, the data analysis process was

TABLE 2 General characteristics of the sample (absolute values and %).

	a. v.	%
Age (from 18 to 91)		
Upto 30	43	22.6
31–45	75	39.5
46–60	39	20.5
Over 60	33	17.4
Gender		
Women	99	52.1
Men	87	45.8
Other	4	2.1
Location		
Urban (Rome)	101	53.2
Rural area (other Latium municipalities)	89	46.8
Modality for interview		
In presence	75	39.5
Web/telephone	115	60.5
Total	190	100.0

substantiated by the research team's interpretive contribution, which involves exploring the data, modifying and integrating the initial codes, and identifying salient themes that are supported by codes.

Here again, the methodological aspect should be emphasized, since it was a method characterized by an integrated approach of analysis that allowed the schematization and understanding of the contents of the interviews through a logical ordering of the information obtained thanks to the software, which formed the basis for the researchers' interpretation.

3. Results

Thanks to the sampling method and the indications of interviewees, eight new vulnerability categories were found compared to those initially selected for sampling.

The following table shows the categories of vulnerability taken into consideration, which are the result of a mix between the initial ones and the subsequent integrations resulting from the sampling.

Table 2 reports the general characteristics of participants.

One important finding is that consequences of the pandemic fell into two broad categories: those relating to the COVID-19 disease and those connected to pandemic control measures.

In fact, the second category of consequences is the result of political decisions that may have been wrong or excessive. Nevertheless, the effects of these different types of consequences are often linked: for example, the lockdown has not only impacted economic activity but increased fear for this unknown disease and also, reducing sociality, created anxiety and depression.

3.1. The consequences of the COVID-19 disease

COVID-19 disease not only affected those who fell ill, but also affected their carers, as well as the broader population, particularly in catalyzing generalized fear of an unknown disease, which in turn accentuated a sense of general vulnerability.

The fear of contagion and the fear of falling ill with COVID, given their health situation, and consequences of an unknown disease with potentially very serious outcomes certainly increased the vulnerability of chronic patients. Again, the most problematic situations concerned the frailest among the chronic patients, such as the elderly and the lonely elderly.

Caregivers have also experienced the fear of illness for the family members they care for and also for themselves, because of the possible consequences also with respect to their care commitment.

But there is also a very acute feeling of transversal vulnerability, fear and anxiety, linked to the characteristics of COVID, to the lack of knowledge and its unpredictability, which is independent of the presence of a previous situation of illness or fragility.

In addition to the distress created by the fear of illness, it should be noted that most situations of psychological vulnerability are the result of restrictive measures.

3.2. The consequences of the restrictive measures

The initial lockdown (introduced for the first time in Italy with the Ministerial Decree of 9 March 2020 “To resto a casa”) is particularly relevant. Along with other subsequent restrictions such as the so-called red zones—Zones (cities or regions) in which the lockdown were active, on the basis of the monitoring of the disease trend—these measures led to significantly increased economic, social, and health vulnerabilities. Reductions in mobility, outdoor activities, closure of shops, meeting places and cultural venues are among the most impactful factors.

Many of the economic consequences such as reduced income, loss of work, but also difficulties with smart working are linked to these measures.

At the same time, the lockdown and restrictions have had wide-ranging consequences: from worsening lifestyles to the reduction of the access to care, hospitalization, treatment, monitoring of chronic diseases and prevention; from difficulties in managing distance learning, to children of families with greater social, economic and cultural difficulties dropping out of school.

Moreover, another large part of these consequences can be attributed to the increase in stress and the perhaps still difficult-to-measure consequences on the mental health of the population and again of the most fragile, the elderly and especially the young, often linked to the drastic cutting of social relations. An important example of this impact is the increase in eating disorders in Italy during the first 6 months of 2020, linked, among other things to the increase in exposure to social media (Vaccaro et al., 2021).

TABLE 3 Compounded vulnerabilities (val.%).

	Total interviews	New vulnerabilities due to COVID-19	Increased vulnerabilities due to COVID-19
No initial vulnerabilities	25.3	54.5	0.0
Pre-existing vulnerability	74.7	63.1	38.5
One vulnerability	31.0	63.0	18.5
More than one	43.7	63.2	52.6
Total	100.0	60.9	28.7

3.3. The intertwining of vulnerabilities

In addition, we also found an intertwining of vulnerabilities. We found several cases (43.7%) in which a subject fit into more than one category of vulnerability. Moreover, most participants (74.7%) had a pre-existing vulnerability. Some 38.5% of participants with (pre-existing?) vulnerabilities experienced an intensification of their vulnerabilities (Table 3).

The following examples show respondents whose vulnerabilities were compounded by COVID-19 (Table 4).

In the second example, a woman with pre-existing health problems, which already had a major impact on her living situation, noted that becoming ill with COVID worsened her condition, also from an economic point of view. At the same time, finding a new job improved her psychological situation (Table 5).

3.4. The impact on health

The impact on health is one of the most relevant aspects of the consequences of the pandemic in the strict sense and of the measures decided to combat its spread.

Some data from the first quantitative questionnaire testify this generalized health impact:

- 57% during the last 3 months was unwell (at least one day);
- 45% did not sleep well and among them, 27% because of COVID-related stress;
- 49% changed their (gained?) weight due to the COVID. The percentage rises to 61.2% among those who are overweight/obese;
- 42.1% of respondents spent most or most of their day sitting down.

The qualitative interviews highlighted many nuances of this impact on health, most notably psychological.

Considering COVID and its “disease” consequences, an increase in vulnerability is first and foremost evident, as can easily be expected, in people who have contracted COVID, but irrespective of the level of severity of the illness they have experienced, partly due to a lack of knowledge about the disease and a fear of being left more fragile in the face of future illnesses.

TABLE 4 The non-integrated foreign woman.

Woman	She studies medicine and works as a waitress,
40 years old	after going on layoff for COVID-19 she no
Foreign	longer has sufficient income and found a
Lives in Rome	work in a call center
She doesn't feel integrated in the place where she lives and she thinks that there are problems of integration that concern all foreigners toward whom there is a lack of interest from public institutions and also the associations of the third sector don't do enough	
Vulnerability is a mixture of loneliness, uncertainty, anxiety, financial and health problems “I know people who are not doing well at the moment both economically and mentally. If one is sensitive or in difficult situations the body is affected. If a person is alone, has to support himself and does not have economic security, these elements affect the rest. And everything is increased by the anxiety of the moment”	
Living conditions and discrimination against foreigners create more forms of vulnerability “There are people of different nationalities and I think they are quite neglected. Their lifestyle and the environment they live in increases their health risks. My guess is that they don't even get tests for prevention and even forgo medical care for economic reasons of course. Those who work off the books would rather go to work even if they're sick than miss a day of work that won't be paid.”	

TABLE 5 The woman with chronic diseases and long-COVID.

Woman	She lost her job because of COVID
35 years old	but recently found another one
She lives alone	
She lives outside Rome	
She has chronic diseases and is obese, has long-COVID	
Her illness had a major impact on her living situation (her boyfriend left her when he knew she was sick) but COVID also created psychological as well as physical problems to her	
She believes that a healthy environment is strategic to health, and likewise, good social relationships, which it is up to us to create	
The psychological vulnerability related to COVID “The COVID had a strong emotional impact for me both physically and emotionally. I had to do two quarantines (40 days + 40 days). The fact that I can't get a hug or the fact that I can't invite people, to not see them physically at all has changed me so much.” “For months I felt that I had experienced a period of extreme loneliness.”	
Work as a tool for resilience “The biggest concern for me is having a stable job. Now that I have a job that I thought I couldn't do because of my physical problems, I feel more positive about facing life”	

“I had COVID about a year ago. But I still have ailments, especially a sense of asthenia, insomnia, I can no longer sustain work as I did before, both manual and concentration work. I feel old, I'm worried about how my body has reacted, I'm afraid of how it will react to other infections, even a simple flu. I try not to make the situation worse by avoiding harmful behaviours, such as smoking.”

(Male, 55-year-old, nurse, lives outside Rome).

Caregivers experienced a worsening of their condition, even when their family members did not fall ill. On the one hand, there was increased concern that their parents or frail relatives they were

caring for might become infected with SARS 2 and suffer serious consequences. On the other hand, because of the restrictive measures, they experienced loneliness and abandonment, without the support of other relatives or the same services.

“By the way, my dad is immuno-depressed. So we had a lot of scruples many times. Today, fortunately, he’s had his second dose of the vaccine and so we’ll certainly be calmer for the future. Until now we’ve been really worried because if my dad had been infected it would have been the end of him because he’s very, very weak.”

(Female, 46-year-old, housewife, caregiver, lives outside Rome).

“So this is the situation inside the house (two disabled parents), so imagine with COVID how I was obviously, we were extra careful, it was just absurd. that is, we all had to be careful because that applies to everyone, plus we really haven’t done anything this year, nothing, always inside the house.”

(Female, 37 years old, secretary, caregiver, lives in Rome).

Chronically ill patients also experienced a greater sense of health vulnerability, both because of the fear of falling seriously ill with COVID and because of the restrictive measures and fear of contagion themselves, which reduced their access to monitoring and treatment.

I am worried because I have chronic bronchitis. In this situation I feel bad I even tried to commit suicide. From the beginning I had the impression that COVID was serious”

(Male, 63 years old, unemployed, has a citizenship income and a disability allowance. An earthquake victim, he lives between Abruzzo and Rome).

“At the moment I am not doing the checks I should because of the COVID, I preferred not to do it.”

(Female, 61 year old, with chronic illness, employed, lives in Rome).

In addition to the distress created by the fear of illness, it should be noted that most situations of psychological vulnerability are the result of restrictive measures.

“Because of the COVID by reducing sociality I am sadder, I struggle to do things, study, I sleep more.”

(Male, 29 years old, student, lives in Rome).

“This dark, tragic period has also stopped our emotionality, because we’re scared, we’re worried”

(Female, 43-year-old, on redundancy pay due to COVID, lives in Rome).

Another negative effect on health, particularly widespread, is the decline in practices to sustain good health, linked to anxiety, fear of illness and restrictive measures introduced.

Very common is the experience of bad eating habits, much more carbohydrates and sweets, often homemade, also for their consoling and anti-stress power and the tendency to eat much more often during long hours at home. In fact, it is relevant to consider that

the increase in the consumption of some types of food is linked with their symbolic value: the tendency to make bread, pizza and sweets at home, for example, it is linked to a specific food craving (especially carbohydrates) but could be interpreted as a pleasant way to spend time during a forced stay at home, and also as a way to deal with a difficult situation (Bracale and Vaccaro, 2020).

Reduced physical activity also had a great impact on health, both physical and psychological, and here too, the characteristics of the living environment made a difference. A larger house or one with outdoor space, the availability of parks or areas favorable to physical activity led to very different situations, with less impact on physical and mental health for those living in more facilitating contexts.

“When there was lockdown we drank more alcohol, but not too much. There were times when we were quite nervous and maybe even at lunchtime we drank wine.”

3.5. The great weight of economic vulnerabilities

But while the health vulnerabilities were important to our participants, they more frequently cited the disastrous economic consequences of the pandemic for them.

In this case, the preeminent role is certainly that of the restrictive measures that have blocked or reduced many economic and productive activities, especially in the tertiary sector, catering, tourism and many cultural and leisure activities (gyms, sports centers, cinemas, theaters, etc.).

The substantial impact is also evident from the quantitative questionnaire data:

- 48% of the VA sample experienced a decline? in income due to the COVID pandemic and, among those, 43% believed that it would not return to pre-pandemic levels;
- 73% of those experiencing a net decline in income as a result of the pandemic said their income was insufficient to sustain their desired standard of living.

Changes in the economic situation were linked to several aspects. Many respondents point to a major change from the previous situation. Economically strong groups such as restaurant entrepreneurs and shopkeepers in many categories were also affected.

These are often privileged categories, also from an economic point of view, who have experienced in a dramatic and unexpected way the consequences of a job characterized by entrepreneurial risk, as in the case of restaurateurs or shopkeepers who have had to close their businesses for long months, or by instability, such as that of freelancers or entertainment workers who have suddenly lost customers or spectators.

“Until two years ago I was earning 2000–2500€ per month, and now for a reason, yes, they explained it to me, but nobody cared that I had a job and I have nothing anymore.”

(Male, 55 years old, entertainment worker, lost his job due to COVID, lives in Rome).

“The pandemic has created new poor and therefore these new poverties are not covered.”
(Male, 56 years old, employee, lives in Rome).

But alongside these new poor, for whom a recovery of their economic and income situation was likely when the restrictions come to an end, there is an awareness among the interviewees that the most serious consequences have affected those categories of workers who started from weaker positions in the labor market, those with precarious contracts or illegal workers, the youngest, women and immigrants. For these categories, the situation of greater economic vulnerability created by the measures to combat the pandemic, although mitigated by the new forms of welfare and subsidies introduced in the emergency phase, does not seem destined to change in a positive way over time.

“For COVID, restaurant and pub owners and sports workers, who often do not even have a contract, are economically vulnerable.”

“A precarious person is economically vulnerable. He is someone like me. If I don’t have 30 hours of lessons, if I only have 10, two people tell me from tomorrow that they don’t have the money for the lessons and I can’t buy food anymore. And maybe they are also prevented from doing their job, like me in the red zone.”
(Female, 35-year-old, personal trainer, lives outside Rome).

“If I didn’t have help I wouldn’t know what to do, in the end you have to pay the bills and have nothing left to eat. If I don’t call friends to ask for food, I’m left with nothing. People I know, people I’ve done jobs for, who remain as acquaintances, kind people who tell me that if I call them they’ll bring me something.”
(Transgender, 34 years old, gardener, lives outside Rome).

3.6. Lesser-known vulnerabilities

The consequences of the pandemic are also reflected in other forms of vulnerability which appear less obvious, which have created discomfort often due to isolation and the new habits imposed by measures to contain the contagion, and which are often described as forms of anxiety, fear or disorientation. At the same time, participants allude to possible future consequences in relations between generations, in the face of the suffering of the elderly who have experienced a decisive rupture in relations with their children and grandchildren and who have spent the difficult times of lockdown or those of staying in RSA or possible hospitalization in solitude.

“I had my grandfather who was hit by a stroke in hospital. And one thing I will never forget is the very nice nurse who handed the phone in face time to my grandfather... he was alone and in these cases a person could barely go. Support and never make people feel alone.”
(Female, 24-years old, university student lives in Rome).

Moreover, it is interesting the reflection on the possible negative effects on the future development of the youngest, victims of the drastic cut in peer relationships. Not only adolescents, but also children, a silent section of the population on whom the effects of the pandemic in terms of increased vulnerability should be examined in depth. Many of them have experienced the situation of distance learning with difficulty, some have been cut off from it because of their family’s initial difficulties, they have spent a lot of time alone in their rooms and on social networks, without being able to experience some important stages in their growth.

“So vulnerable are the children and young people these days in my opinion. I saw my sister preparing for her baccalaureate at home. She did ‘the 100 days’ at home. She didn’t do the trip that classmates take together in their graduation year.”

“Or children with computers at 5 years old, and those at 8,9 years old who are happy to have the iPad so they can follow the lesson and they give them their homework on the iPad, does that seem normal? These are kids who haven’t breathed a word but they exist. And it’s important to keep an eye on them.”
(Female, 24-years old, university student, lives in Rome).

Finally, our NVivo data analysis summarized the prevailing sentiments during the pandemic indicating the recurrence of certain sentiments.

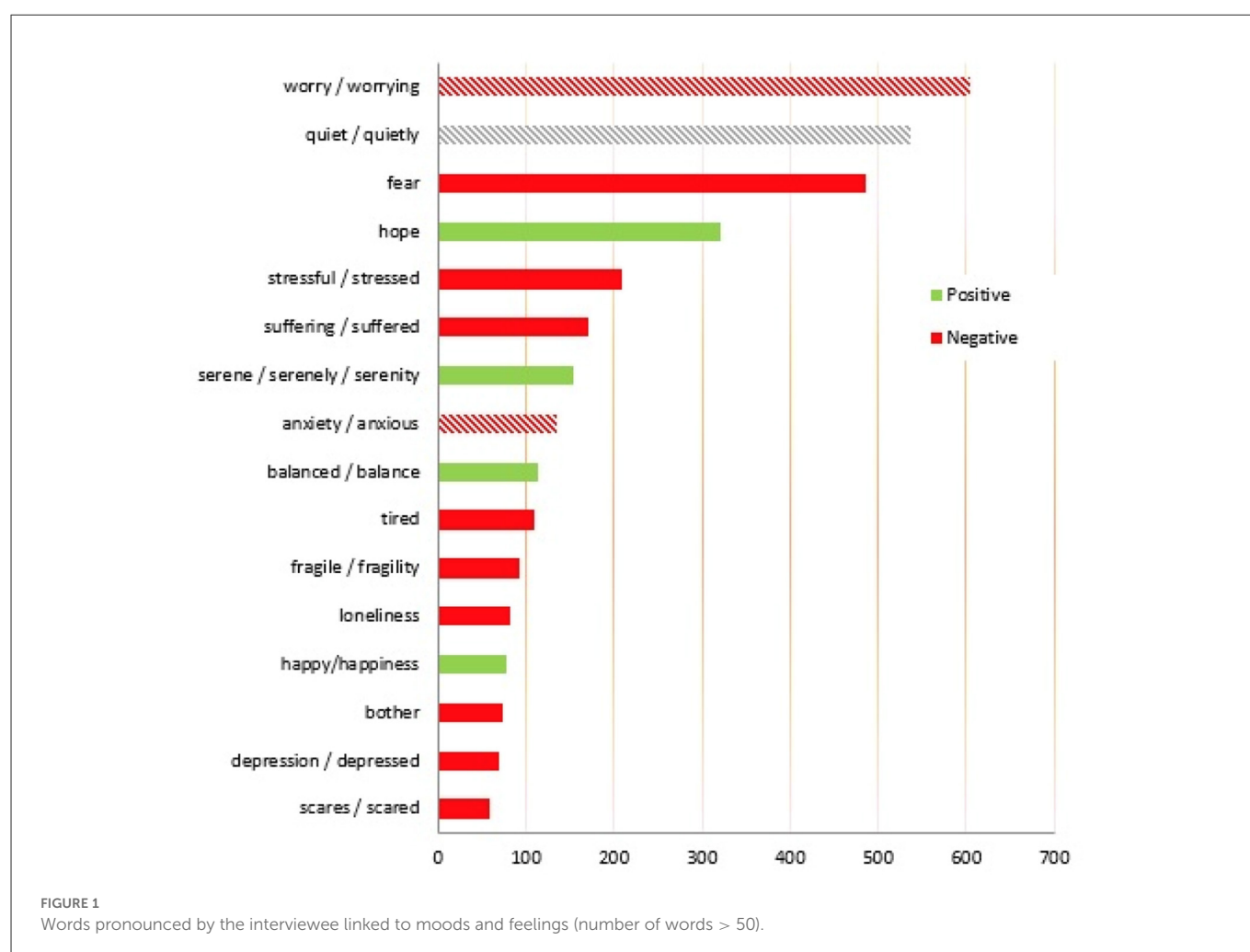
Fear prevails among all of them, although it was not present in the words used in the formulation of the questions. This state of mind, even if not necessarily explicit, emerges as a background reason from the tales of the interviewees and seems transversal to many conditions even if not marked by particular vulnerability (Figure 1).

When speaking of feelings of trust, it should be remembered that a minority of those interviewed expressed trust in the institutions, even before the emergency situation and independently of it, even if there are cases in which there has been an increase in this distrust precisely because of the management of the emergency.

“I don’t have much faith in institutions. Precisely because I think there is a lot of weakness and also in the government system... I don’t feel very much... certainly the pandemic has made me change this view, you realise, as an entrepreneur, that if you have a problem nobody helps you. All they do is keep asking. We don’t even have a trade union, to give you an example. The institutions don’t give me confidence.”
(Male, 33 years old, entrepreneur, with a chronic disease, lives in Rome).

There is also widespread criticism of the management of communication, which almost everyone describes as contradictory, redundant and confusing.

“I believe that information is not that there is a lack of it, and that there is a lot of it and it is all different, so depending on the people you hear from, specialists, virologists or doctors in general, you hear a lot of different things that can create confusion and not reassure the person.”
(Transgender, 34 years old, gardener, lives outside Rome).



4. Discussion

The analysis has shown the complexity of the achieved concept of vulnerability on the ground experiences. First of all, vulnerabilities are often multiple and interconnected and can include several aspects: there is a biological/physiological vulnerability and an emotional/ psychological one. The socio-economic aspects are very relevant (e.g., isolated/ socially and/or financially disadvantaged) as well as the forms of cultural vulnerability. In any case, the results indicated that the health consequences of COVID (including psychological and mental health) tend to be more severe in the presence of existing health or economic vulnerabilities. Finally, it is interesting to point out that vulnerability to COVID itself can depend on individual behavior, strongly influenced by aspects such as trust in institutions, especially health institutions, and cultural aspects. More specifically, the level of information, on the one hand, and attitudes toward vaccinations, on the other, are two aspects that have greatly influenced behavior and also the vulnerability brought about by the pandemic experience. The set of results that describing the multidimensionality of the forms of vulnerability detected were also important because they formed the basis of the discussion during the Community Engagement phase and in the elaboration of action and intervention proposals.

5. Conclusion

The entire vulnerability/resilience assessment process is based on the fact that compounding multiple risk factors inhibit health agency, and eventually make it difficult or even impossible for people to become advocates for their own health destinies. In other words, the challenges of daily living for the most vulnerable can make it difficult if not impossible to capture their experience in other than ethnographic ways. This being so, nearly all survey techniques fail to reach the most vulnerable populations because these populations are so often unable to respond; for their loss of agency leaves them in a state of calamity coping in which the very thing that they are most at risk for cannot be attended to. We all know this; but figuring out how to study and characterize it as data has until now been a challenge, for individual ethnographies are episodic and hard to apply to larger populations. A recent publication called *The Economist* on the new *Health Inclusivity Index* (<https://impact.economist.com/projects/health-inclusivity-index?i=2>) describes the innovation of the SoNAR-Global research group in possessing proven methodologies for both identifying hidden vulnerable groups, but also for characterizing those otherwise invisible groups and bringing their lived experiences to the level of evidence—as already done for *Cities Changing Diabetes*. We also know this from an unpublished Vulnerability Assessment review study SoNAR-Global carried out

for WHO, and from various reviews of Vulnerability Assessment strategies several of us co-published for SoNAR-Global and for Cities Changing Diabetes project: these procedures are broadly described in Napier and Volkmann (2023), *The Vulnerability Vortex: Health, Exclusion, and Social Responsibility*. The advantages of the emergence and empirical analysis of vulnerability are amplified by the possibility of their use in the shared elaboration of intervention proposals allowed by Community Engagement, which in the experience of the Italian study group has indeed yielded important results.

Data availability statement

The datasets presented in this article are not readily available because the datasets used in the article are part of the SoNAR-Global European project and they're not transferable. Requests to access the datasets should be directed to <https://www.sonar-global.eu>.

Ethics statement

The Ethics Committee of the Policlinico Umberto I of the University La Sapienza of Rome approved the Italian study with App. 6340 on 26/05/2021.

Author contributions

Conceptualization: FL and CV. Methodology and supervision: DN, AV, and TG-V. Formal analysis and writing—original draft preparation: CV. Investigation: CV, DG, and GA. data curation: CV and GA. Writing—review and editing: FL. Visualization: CV.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The SEO effect. Mapping the optimized landscape around controversial policy issues in Italy

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This research investigates the use of search engine optimization (SEO) by political and non-political actors to amplify the visibility of search engine results. While there has been much theoretical speculation around the role of SEO techniques in boosting the ranking appearance of a website, few empirical studies have been undertaken to understand the extent to which SEO techniques are used to promote visibility online. This study takes Italy as a case study to map the information landscape around nine highly controversial issues during the Italian electoral campaign of 2022. Using a combination of digital methods and a tool detecting optimization in websites, our article aims at examining which actors employ SEO techniques to foster the circulation of their ideas and agendas around hot topics. Our analysis reveals that information channels, institutions, and companies are predominant, while political actors remain in the background. Contextually, data indicate that SEO techniques are employed by several recurrent editorial groups, company owners, and institutions. Ultimately, we discuss the impact of SEO techniques on the circulation and visibility of information around relevant policy issues, contributing to shaping and influencing public debate and opinion.

KEYWORDS

Google search, search engine optimization, digital methods, electoral campaign, policy issues

Introduction

This research investigates which actors have employed search engine optimization (SEO) to amplify their visibility on search engine results concerning relevant policy issues. Search engine critique has long revolved around privileging mechanisms and how to identify them. While there has been much theoretical debate around the role of SEO in boosting the ranking appearance of a website, few empirical studies have been undertaken to understand who uses SEO techniques to promote their websites (Cui and Hu, 2011; Zilincan, 2015). In this study, we look at nine policy issues that have played a central role in the context of the 2022 Italian elections: abortion, euthanasia, work, LGBTQIA+, migration, taxes, healthcare, innovation and digitization, and environment, with the intent to explore which actors have mostly employed SEO techniques to promote their visibility online and, contextually, to make their voices heard about hot topics. For each topic, we formulated a list of keywords, which were identified through a manual search on the electoral programs of the four main political forces: center-right coalition, left coalition or PD party, Five Star Movement, and third pole.

The keyword list was used as queries on software that simulates a search on Google, extracts the top 20 website links, and outputs a probability score for optimization. Specifically, the tool analyzes the website HTML searching for SEO indicators, classifying websites into four classes according to these factors: definitely optimized, probably optimized, probably not optimized, and definitely not optimized (Lewandowski et al., 2021; Lewandowski and Schultheiß, 2022). For each query entry, the tool extracted the first 20 results returned by Google.

The results of our analysis indicate that SEO techniques are mostly employed by news channels, which are the most frequently occurring actors across the different topics in our dataset. Within this category, we have identified several recurring editorial groups such as *Condé Nast*, *Wolters and Kluwer*, and *Gedi*. Their widespread presence demonstrates how, through the use of SEO tools, news outlets can rise to prominence and even monopolize the information environment with respect to certain topics. Besides information channels, the first positions of Google search result pages were occupied by institutions and companies—especially in the context of healthcare and environmental issues. In our understanding, these actors employ SEO for advertising purposes, exploiting both the visibility granted by these techniques and the timely popularity of topics such as euthanasia, abortion, and climate change. In this scenario, it appears surprising the scarcity of political actors. Despite dealing with politically relevant issues, which played a relevant role in the debate surrounding the 2022 Italian political elections, the presence of leaders' and parties' websites is reduced to a minimum, hinting at the possibility for these actors to rely on other channels and other recommendations systems (e.g., social media) to make their voices heard. In conclusion, our piece reflects on the consequences and risks of using SEO to spread information about policy issues.

Theoretical framework

According to *The Stanford Encyclopedia of Philosophy*,¹ the term democracy refers “to a method of collective decision making characterized by a kind of equality among the participants at an essential stage of the decision-making process”.

In the transition from the direct democracy of the Athenian agora to the modern democracy defined as the “democracy of power,” even if the public square is no longer there, the need for the visibility of power remains and is satisfied through publicity and through the formation of a public opinion that is created through freedom of the press and political leaders making statements through the mass media (Bobbio, 2014).

As stated by Kelsen (1945), the will of the community in a democracy is always created through a continuous discussion between the majority and minority across a free examination of arguments for and against a given regulation of a matter. The discussion takes place not only in parliament but also, primarily, in political meetings, newspapers, books, and other means of disseminating public opinion. Insofar a democracy without public opinion is a contradiction in terms.

Political communication, which has become essential in electoral campaigns and beyond, is understood as “the exchange and confrontation of contents of public-political interest produced by the political system, the media system and the citizen-voter” (Mazzoleni, 1998, p. 34), has reached its third phase, the post-modern one, characterized by the widespread use of new technologies and mobile devices and by a more thematic, personalized and interactive consumption with massive use of the Internet as an alternative to television (Blumler and Kavanagh, 1999; Norris, 2000).

A well-organized online political communication can lead to the participation of a large number of people, reproducing it on an already large scale and benefitting from the synergies generated by the visibility that moves from the web to traditional media (Chadwick, 2013). In Italy, the case of the Five Star Movement is emblematic: a party that, without the use of the Internet, would not have been born and that has managed to establish itself precisely due to the web (Biorcio, 2013).

One of the fundamental aspects of democracy is the degree of freedom with which citizens vote based on consistent preferences. The use of new technologies, access to limited independence of information or fictitious and manipulated information, or their excessive personalization can lead to an increase in ideological biases, which could undermine voters' free and informed choices (Achen and Bartels, 2016; Suzor, 2019).

Precisely because of the Internet's infrastructure, search engines, and social media platforms have huge power in organizing information for their users, and the consequence is that not all choices become equal. Even the findability and visibility of some sites on the Google search engine follow different rules: some are highly indexed and rise to the top of the search results, while others are never indexed. The same happens with the visibility of political content on the Internet, which has a strong impact not only on the voice of the politicians themselves but also on the voters who come into contact with a certain type of information that can have significant effects on society and individuals, such as undermining a country's electoral process (Hindman, 2008; Pariser, 2011; Vaidhyathan, 2011; Bucher, 2018).

Following the political agenda and the agenda setting,² this research aims to study the use of SEO during the national electoral campaign in 2022 in Italy because “we look at Google results and see society, instead of Google” (Rogers et al., 2009, p. 49).

The role of public policy issues and how these are treated and covered by the media is very important during the election campaign and becomes even more decisive to the extent that voters perceive differences between candidates on political issues and vote on this basis (Alvarez, 1998; Merrill and Grofman, 1999; Neufville and Barton, 2004). We refer to public policy issues as arguments involving a conflict over what the government should or should not do in this Googolization era.

² We consider Political Agenda as the list of topics or problems that government officials, and people outside government closely associated with these officials, pay attention to at a given time; Agenda Setting is the process of defining these problems followed by solutions or alternatives, thus becoming relevant topics for the actors in the political process (Dunn, 1994; Kingdon, 1995).

¹ <https://plato.stanford.edu/entries/democracy/>

Thus, in the informational society, where information development and transmission are the basis of productivity and power and where the source lies in the technology that generates knowledge, information processing, and symbolic communication, technological development, and its utilization acquire greater significance (Castells, 2002). Furthermore, in an economy based on the Internet, education, information, science, and technology become critical sources of value creation (Castells, 2001).

Information retrieval deals with the structure, analysis, organization, storage, search, and retrieval of information (Salton, 1968). Although its first definition dates back to the last century, its true meaning was best understood when Google was founded in 1998 with the idea of organizing the world's information and making it universally accessible and useful (Jones, 2013).

During a campaign, ensuring that content has good visibility in searches is vital for political actors. Over the years, practices, tricks, and habits have spread to enable sites to climb the rankings of search engine results pages (SERPs) (Giansante, 2014).

Google's SERP, formed by a list of organic content and a list of sponsored content, competing with each other to attract the attention of search engine users (Xu et al., 2012), is continuously updated and sees changing search results rankings to generate relevant results based on users' clicks (Clemons and Madhani, 2010; Baye et al., 2016) and presenting relevant information to users based on the search engine algorithms (Klatt, 2013).

The process of improving a website's visibility in organic search results is called SEO search engine optimization. The website is created so that it ranks well for the chosen keywords in the organic search results of the major search engines, the volume and quality of traffic to a website from search engines are improved organically due to the selected keywords, and unlike advertising, the traffic is organic and free (Chen et al., 2011; Kritzinger and Weideman, 2013; Iskandar and Komara, 2018).

It has already been shown not only that the ranking permanence of sites using SEO is much longer but also that users often tend to click more on organic listings than on paid ones, so the results at the top of the search results are more likely to be visited and clicked on, also because engine users over the years have been browsing fewer and fewer result pages (Jansen and Spink, 2009; Klatt, 2013; Panda, 2013; Baye et al., 2016; Dan and Davison, 2016).

Search engine optimization techniques can be distinguished into white hat techniques, i.e., accepted by search engines, and black hat techniques, which cause search engines to remove sites from the results until they are adjusted. White hat is the most legitimate way of implementing SEO to achieve high rankings and is based on Google's guidelines, following its algorithm and avoiding bad practices. In this way, growth is steady, gradual, and lasting. On the other hand, the black hat is an illegitimate way of ranking in the SERPs, is contrary to the guidelines, and finds fertile ground in the shortcomings and gaps in Google's algorithm.

Therefore, also following reports in the Italian press on the concerns of the Copasir³ (Parliamentary Committee for the Security of the Republic) about the risk of the public debate being polluted and distorted:

Communicative strategies articulated in disinformation (all those practices of voluntarily creating and disseminating untrue or misleading information to deceive the recipient of the message), misinformation (all those practices of disseminating untrue information without the knowledge that it is false and, therefore, in the absence of the voluntariness of deceiving the recipient of the message) and media manipulation are established and spread; in data-driven strategies that make use of the 'targeting' systems of large social media companies; in the use of trolling (the act of creating and disseminating online messages and comments of a violent or defamatory nature, prompting the recipient to an emotional response) or harassment directed at users' digital profiles; in mass reporting of content and accounts, indirectly exploiting the filtering systems of platforms.

As mentioned earlier, studying SEO techniques during the 2022 electoral campaign that led to the election of the first woman as head of government in Italy is vital to understand how information was disseminated on topics that were (and still are) pivotal to the Italian political debate. Our research revolves around two research questions and two sub-questions, as follows:

1. Which actors appear in the first positions when searching for key policy issues of the Italian political elections?
 - a. Which of them uses SEO?
 - b. How relevant are political actors in this context?

Methodology

Following the digital methods (Rogers, 2013, 2018) our empirical investigation focuses on nine social and political issues: abortion, euthanasia, work, LGBTQIA+, migration, taxes, healthcare, innovation and digitization, and the environment. These topics were identified through an exploration of the electoral programs of the most relevant parties (i.e., having at least the 5%) and coalitions competing in the 2022 Italian election. These are the center-right wing coalition (*Fratelli d'Italia*, *Lega Salvini Premier* and *Forza Italia*); *Partito Democratico* (PD); *Terzo Polo* (*Azione*, *Italia Viva*); and *Movimento 5 Stelle*. For each topic, we formulated a list of relevant keywords, either one word or more than one (see Appendix 1), which were manually extracted from said programs.

The keywords were then used as queries on software developed by the Hamburg University of Applied Sciences (HAW Hamburg), which simulates a search on Google, extracts the top 20 website links, and outputs a probability score for optimization. Specifically, the tool analyzes the website HTML searching for 32 SEO indicators, classifying websites into four classes according to these factors: definitely optimized, probably optimized, probably not optimized, and definitely not optimized (Lewandowski et al., 2021; Lewandowski and Schultheiß, 2022). We performed the search straddling the election day: 23, 24, and 25 September 2022. The output is a file including the following data: the input query, the link of the website, the position of the website in the ranking (from 1 to 20), and the probability of optimization.

We decided to limit our analysis to the first five results for each query, deeming them to be the most visually prominent on

³ <https://formiche.net/2022/08/russia-interferenze-italia-copasir/>

TABLE 1 Overview of the categories of actors behind the websites.

Category	Description
Information channels	It groups together national (e.g., <i>Il Sole 24 Ore S.p.A.</i> or <i>RCS S.p.A.</i>) and local news outlets (<i>Citynews S.p.A.</i> or independent local ones) and also include independent newspapers (e.g., <i>ILPOST</i> or <i>Open.Online</i>)
NGOs	Non-governmental organizations such as <i>Amnesty International</i> , <i>Save the Children</i> , and Italian ones like <i>Associazione Luca Coscioni</i>
Political actors	Websites of political parties and individual leaders. We have also included in this category official social media pages
Institutions	Within the definition institution, we have included: institutional sites of the government, institutional sites of the various ministries, the chamber of deputies and the senate, institutional sites of regions and municipalities, para-state and governmental bodies, national agencies, public health companies and public hospitals, and international organizations
Cultural websites	Encyclopedias (<i>Wikipedia</i> , <i>Treccani</i>) and vocabularies
Companies	Business-oriented companies, such as <i>Cisco System</i> , <i>Nestlé</i>
Research institutes	Universities or other research institutes
Self-employed workers	People who use their own sites to implement their customer base or for their personal branding

the Google result page and, thus, most likely to be seen (and visited) by users. The final dataset counts 1.335 websites, divided as follows: 55 for abortion, 45 for euthanasia, 230 for work, 130 for LGBTQIA+, 170 for migration, 160 for taxes, 205 for healthcare, 165 for innovation and digitization, and 175 for the environment. Afterward, we categorized the players appearing for each result into eight categories, according to the typology of actors owning the websites. Both researchers engaged in the coding process, which involved iterative rounds of individual coding and collective discussion. The categories were not decided *a priori* but emerged deductively from the data, following the principles of ethnographic content analysis (Altheide, 1987; Caliandro and Gandini, 2016). They are information channels, cultural institutions, research institutes, companies, political actors (including both pages of parties, coalitions, or individual leaders), institutions, and NGOs. In Table 1, we detail each category, providing a brief description of the type of actor it identifies. This specification appears to be particularly relevant in order to disambiguate overlapping terms and “lost-in-translation” types of nuances. Further analysis was directed at identifying recurring editorial groups, companies, and institutions behind the most relevant categories (in terms of numbers), which was carried out in a collaborative way by the authors, manually inspecting the websites included in the “news” category.

Findings

Looking at the typologies of actors present in the first five results, we notice that the majority of the websites are information channels, a broad category that comprises a variety of news and media outlets. Immediately following this category for frequency of occurrences in the dataset, companies and institutions are equally very present in our dataset (Figure 1). In the following sections, we look at the most prominent players across the issues analyzed, divided per topic, paying particular attention to recurrent actors, such as editorial groups (in the case of news outlets) or companies.

Abortion

Website results connected to the topic of abortion present a majority of information sites, which amount to 36.36% of the actors. It is interesting to note that all these actors are optimized. A further look at this category, which constitutes the most prominent group in this topic (and many others, as we will see), reveals the presence of two editorial groups: *Condé Nast* and *Gedi*. The first is a U.S.-based global mass media company, whose media brands include *Wired* and *Vanity Fair*—both present in the dataset. The second is an Italian media conglomerate, owners of national newspapers such as *La Repubblica* and *La Stampa*. These are followed by NGOs and cultural websites (specifically *Wikipedia* and *Treccani* encyclopedia), totaling 16.36% of the websites. While their presence is the same, the optimization level for these two actors is the opposite: Most websites of NGOs are optimized, and *Wikipedia* results are classified as “most probably not optimized.” Then, we find companies and institutions, respectively 14.55 and 10.91%. Most of the websites included in these two categories result to be optimized for the most part.

Euthanasia

Information websites constitute the predominant category (33.67%) of the first results outputted by the queries associated with the topic “euthanasia.” Furthermore, our analysis highlighted the presence of two editorial groups: *Mondadori* and *Wolters Kluwer*, both recurring four times (each) in the dataset related to euthanasia. *Mondadori*, the biggest Italian publishing company, appears because it is the owner of *My Personal Trainer*, a website spreading news and information around topics such as wellness, health, and nutrition. *Wolters Kluwer* is a Dutch information services company. It owns many of the information websites, and, as we will see, it is a recurrent player in other datasets as well. In this case, we find the site *Altalex*, the Italian newspaper of legal information.

Closely following the category “information channels,” we find sites of Non-governmental organizations (NGOs), counting 31.11%, such as *Fondazione Veronesi* and *Associazione Luca Coscioni*, an association advocating in favor of euthanasia. Other actors seem to have a minor impact (i.e., to be less frequently present) on the information landscape related

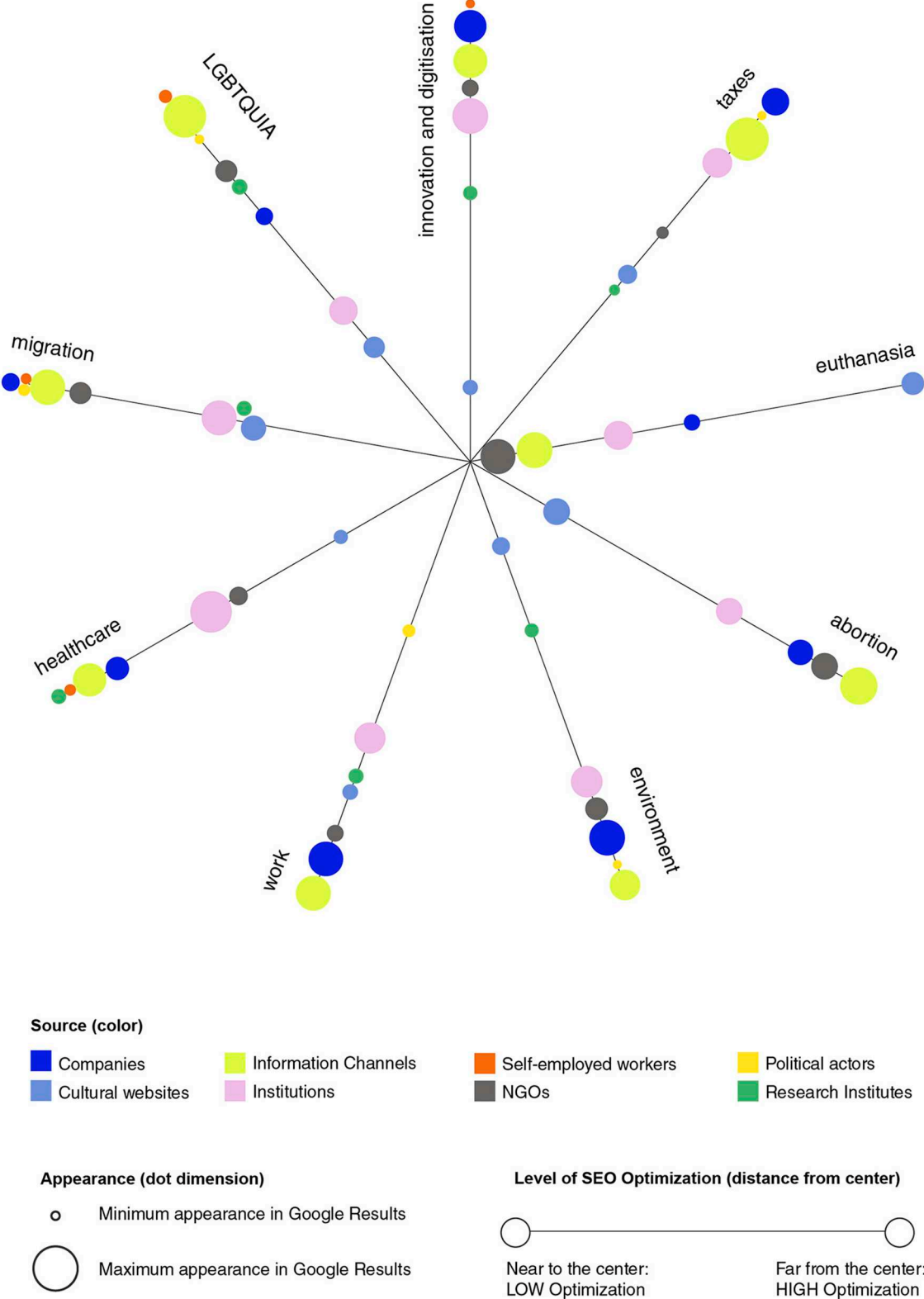


FIGURE 1
Optimization percentage per topic. Dot colors correspond to different actors (refer to legend), and their size corresponds to the frequency of occurrence in the dataset.

to the topic: These include institutions, cultural websites, and companies. Looking at the overall optimization level of the players identified, we can observe that most of them have probably made use of SEO techniques to boost their online visibility. A notable exception is constituted by cultural websites, here represented by *Wikipedia*, which is always not optimized: This result is in line with the findings of other topics too.

Work

As for work-related results, information channels (31.30%), sites, and companies (30.43%) represent—together—two-thirds of the actors in the dataset. Among the most influential editorial groups of the set, we find once again *Wolters Kluwer*, which recurs 11 times. In addition to *Altalex*, the other website present in the dataset belonging to this editor is *Ipsoa*, which—similarly to *Altalex*—describes itself as an online information service on taxation, financial statements, and accounting.

Another relevant group is constituted of institutions, which represent ~24% of the websites. Here, we find websites related to the Italian government, such as the page of the Work Department, the Ministero delle Imprese e del Made in Italy, INPS (the main entity of the Italian public retirement system), or unions' websites (e.g., CGIL). In addition to those, we find websites of local (i.e., regional) institutions, like ATS Sardegna, the web page of Sardinia region's healthcare system.

The remaining 10% of the results related to the study are fragmented into four categories: NGOs, cultural websites, research institutes, and political websites. Interestingly, political actors are the only category with a majority of non-optimized sites (60%), while for the other categories of actors, a significant proportion (if not the totality) of the results is classified as being optimized or most probably optimized.

LGBTQIA+

The web results connected to LGBTQIA+ issues present little differences from the other topics presented so far, with respect to the categorization of actors. Once again, “information channels” appears to be the most frequently occurring type of actor present in the dataset, with almost half of the results being sorted into this group. When looking at the most recurrent editorial groups, we note the presence of already found ones—e.g., *Condé Nast*, *Gedi*, and *Wolters Kluwer*—along with new ones, such as *Gruppo Maggioli* and *Avvenire Editore*, which owns the Italian newspaper *Avvenire*, affiliated with the Catholic Church. Belonging to the first one is the website *diritto.it*, which is a resource for legal professionals, providing the latest information on the law.

Institutions and NGOs follow, counting 10 and 9.23%, respectively. Among the first ones, we found the official websites of the Italian Senate of the Republic and the Chamber of Deputies.

Relevant NGOs identified in the dataset were *Amnesty* and *Pro Vita e Famiglia*, an association promoting and defending conservative views around (among others) sexual identities, marriage, and family. Cultural websites, companies, research institutions, self-employed workers, and political actors were identified as minor players: Individually taken, their presence does not reach 10%.

As for the optimization probability, all information websites have been classified as probably (or most probably) optimized. The same applies to political actors and self-employers. Other categories, such as companies, NGOs, and research institutions, show a majority of optimized results. On the other hand, institutions and cultural websites appear to be, for the most part, unlikely optimized.

Migration

Consistently with the other topics, information (32.35%) is here too, the biggest category, immediately followed by institutions (31.18%). A closer inspection of the editorial groups reveals the already-seen *Gedi* group (here represented by the Italian newspaper *La Repubblica* and *Huffington Post*). In addition, we find the national public broadcasting company RAI (specifically Rai Scuola and Rai News) and the Italian national daily business newspaper *Il Sole 24 Ore*, which is owned by the Italian employers' federation *Confindustria*. According to the classification operated by the software we used, most news outlets have most likely employed SEO strategies to boost their visibility on the web.

After cultural institutions (14.12%) and NGOs (10%), the tail of the actors is constituted by companies, research institutes, political actors, and self-employed actors. It is interesting to observe that the categories of actors in this dataset are mostly optimized, with the sole exception of research institutes and cultural websites, which appear perfectly balanced. Some categories are instead entirely optimized (companies, political actors, and self-employed workers).

Taxes

More than half (50.63%) of the websites connected to the topic “taxes” are information channels. Among them, we find several newspapers owned by *Network Digital 360*, a network of media outlets dedicated to the topics of digital transformation and entrepreneurial innovation. Examples of these outlets within this dataset include the website *Agenda Digitale*, *Corriere Comunicazioni*, and *Innovation Post*.

Institutions and companies come afterward, constituting, respectively, 21.25 and 17.50% of the total. Most websites of the category “institution” belong unsurprisingly to *Agenzia delle Entrate*, the Italian governmental agency that enforces the financial code of Italy. Among the most frequently occurring companies, we find portals of real estate advertisements for the sale and rental of apartments and houses, such as *Immobiliare*, *Idealista*, and *Immobili Ovunque*. Alongside those, there are websites for comparing rates for energy, online insurance, mortgages, and

loans, telephony (e.g., *SuperMoney*), or job search portals (e.g., *Ti Consiglio Un Lavoro*).

Cultural institutions, NGOs, research institutes, and political actors represent the marginal players in the dataset: Aside from cultural institutions (6.88%), the other actors do not reach 2% of the total, individually. Taking optimization levels into consideration, we can see that the majority of all the categories appear to be optimized. Political actors are, once again, entirely optimized.

Healthcare

The dataset of healthcare presents slightly different results when compared to the others since the ranking by frequency of institutions, and information is inverted. The institution is here in the lead, with 46.34% of the results. By inspecting the category, we found websites of many local sanitary systems (e.g., *ASL Roma*, *ASL AL*, and *Salute Lazio*), alongside national ones like, in particular, the *Istituto Superiore di Sanità* (ISS), the main center for research, control and technical-scientific advice on public health in Italy. Private institutions are also present: Among them, we mention private centers like *Futura IVF* and *IVI Italia*, both centers for medically assisted procreation, but also hospitals and RSA (e.g., Centro Residenziale Anziani “Umberto I”).

Conversely, information channels cover “only” 27.80% of the total. The biggest cluster of this group is composed of web pages from *Quotidiano Sanità* (QS), the online newspaper of health information, which is found 13 times in the corpus. Also quite frequently found is *Sanità 24*, the insert of the newspaper *Il Sole 24 Ore*, dedicated to health issues and the healthcare system.

The next most frequently found categories are companies (11.71%) and NGOs (6.34%). Within the latter, it seems relevant to note the presence of centers for research, like *The AIRC Foundation for Cancer Research* and the *Cystic Fibrosis Research Foundation (FFC)*. Cultural websites, research institutions, and political actors take, once again, the last positions—with <5% each. Apart from cultural institutions, which appear to be mostly unoptimized, the optimization level of the remaining categories of actors have definitely used SEO techniques to increase the visibility of their web pages: This appears evident in the case of information channels, and companies that are almost entirely classified as optimized.

Innovation and digitization

The results related to the topic “innovation and digitization” present some novelty with respect to the ranking of the categories too: Here, information channels (25.45%) come third, after institutions (31.52%) and companies (30.91%). Looking closely at the institutions present in the dataset, it is worth mentioning that most sites belong to the Italian Data Protection Authority (*Garante per la protezione dei dati personali*), which is the supervisory authority responsible for monitoring the application of the General Data Protection Regulation (GDPR). Other institutional websites belong to different government departments, like the Department for Digital Transformation (*Dipartimento per la Trasformazione Digitale*), involved in defining strategies for modernization through

digital technologies, or the Ministry of Enterprises and Made in Italy (*Ministero delle Imprese e del Made in Italy*).

Among the companies, the dataset features the U.S.-based multinational *Cisco*, the Italian telecommunications company *Tim* and Internet providers like *Ultraset*. The remaining categories (i.e., NGOs, cultural institutions, research institutes, and self-employers), taken individually, do not reach 5%. Political actors, like in many other cases, are absent.

Similarly to what we have observed for the “healthcare” dataset, all categories of actors appear to be optimized, with the sole exception of cultural institutions, which have a majority (~80%) of non-optimized websites.

Environment

As for the results obtained from the search queries related to the environment, the first position is taken by companies (32.57%): Unsurprisingly, most of them are gas and electricity suppliers, such as *A2A*, *Enel*, *ENI*, and *VIVI Energia*. Other recurrent players are *Octovo*, a marketplace managing a network of energy installers, and *Selectra* and *Papernest*, web companies specializing in the comparison of electricity, gas, and Internet offers. In addition to those, we also found companies selling products such as *Colgate-Palmolive Company* and *San Pellegrino*.

Companies are followed by institutions (24.57%), among which it is possible to find both European (i.e., the site of the European Parliament) and national realities (like the already encountered *Agenzia delle Entrate*, the *Ministry of Sustainable Infrastructures and Mobility*, and the *Ministry of Health*). Very numerous are then the websites of local institutions: In the dataset, we identified sites of different municipalities and regions (Umbria, Veneto, Piemonte, Emilia-Romagna, the Metropolitan City of Milan, and Turin).

Similar to the topic innovation and digitization, the category information channel takes third place (22.86%) for frequency of occurrences. Here, no editorial group appears to predominate the others: Among the most frequently occurring ones, we find again *Wolters Kluwer* (with the websites *Ipsos* and *Altalex*), *Network Digital 360* (Innovation Post), and *National Geographic*.

As seen for many other issues, NGOs, cultural institutions, research institutes, and political actors are found in the last positions of this ranking. Finally, the optimization level does not present innovation with respect to what has been observed so far, with a majority of optimized websites, especially in the category of “information channel,” where the totality of the pages has most likely employed SEO techniques.

The role of politics

The almost total absence of political actors is perhaps the most relevant finding of our analysis. As a matter of fact, only five out of nine of the considered issues report the presence of political actors: work, migration, environment, tax, and LGBTQIA+. Moreover, the category “political actors” always takes the last position of the players, ranked for the frequency of occurrences: In fact, political actors appear three times in work-related results, three times in the

migration dataset, and one time each for the remaining searches—environment, tax, and LGBTQIA+.

Nonetheless, we can observe that political actors have a prominent role with respect to their position in the page result ranking. In work, for instance, the first result output by the query *aiutiamo i lavoratori* (let us help the workers) is the official website of the Democratic Party (*Partito Democratico*), while the website of Pietro Ichino, senator for the Democratic Party, appears as the first result for the query “lotta al precariato” and third when searching for “riduzione dell’orario di lavoro a parità di salario.”

In addition to websites, social media pages were found in the datasets: The official Facebook page of Nicola Zingaretti, former Democratic Party secretary, appears as the first result when querying for *Italia più umana e sicura*. The Twitter account of Matteo Salvini and the Twitter account of his party, Lega Salvini Premier, feature in the second and third position on the page result for *stop agli sbarchi*. The three remaining occurrences of political actors are as follows: The official Facebook page of current Prime Minister Giorgia Meloni, who appears as a third result for the query *no al matrimonio tra persone dello stesso sesso* (topic LGBTQIA+); the Five Star Movement official website, second result of the Google search *ridurre l'impatto del trasporto merci* (environment); and Massimo Ungaro’s website (*Italia Viva* party), in third position for the query *abbassare tasse sul lavoro* (Taxes).

Looking at the optimization probability level, we can observe that—with the sole exception of the website of the Democratic Party—the rest of the political actors have been classified as being probably optimized. In particular, Matteo Salvini Twitter account, Lega Salvini Premier Twitter account, and Zingaretti’s Facebook page have a high probability of having implemented SEO techniques (i.e., are classified as “most probably optimized”).

Discussion

The article investigates the results outputted by Google search queries connected to nine key policy issues of the 2022 Italian electoral campaign, with the purpose of understanding which actors use SEO techniques to raise their visibility on the web. Our analysis revealed that information channels, institutions, and companies appeared most frequently in the first positions of the result page, whereas research institutes, cultural websites, and political actors were less significantly present. We also found that, with few exceptions (e.g., cultural websites), these categories of actors have most likely implemented search engine optimization strategies to climb to the top of the Google search result page.

From a global perspective, information channels are the predominant actors throughout the dataset. More specifically, we have identified the presence of large editorial groups, such as *Network Digital 360*, *Maggioli Group*, *Wolters Kluwer*, *Gedi Group*, *Condé Nast*, *Società Editoriale Fatto Quotidiano*, *Il Sole 24 Ore*, and *Mondadori Group*. It is worth noting that these actors usually traverse more than one topic: for instance, the *Wolters Kluwer* group appears in the results from queries connected to work, euthanasia, LGBTQIA+, and environmental issues. It is interesting to note that many of these websites are segment outlets, spreading information related to specific topics such as the legal one (e.g., *Altalex*), newspapers for accountants, medical doctors, and nurses (e.g., *Quotidiano Sanità*). Most importantly, the analysis

of the optimization level has shown that large editorial groups are associated with a high probability level of SEO usage.

Another relevant finding regards the presence of a sheer variety of local media outlets alongside national newspapers. This is, too, partially connected to the presence of large editorial groups relying on SEO techniques to boost the visibility of their media products. For example, *CitynewsSPA* is one the largest companies, which owns many local newspapers contained in our datasets, such as *Milano Today*, *Roma Today*, and others. These findings appear to be consistent with recent trends, showing an uptick in the sales of local newspapers.⁴ On this note, research on digital journalism explored the different strategies of value creation implemented by local newspapers in the transition from print to digital environments. Drawing from our results, we might argue that local newspapers, especially those owned by large editorial groups, implement SEO techniques to carve out a relevant role in the digital informational space (Ragnhild, 2021).

While informational channels are predominant in most topics, healthcare and the environment appear dominated by institutions and companies, respectively. As for the topic of environment, it is interesting to observe that many companies selling energy and gas (e.g., *Enel*, *A2A*, and *Eni*), or that provide renewable energy services or connectivity, use SEO techniques not only for their own institutional sites but also for their sites that pretend to be publications in support of climate change: Some examples include news about the circular economy, clean, or renewable energy, the ecological transition, energy efficiency, sustainable mobility, and green tech. In reality, these appear to be cases of house organs to actualize “greenwashing” strategies. It is not uncommon for companies to “invest in green marketing communications, to be perceived as eco-friendly and socially engaged” more than they actually are (de Freitas Netto et al., 2020). Digital communication and online marketing have contributed to the rise of the phenomenon of greenwashing (Gräuler and Teuteberg, 2014; Adi, 2018). Our analysis demonstrates that different companies have relied on SEO techniques as a communication strategy in order to build and promote their public image of eco-sustainable, further spreading the circulation of the phenomenon of greenwashing.

Similarly, the massive use of SEO by clinics and private practices could be seen as a marketing strategy put in place to increase the visibility of these facilities. On a broader level, this tendency may be connected to the rising popularity of Italian private clinics due to the issues connected to the public health system (e.g., prolonged waiting periods, inferior quality of the service provided, and geographical inequalities) (Cioffi, 2021). In this sense, private clinics and nursing homes, among others, may invest in the use of SEO to boost their searchability by potential patients. In doing so, these facilities would benefit from the exposure granted on the one hand by SEO techniques and by the popularity of these topics for advertising purposes.

More observations can be made with respect to the marginal role played by websites and social media pages of political actors in the context of this work. As our study points out, politics is almost absent from the collected dataset. This finding is quite surprising if we consider that all nine topics are politically relevant and that

⁴ <https://www.agcom.it/documents/10179/28529091/Studio-Ricerca%202-11-2022/d5e11837-cedc-49ed-9b09-c1f28e59fe31?version=1.1>

we extracted the keywords employed for the query from political programs. Adding to the fact that the data collection was performed in the days leading to the elections, we expected political actors to be significantly more present in our datasets in terms of number and variety. While finding a cause for this evident absence falls beyond the scope of the present research, we may hypothesize that political actors do not use SEO on social media pages, as they believe that users will find their account through the platform and not search engine results.

In conclusion, our study provides the opportunity to reflect on the impact of SEO techniques in shaping the informational landscape regarding controversial policy issues, like the ones considered here. This may be relevant to analyze how SEO determines the consumption pattern of the digital population and information has become capital. As Castells (2007) argued, “media have become the social space where power is decided.” The emergence of a networked digital space where information flows has significantly changed power relationships in the distribution of news. According to the scholar, central hub(s), whose ultimate purposes can be undisclosed to users, provide and control the flow of information (Castells, 2001). Similarly, in our dataset, such a role is played by large companies and editorial groups: The extensive use of optimization enacted by these players can significantly undermine the variety of the information ecosystem found online, boosting the visibility of a small percentage of actors, to the detriment of variety of opinions and sources.

The present research comes with several shortcomings, such as the limited time and geographical reach (limited to just the Italian case), which may have undermined the generalizability of the results obtained. Future research may expand the scope of the research, scaling the analysis to other geographical areas or producing a longitudinal study. Despite its limitations, however, we argue that the present study contributes to the ongoing debate on SEO and its consequences with a previously overshadowed empirical perspective. More specifically, our findings do not only shed light on the type of actors that may be most interested in employing SEO but also on the underlying interests that push these actors to implement these techniques. Ultimately, it provides initial reflections of the extensive and unregulated use of SEO on the consequences on users’ informational diet, which, unbeknownst to the web population, may be less varied and polyvocal than expected.

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Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

The whole research is a result of intense collaboration among the authors LC and GG. CD contributed to the data analysis and data visualization. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsoc.2023.1144669/full#supplementary-material>

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Exploring the use of WeChat for qualitative social research: The case of Italian digital diaspora in Shanghai

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The widespread use of digital communication technologies has created new opportunities for social research. In this paper, we explore the limits and potentials of using messaging and social media apps as tools for qualitative research. Building upon our research on Italian migration to Shanghai, we discuss in detail the methodological choice of using WeChat for teamwork, remote sampling strategies, and conducting interviews. The paper highlights the benefits that researchers may have from employing the same technology that the studied community uses in their daily life as a research tool, and advocates for a flexible approach to research that adapts its tools and methods to the specific requirements and characteristics of the fieldwork. In our case, this strategy allowed us to emphasize that WeChat represents a digital migratory space which played a crucial role in understanding and making of the Italian *digital diaspora* in China.

KEYWORDS

digital migratory space, Italian digital diaspora, digital methods, netnography, qualitative online interviews, WeChat, methodological innovations, social research

Introduction

This paper presents a methodological reflection based on our studies on the Italian community in Shanghai and focuses on the potential and limitations of using WeChat as an investigation tool for qualitative research. Our studies on the Italian immigrants in Shanghai began in 2018 as a qualitative investigation in the overall research project of the Documentation Center on New Migrations of the University of Salerno (Ce.Do.M.-UNISA). We used WeChat as the main tool for conducting our research and carry out interviews. WeChat is the leading internet communication system in China, offering traditional messaging, multimedia sharing, and represents a key element in the everyday life both for Chinese people and for the immigrant population in China. This tool was key in recruiting interviewees and creating relationship with local key informants, who were representatives of associations of Italians abroad or spokespersons for Italian cultural centers in Shanghai. On the basis of these studies, we analyze the benefits of using WeChat as a research tool. First, it helps researchers to create an informal environment where they can have frequent and real-time feedback that facilitates communication. Second, as we obtained the personal phone number or WeChat ID of key informants in Shanghai, almost all other communications were held online. This enabled us to implement a strategy of snowball sampling that allowed us to effectively reach a great number of people remotely and at no cost. Moreover, instant text and audio messages make easy to have asynchronous communications, that is key when working in different time zones. Third, as for other web-based tools, audio and video

interviews are free, easy to use and familiar to interviewees who only need their mobile phone. Fourth, since WeChat is a ubiquitous tool in the interlocutors' daily life, used for both professional and social purposes, this tool allowed us to gain deeper insight into the *digital lifeworld* of the community studied. In fact, Italian immigrants in China regularly update their WeChat profiles and share information, feelings, and ideas with friends and public. Having access to their digital space, we gained valuable insights into their daily habits, social activities, emerging problems, and work conditions. This provided us with access to a wide variety of supplementary material, which helped us analyze the interviews upon which the study was based. However, the large amount and the variety of this material prompted us to consider how best to utilize it for our research purposes. This poses a stimulating methodological challenge, which drives us to go beyond using WeChat as a data collection tool and reconceptualize it as a social object of enquiry to be explored using the netnographic approach. This shift in research method, which does not rely merely on the planned interviews, also poses practical and ethical challenges in terms of informed consent, data collection and analysis. These opportunities and limitations are discussed in the section "Challenges and lessons learned".

In the conclusions, the paper highlights the benefits that researchers may have in using the same communication tools that the examined community itself uses to build and maintain social relationships in their everyday life. It advocates for a methodology that is responsive to the unique needs and circumstances of each specific case study. This approach prioritizes the subjects' involvement in the research by avoiding the imposition of tools that only suit to the researcher's habits and needs.

This encourages us to make sense of the specific use that Italian community in Shanghai make of WeChat as a digital migratory space, thereby contributing to the broader debate on the digital diaspora.

WeChat in the context of the Italian migration to Shanghai

The most popular Internet-based communication system in China is Wēixìn (微信), launched in 2011 by the Chinese technology company Tencent. Since 2012, WeChat has been available globally as an international version of the original Wēixìn; the two are interoperable. For simplicity, in this paper we refer to both as "WeChat". Like WhatsApp, WeChat integrates the most classic messaging and multimedia sharing services with features that allow users to create and manage multiple groups, laying the foundations for the establishment of online communities. In addition, WeChat has a public message board for sharing images and short videos (Channel) and social networking features (Moments), which replace social media such as Instagram or Facebook. It offers mobile payment services (paying fines, booking taxis, food delivery, bicycle rental, etc.) with the possibility of starting and managing a business. With WeChat "City Services" you can also book doctor appointments, report incidents to the police, control traffic, and much more. All these features encourage users in China to use WeChat on a regular basis, whether for business, entertainment, or everyday social interactions with family

and friends. The attachment of Chinese users to WeChat is such that [Chen et al. \(2018\)](#) define the app as "Super-Sticky".

WeChat has been properly described as a «digital Swiss Army knife for modern life» for Chinese users ([Lee, 2018](#), p. 17; [Miller et al., 2021](#), p. 84). Recent literature has also highlighted that «WeChat is an essential part of the migration infrastructure» for both Chinese migrants throughout the world and foreign immigrant populations in China, since it compels them to live in the Chinese digital world ([Ryzhova and Koreshkova, 2022](#)).

Because the Chinese government restricts many Western social media, without WeChat immigrants would face not only marginalization in China, but also increased difficulties in maintaining relations with relatives and affections in homeland and around the world. On the one hand, using WeChat for immigrants is the most comfortable alternative if not a forced choice. On the other hand, migration to the Chinese digital world is not a neutral process. For Western people it contemplates a radical change in the cognitive landscape, which is affected by the ideological and value conflict between the two societies.¹

Our studies on the Italian immigrants in Shanghai began in 2018 as a qualitative investigation in the overall research project of the Documentation Center on New Migrations of the University of Salerno (Ce.Do.M.-UNISA). The main aims were: (i) to outline the profiles of Italians who decide to migrate to the Chinese metropolis of Shanghai; (ii) to understand the factors that influenced this decision; (iii) to collect stories and experiences of Italians in China to identify the opportunities and constraints they are experiencing in the new environment.

A significant part of the research was planned and completed before the outbreak of the COVID-19 pandemic. The empirical basis was obtained through individual semi-structured qualitative interviews *via* videoconference or audio-only call. We recruited 53 interviewees (28 men and 25 women) through a snowball sampling procedure from a core of local key informants, who were representatives of associations of Italians abroad or spokespersons for Italian cultural centers in Shanghai. Over time, we have maintained continuous contact with respondents and reached new ones.

After a few years, in spring 2021 we launched a new study on the impact of the COVID-19 pandemic on the migration of Italians to Shanghai. This focus involved 20 key informants, who responded to open-ended questions in writing. The network of relationships we have built with individuals and associations of Italians in Shanghai allows us to imagine the continuation of the research with longitudinal studies, enrolling new participants.

The research team included three researchers based in Italy and one research assistant in Shanghai. The scientific director was in Italy as well. Structuring fieldwork with the relocation of a portion of the team to Shanghai for a long period of time would not have been viable, both economically and because of career and personal responsibilities. There was the option of conducting face-to-face interviews entrusting the entire task to the Shanghai

¹ In this regard, [Miller et al. \(2021\)](#) describes the "red envelope" and "kinship card" functions as examples of incorporating Chinese culture and traditions into WeChat. Using these app features, foreign users are socialized to Chinese culture.

research assistant. However, such a strategy would hardly have laid the foundation for an ongoing relationship with respondents, which was necessary to observe changes over time. For this reason, we had assumed to carry out our study with interviews remotely by employing five more interviewers recruited and trained in Italy. In addition, because to the unexpected pandemic situation, face-to-face interviews would have been problematic.

Due to the peculiar characteristics of the population, the choice of a smartphone app to interact with them would have guaranteed more advantages than disadvantages. The research takes place in Shanghai, a metropolis with high levels of mobile penetration, and focuses on a young and cosmopolitan community of people who need to maintain their network of relationships in Italy and the world. Because government in China is interested in attracting skilled talent to support social and economic development in the country,² immigrants from Italy are generally highly educated professionals.

We needed a communication system that would allow us to make low-cost international calls and send messages, both synchronously and asynchronously, to easily communicate with people located in different time zones. It was crucial to allow them to participate in comfort, with a familiar and flexible tool, respecting their life and work times. We also considered that using an instant messaging app could make communication faster and more conversational than email (see [Hinchcliffe and Gavin, 2009](#)), strengthening bonds with respondents and thus reducing the risk of dropout.

Although in 2018 the literature on the use of WeChat in social research was scarce, we were aware of the increasing use of it to recruit participants for questionnaires or in-depth interviews in China ([Montag et al., 2018](#)). In just a few years, WeChat has become one of the most popular smartphone apps in China, not only for the size of the community but also for the increase in function with “mini-programs”.

“Here we only use WeChat and Alipay to pay. With WeChat you can pay for the taxi, too.” (I01).³

Since the outbreak of the coronavirus pandemic, WeChat has also been used to obtain and carry the “Health Code” (the Chinese digital pass). COVID-19 vaccination and test records can also be checked on WeChat ([Liang, 2020](#)).

“On WeChat you have your own health code, which is a sort of traffic light. You must hope every day that it is green! Green means you are free; otherwise... well, better stay at home.” (I02).

From the information gathered in the preliminary phase of the research and the personal experience of the research assistant in Shanghai, WeChat seemed to be the best choice. Subsequently, all the respondents confirmed that they prefer WeChat for their inside and outside China communications. We observed that Italian

immigrants use WeChat to actively engage in Shanghai’s Italian community and maintain relationships with family in Italy and Italians around the world ([Moffa and Chirivì, 2021](#); [Moffa, 2022](#)).

“To communicate with friends and family who are not here in Shanghai, some still use Skype. But it is very rare: WeChat is more comfortable. I only use Skype with my husband’s older parents... but as soon as we go to Italy, I will sign them up on WeChat.” (I03).

“I miss Italy. I have a fridge full of San Daniele ham! Luckily, with WeChat I am in touch with my world every day. I have many WeChat groups with family and friends. I have the group for the favorite team, the one for travel, the one for recipes and traditional dishes, or whatever. You can share photos and videos, you can joke ... You are together! Here all this would not be possible without WeChat. When I am in Italy, I also use WhatsApp, but it does not allow me to stay in touch with friends in China. WeChat connected us.” (I04).

Moreover, it seems that WeChat is also favored for institutional communications of Italian associations in Shanghai.

“We have a Facebook page, but we have not updated it for a long time. We use WeChat.” (I05).

“Now we only use WeChat... for everything. There is also a WeChat group for [the Italian association of migrants in Shanghai]. We are 150 members.” (I06).

WeChat as a tool for online interviews: Methodological considerations

Using WeChat with people living in China for social research offers many advantages and opportunities, but it also has constraints and disadvantages. Some of these pros and cons are presented in the following paragraphs. We will also distinguish between what we had planned and what emerged from the field work. In fact, our evolving experience with WeChat and its users has pushed us to move the research in unexpected directions.

A private group has been created on WeChat to have frequent, real-time feedback among team members in an atmosphere of informality that facilitates communication (see [Jailobaev et al., 2021](#)). The private group was also a “protected space” to acquire familiarity with WeChat and experiment with its various tools. Almost all the members of the research team have used the app for the first time and the research assistant has guided us toward a conscious and efficient use.

We preferred to avoid using WeChat to share sensitive documents, such as the outline of semi-structured interviews and the transcripts, to avoid the risk of banning. It is well known that the Chinese government controls and censors the material that circulates on WeChat (see [Sun and Yu, 2022](#), p. 260). There is proof that they run an algorithm to track and ban posts and accounts that use sensitive keywords ([Ruan et al., 2016](#)). In fact, a team member was banned from WeChat after submitting a draft question on the impact of COVID-19 and China’s lockdown strategy on Italian migration.

² Local authorities in Shanghai, especially, have undertaken special initiatives for skilled immigration ([Centre for China Globalization, 2017](#); [Tao et al., 2022](#)).

The initial contact with key informants was made by our research assistant in Shanghai. This interaction usually took place face-to-face; subsequently, almost all other communications were held online.⁴ Once their personal or institutional phone number or WeChat id was obtained, the scientific director contacted them on WeChat. Through text messages, the scientific director explained the purposes of the research, and collected suggestions about the topics to explore and the people to contact. In this way, the key informants were actively involved in research, entrusting them with a privileged role in a sort of “collaboration agreement”. Most of the key informants gladly accepted this agreement and are still collaborating in the development of the research.

Key informants played a leading role at the beginning of the study. After analyzing the relevant scientific literature on the topic, we needed to learn more about the emerging issues and the current living conditions of the Italian people in Shanghai. The specific objective was to clarify the analytical parameters on which to build the outline for subsequent semi-structured interviews. From their privileged point of view, local key informants suggested new themes and little-explored aspects of the Italian migration phenomenon. In addition, key informants were the starting point for the sampling plan according to a snowball strategy.

WeChat has been particularly useful in recruiting potential respondents thanks to the digital “name card” feature for sharing contacts. By submitting the name card, a person can share his or her contacts with another WeChat user if both are on his or her WeChat contact list. The name card includes public profile information, such as username, profile picture, possibly real name, gender, telephone number or email address. Furthermore, the sender can add a few lines of presentation. Only fifty characters are allowed, including spaces.

Those who receive the name card can send a “friend request”; by approving the request, the person contacted opens a new communication channel on WeChat. Similarly, knowing the username or mobile number, you can send any user a friend request attaching a brief introduction to your contact details. We have always attached the official link to provide all the information about the context and purpose of the study. In this regard, we found the importance of building a solid digital identity for the team and individual researchers both in WeChat and on websites that people can reach independently and at any time.

We were surprised to see that some of our primary informants have set up group chats to introduce us to their contacts. For instance, the presidents of cultural circles frequently introduced us to their colleagues in the association’s main group or by opening a new one for that purpose. The desire to share experiences and be heard has made these chat groups similar to “spontaneous” online focus groups. This provides good opportunities to collect textual and relational data for further analysis.

Thanks to these online interactions, we were able to reach many Italian immigrants in Shanghai, improving our sampling. The disadvantage of relying excessively on a WeChat-based sampling

strategy is that owning an account and knowing how to use it is a barrier that prevents us from reaching people who are less technologically informed or who do not use WeChat. But this is, likely, an unusual condition among the subjects of our interest. It is worth saying that they were free to communicate with us in other ways, but this never happened.

Online text messages are used for both the initial contact and for scheduling the interview. A significant advantage of asynchronous communication is that «the availability of a persistent textual record of the conversation renders the interaction cognitively manageable, hence offsetting the major “negative” effect of incoherence in spoken interaction» (Herring, 1999). It also helps to overcome the barrier due to the different time zone in the delicate recruitment phase (O’Connor and Madge, 2016, p. 417).

Once availability is achieved, the scientific director introduces the interviewer and respondent to each other *via* the “name card” tool. At this stage, it is made clear that the interview requires the right attention, with a specially dedicated time and space, so it is necessary to make an appointment. Then, interviewer and interviewee reach an agreement *via* WeChat.

We preferred to use email rather than WeChat to confirm the date and obtain informed consent. The email communication sent from the institutional account guarantees greater formality to the interview request. The email also allows us to attach important documents without triggering WeChat’s censorship algorithm. Together with the leaflet that reminds them, once again, of the context and purposes of the study, we deemed it appropriate to anticipate in writing the questions we would ask. In accordance with agreements, the interview took place with an audio or video call on WeChat.

Right after the interview, the scientific director contacted the interviewee *via* WeChat to thank him. This was a key step because it allowed us to take care of the relationship with the interviewee and keep open a communication channel for further reflections and future insights. Later, the transcript was emailed to each interviewee to obtain confirmation about the fidelity of the data and the release for use. This method gives respondents the opportunity to better clarify their point of view, correct any mistakes, or add additional considerations that they feel are worthy of attention. In this way we ensure that the text analyzed and presented in the research results has been approved by the actors involved.

The main advantage of phone interviewing through WeChat is that it is free, easy to use, and familiar to respondents. The call works over the internet and can be taken from both a smartphone and a computer. Using WeChat, we avoid asking them to download and install additional software, sign up for an account, and learn how to use a new tool. It should also be considered that using non-Chinese software in China, such as Microsoft Teams, can be complicated due to government restrictions. Getting around these blocks requires technical skills that we could not take for granted.⁵

One downside is that WeChat, unlike Microsoft Teams or Google Meet, does not have a built-in feature to record and transcribe the call. After obtaining explicit consent to registration, we had to proceed with an external device. Since respondents

⁴ Before COVID, more than one interlocutor invited us to be their guests in Shanghai or to meet them in Italy. When the meeting took place, it was an opportunity to strengthen the bond and further expand the network of contacts.

⁵ You can access social media and government-censored apps from China using virtual private networks (VPNs).

mainly used WeChat on their smartphones, the second downside concerns the multiple distracting factors for notifications or phone calls that came in during the interview. Based on our experience in the field, we assume synchronous interviews *via* WeChat (or other smartphone apps) are more prone to interruptions or postponements due to interference than face-to-face interviews. The third downside is that most of the time the video call turned into an audio-only call, excluding the possibility of observing body language and the environment.

The second phase of the research followed a different method. The focus on the pandemic was possible precisely because, about a year after the end of the previous study, a digital community of Italians residing in China had already been formed around the research team. From this community, through one-to-one messages or group chats on WeChat, the need emerged to investigate the impact of the pandemic crisis on Italian immigrants in China.

For exploratory purposes, emerging issues were first covered in short individual interviews on WeChat *via* instant messages or short audio recordings. Then, after establishing the research questions and the key concepts, we recruited a panel of informants and sent them a semi-structured interview with written and open answers. To the spontaneity of interactions on WeChat, we have associated a type of interview that produces authentic texts with greater reflexivity. In both cases, the advantage is to collect the written text directly without the need for transcription.

Beyond the interviews: Insights and supplementary material from WeChat

As anticipated, throughout the long duration of the research we managed interactions with our respondents and key informants through WeChat. In this way, we have been able to get closer to the *digital lifeworld* of our interlocutors, who use this tool daily and pervasively both for work and social life.

Although the specific object of our studies was not the use that Italian migrants make of WeChat, respondents often brought this theme to our attention. They told us how it is helpful for shopping, organizing trips, promoting cultural or leisure activities, or simply exchanging information, photographs, videos, and documents: “I don’t really know how to do without it.” (I07).

Using an instant messaging tool facilitated the construction of a mutual and fruitful relationship between the researcher and the subject of the investigation. Over time, this digital relationship has produced much more material than we requested and expected. By “expected material”, we mean what we collected according to the research project. It is basically about records and texts we obtain from online interviews and notes from the interviewers.

As mentioned, the interviews were conducted by trained interviewers; the other contacts, before and after the interview, were maintained by the scientific director. During these interactions on WeChat, respondents and key informants spontaneously sent us a lot of material. These are text messages, web links, photos, videos, and digital documents that deepen their opinions on the topics of the interview but also GIFs, emojis, and memes. In this mass of this “supplementary material”, we distinguish between what

respondents themselves have produced and the material taken from the web or from other WeChat users.

The first set of materials includes photographs they took “in real time” during a conversation to share with us their life in China. This often happened as an answer to a question from the researcher, not only during the actual interview but also in the interactions before and after the interview. Taken as a whole, these photographs constitute a valuable archive that can be explored through the lens of visual sociology.

We interpret these events as a sign of respondents’ involvement in the research. It is also a desirable byproduct of employing a versatile tool that offers the interviewee several opportunities to respond to a stimulus beyond the simple text or audio message. In addition, because chat messages are recorded and communication proceeds asynchronously, the door for new interactions is always open.

In particular, those who are part of associations or clubs continue to share with us the appointments, initiatives, and publications of their community. At their invitation, we are still subscribed to the WeChat channels of these people and organizations.

The possibility of exploring a large amount of material published on personal and institutional WeChat channels of Italians in China suggests a further distinction between “direct” and “indirect” material. By “direct” we mean what the subject has sent us firsthand and voluntarily. By “indirect material” we refer to everything that constitutes the digital trace of the subject and is independent of our intervention.

WeChat users, including our interlocutors, curate their profiles by updating their photographs and “status” messages; through Moments, they share emotions and information with their existing friends, who respond with *liking expression* (Chen et al., 2019; Li and Wang, 2021); they interact with small or large groups or share their ideas with the public in Channels. By exploring WeChat, we learn about their daily habits, worries, joys, and emerging social problems. Following the personal and club channels, we find posters, photos, videos, and other material that tell us a lot about what social and cultural activities are organized by Italians in China, what is the level of involvement, and what is the mood of the participants. We also find out about social problems, working conditions, and career opportunities. Precisely the wealth of “supplemental” and “indirect” material that is available in the digital world that Italian migrants in China build on WeChat allows us to understand more deeply the reality of their daily lives. In short, thanks to WeChat, we can participate in the same Chinese (digital) world in which our interlocutors live, regardless of where we are physically.

Especially in reference to the pandemic, this method has allowed us to access a distant and otherwise impenetrable world. A world that seems alien to us but for the subjects of our research is everyday life.

During the early stages of the pandemic, key informants kept us updated through WeChat messages about the situation in Shanghai. In mid-January 2020, along with sending us GIFs of greetings, several messages expressed worries about the potential spread of the new virus during the Chinese New Year celebrations. On January 24th, some sources shared their concerns about COVID-19 and lockdown.

In February, through WeChat, we were engaged in the initiatives to send our compatriots in Shanghai masks for personal protection from contagion. From key informants, we receive reassuring news about the Chinese government's ability to contain the spread of the infection and its economic impact. The stories about the new difficulties faced by foreigners in Shanghai were more worrying, especially for the "broken families" between China and the homeland.⁶ In the following year, some messages underlined the progressive decline in the living conditions of Italian migrants in Shanghai.

The situation for the Italians who are still here has totally changed. "Bad winds are blowing". Many are leaving. It is not just about lockdown, quarantine, and prevention measures. The price of airline tickets goes up... Furthermore, there is the problem of vaccination...

On the one hand, supplementary material lies outside the original research design; on the other hand, it provides us with a deeper understanding of our research object, allowing us to formulate new challenging questions. To enhance this material and experiences on the (digital) ground, we are called to modify the research design by assuming a *netnographic* position (Kozinets, 2015).

Challenges and lessons learned

Because it was simple, multimedia, and conversational, using WeChat pushed us beyond what we had planned. One of the strengths of using WeChat for our qualitative social research—even just concerning solely interview-based study—is that our ability to analyze respondents' stories improved in empathic understanding through a process of *perduction* (Piasere, 2002). The research team had the opportunity to attend continuously and for a long time a part of the digital world of which the subjects of the study are inhabitants and creators. Of course, as vast as this digital world is, it is only a little window into the world of Italian migrants in Shanghai. However, inhabiting a common space on WeChat has allowed us to internalize—more or less consciously—some cognitive-experiential patterns of our interlocutors and, therefore, to better understand their narratives, problems, expectations, and hopes. In this sense, we were able to deepen and integrate the online interviews (audio, video, and text-based) with a form of online participant-observation.

The second strong point is that the attendance of our informants on WeChat has allowed the building of a sort of panel that we can easily engage for further studies in a longitudinal approach. The availability of a large group of informants, easily reachable *via* smartphone, allows us to activate new interview-based studies or to draw information from their digital track on WeChat. The key informants themselves, who are leading figures of the Italian community in Shanghai, urge us to continue the research and expand it to new themes. Already in 2021, after sharing the reports of the first phase of the research, the common need to continue research with a focus on the pandemic emerged. Today

the informants themselves insist on the need for in-depth analysis, since the feeling is that the recent change in the working and living conditions of Italian migrants in China is not only linked to the pandemic crisis. Rather, the pandemic may have been a catalyst for transformations already underway in the Chinese government's migration policies (Moffa, 2022).

"The living conditions of the Italians here are changing, and it is not just due to COVID. You should conduct an in-depth study." (I08).

"We need a new study; things are changing fast." (I09).

"An interesting topic to explore would be the choice of many Italians to move to inland areas of China." (I10).

The main weakness is that we have not used the full potential of WeChat as a tool for collecting data and as an online environment to be studied with a well-structured netnographic approach.

The classification and analysis of the large amount of supplementary material we collected requires a specific methodology. There are several paths we could take for the continuation of the research. Below we hypothesize some of them, drawing inspiration from the relevant literature on the topic.

As anticipated, we participated in several group chats frequented by Italians living in Shanghai. In some cases, these were already existing groups, for example, those of Italian migrant associations or circles active in Shanghai; in other cases, they were groups created by key informants specifically to introduce us to other people to interview. Among other themes, some topics relevant to our research are spontaneously discussed in these groups. Interesting discussions on WeChat also develop in the comments to the Moments and posts in the Channels. Submitting all these contents for analysis and disseminating the results would be stimulating. Nonetheless, questions of a pragmatic and ethical nature arise.

To constitute a relevant corpus for analysis, the whole text must first be subjected to a long and complex cleaning operation to select only the contents congruent with our research interests, eliminating what does not concern us. Then, there is the delicate problem of privacy and the collection of consent from many interlocutors regarding texts and other contents they produced for purposes other than our research (see Varnhagen et al., 2005).

For the online interviews, consent was explicit, and agreement to use the information they produced for research purposes was confirmed at multiple stages, before, during, and after the interview. In spontaneous interactions, both group and one-to-one, explicit consent may be missing.

In the case of direct interactions based on text or other authentic content, one might assume that consent is implied since that person has been adequately informed from the outset that we are conducting social research. This already questionable assumption becomes untenable in the case of interactions on WeChat groups and Channels.

Whenever possible, we preferred to always ask for explicit consent from the interested party; otherwise, we have refrained from publishing those materials. The same applies to excerpts included in this paper and in previous publications from the studies (Moffa, 2022). However, systematically gathering user consent for comments and other interactions on WeChat would be far-fetched.

⁶ For an overview on the study of *transnational family* see Madianou and Miller (2011), Madianou and Miller (2013), and Kilkey and Palenga-Möllenberg (2016).

Accepting the limitations of doing social research in a less “natural” and “spontaneous” setting, a possible alternative is to conduct asynchronously an online focus group. The method is to invite a select group of informants to join a WeChat group we created to discuss a research topic.

The advantages and disadvantages of the online focus group method with instant messaging apps are recently discussed in [Jailobaev et al. \(2021\)](#) and [Neo et al. \(2022\)](#). For further information on online focus group, we refer to [Murray \(1997\)](#), [Mann and Stewart \(2000\)](#), [Abrams and Gaiser \(2016\)](#), and [Barbour and Morgan \(2017\)](#). Here we limit ourselves to pointing out that online focus groups on WeChat are low cost, relatively easy to moderate and manage, mainly produces text-based interactions that we can analyze without having to transcribe. The asynchronous mode would allow everyone to participate from different time zones and take the time to read and reflect (as long as the chat is well coordinated). Participants, possibly encouraged by the moderator, can also share multimedia content like videos or photographs. The release for the use of anything shared on the group is collected from the beginning explicitly; however, respecting privacy remains a sensitive issue as anonymity on WeChat cannot be guaranteed by the research team. The entire discussion is recorded on the participants’ devices: the research team cannot control the dissemination of all or part of it to third parties. Another delicate issue is the risk of incurring a ban if topics or keywords unwelcome to WeChat’s censorship algorithms emerge in the discussion.

The second direction of research requires a deeper immersion in the digital environment inhabited by Italians in Shanghai. In studies based on interviews or focus groups, the researchers are clearly defined in the role of external subjects interested in listening to learn more about their research subject. They ask questions or introduce discussion topics. In our case, the research team, with a particular focus on the scientific director, was called to participate more and more actively in the social dynamics of the Italian community in Shanghai. Almost all the interactions we participated in, took place on and through WeChat in an informal environment that favored a more conversational and informal approach, even in relationships between strangers.

A clear sign of the transformation of the relationship in the direction of greater closeness between the respondents and the scientific director, in particular, is that the formal linguistic register soon gave way to more direct communication. Here is an example of this process. When speaking Italian with someone you do not know well, it is common practice to address the other in the third person, using the pronoun “lei” instead of “tu”. It was common for our respondents on WeChat to prefer informal language and to switch to second person during conversations, particularly for those cosmopolitan subjects who are more comfortable speaking English in everyday situations and less prone to use formal Italian writing.⁷

Another sign is that voice messages, emoticons, and other visual content have increasingly accompanied text messages as the relationship progressed. In this way, the story that Italian migrants tell us about their life in Shanghai is enriched with

content and depth, in new directions compared to what the interviews alone tell. Often, they send us photographs taken “in real time” or videos or other documents that testify to situations and events that are significant to them. Their intent was to involve us intensely in the narration of the daily reality of Italian immigrants in Shanghai, suggesting the keys to reading a complicated world that they perceived as immanent and distant at the same time.

Italian migrants shared with us photos of their travels, along the Shanghai Metro and beyond. We saw where they work, the magnificence of the skyscrapers, and the charm of the old part of the city through the cameras of their smartphones. Even if at a distance, we experienced with them the dramatic beginning of the pandemic ahead of the rest of the world. On WeChat, we follow the same people watching their Moments, participate in the same Channels and group chats, and keep up with the news that affects them but were unfamiliar to the majority of Italians.

Through the lens of our Italian migrants in Shanghai, we have been able to observe some phenomena as they have occurred, even earlier than the rest of the world in the case of the spread of the COVID-19. It would have been difficult if we had limited ourselves to interviews. In short, because the daily lives of Italians in Shanghai include online exchanges on WeChat, we were a part of their lives for nearly 4 years (see [Hallett and Barber, 2014](#)).

The interaction has gone beyond the conventional roles of observer and observed on several occasions. Some of the people observed, who are in charge of organizations, academics, or Ph.D. candidates, approached us for advice and support in their social research, recognizing our role as experts. They have made us participate in their research objectives, sharing projects and study materials on various topics concerning the life of Italians in China, from everyday life to industrial issues. Other times, they have turned to us to seek solutions to the practical problems of the Italian community in Shanghai. In this type of relationship, the observer turns into a resource and a point of reference outside the community. This happens precisely because of the distance and the academic role covered by the researcher, who is entrusted with the task of interceding for them from Italy.

This has happened to a greater extent with the advent of the pandemic when new problems and needs emerged among Italians in Shanghai. An example is the difficulty in supplying mask to the community during the initial phase of the pandemic; another is the need for support to address limitations in international travel, which have divided families and put professionals and businesses in serious difficulty. Due to the complicated setting in which the interaction took place, which is typical of participant observation, we interpreted the findings reflexively, by taking into account our dual placement inside and outside the group studied.

This fully immersive experience helps us to shift our mental models toward a more global and less Eurocentric outlook. From all these considerations emerges the opportunity to pursue research in the direction of a well-structured netnographic approach ([Kozinets, 2015](#); [Kozinets and Gambetti, 2021](#)) which complements our broader methodological framework. By shifting the level of analysis from the discursive productions of individuals to the digital social relations within the social aggregation «that emerge from the net» ([Rheingold, 1993](#), p. 5), the aim is to focus on the implications of using WeChat for the digital diaspora of Italians in Shanghai in

⁷ We also see a general tendency to use a formal linguistic register in (rare) email communications, even when communication on WeChat was informal.

terms of identity building and social inclusion (digital and not) of the migrants in the host country.

In recent literature, we find some studies on the use of WeChat in the Chinese diaspora (Sun and Yu, 2022); rare are those on the use of WeChat by immigrants in China (Ryzhova and Koreshkova, 2022). By continuing our investigation, we intend also to contribute to the effort to «de-Westernize platform studies» (Davis and Xiao, 2021).

Conclusion

A rich literature on migratory phenomena has long underlined how the geography of migration has drastically changed in the international and global context, and how nowadays references to national borders are deceptive and outdated. In the Age of Migration (Castles and Miller, 2009), the routes of migration intersect, and the variegated socioeconomic compositions of individuals participating move within a setting where outflows, inflows, and transit flows coexist (Calvanese, 1992; Ambrosini, 2019). Within the broad debate on the topic, several studies now focus on *transnationalization* going beyond the conventional country of arrival/country of departure distinction and widening our perspectives on the topic (Glick Schiller et al., 1992; Vertovec, 1999; Faist, 2000; Ambrosini, 2008). Furthermore, scholars focusing on *digital migration* (Komito, 2011; Dekker and Engbersen, 2014; Kok and Rogers, 2017) and *digital diasporic groups* (Hiller and Franz, 2004; Alonso and Oiarzabal, 2010; Laguerre, 2010) are increasingly finding a voice in migration studies.

It is within this framework that this paper contributes to the debate on the new Italian emigration in Shanghai from a methodological perspective that takes into account the interactions produced on WeChat. With reference to our fieldwork, Shanghai is perceived by the migrants interviewed as a Megalopolis connoted by a liquid modernity (Bauman, 2000), in which they struggle to find a social and collective dimension typical of public places. According to what emerged from the analysis of the interviews, Shanghai is perceived as a «non-place» (Augé, 1992): «defined by stereotyped spaces, lacking relationships and frequented by groups of people in transit» (Moffa and Chirivì, 2021), who consequently live in a socially floating setting.

With the words of Ambrosini (2008), we have encountered *transmigrants* who conceive migration as a fluid, non-territorialized process. They nevertheless maintain «across borders a wide arc of social relations» (p. 45) thanks to the technological mediation of WeChat. As previously mentioned, this platform constitutes a powerful means to networking personal and professional relationship, experienced in a social space that is not conditioned by national borders. We argue that the contacts created in these particular digital settings lead to the creation of new types of virtual and international communities.

This further consolidates the dimension of transnationalism in which «the here and the there are thus perceived as complementary dimensions of a single space of experience» (Ambrosini, 2008, p. 48). WeChat is a tool that makes communication deep, dense, instantaneous, continuous, and

replicable and most importantly, helps to the breaking down of geographical borders by fostering the multidimensionality of the cosmopolitan migrant's experience. Through the analysis of the interviews collected, we realized how much this platform supports and encourages an «imagined community» (Georgiou, 2006) that, starting from the members of the physical diaspora and their families, spreads beyond.

From this perspective, it can be argued that the new Italian emigration to Shanghai encountered in our studies is comparable to what some experts on migration call the «digital diaspora» (Laguerre, 2010; Andersson, 2019). Indeed, it presents its three «building blocks», namely: (i) it is a migratory flow, (ii) it makes extensive use of information technology, and (iii) it shares information and weaves networks (Laguerre, 2010).

According to this line of studies, the strength of the digital diaspora lies in the possibility of recreating shared spaces in which «receive support in understanding and expressing the homeland culture and negotiate hybrid identities» (Brinkerhoff, 2009, p. 82). This is exactly what we found during our investigation, to the point that we ourselves, as researchers, have become—at least in part—members of that community, observing from the inside how Italian migrants in Shanghai deal with emergencies but also with ordinary problems due to the differences in culture and customs between the country of origin and the country of arrival.

Therefore, we argued that the interviewees inhabit a *digital migratory space*⁸ as a counterbalance to the *non-place* dimension they experience in Shanghai. In other words, the digital dimension allows them to free themselves from physical places and connect with other realities. It is in this space that the multidimensionality of the migration experience is realized. In this sense, the digital reality represents a *place-localized*, albeit diverse and fragmented. Through the WeChat tool, the interviewees find themselves inhabiting a space nurtured by connection practices, by specific proximity relations, in response to their need to hold together different universes (Italy, Shanghai and the relationships between them).

Tying up the knots of the proposed reasoning, we observe that on WeChat «multiple belongings» (Rocha-Trindade, 1990; Calvanese, 2000) take shape and consolidate as well as the different integration paths of our interviewees. Moreover, as Sun and Yu (2022) point out, for migrants and diasporic communities, digital communication technologies have become an indispensable dimension. For this reason, it is believed that research on the *digital migratory space* offers an opportunity to take a closer look at migratory practices. From this perspective, the study of interactions developed through digital media, which themselves become «places», appears essential for understanding the dynamics of modern diasporas and, more generally, the processes of social inclusion or, on the contrary, exclusion of migration.

⁸ The reference is to the concept of «migratory space» introduced by Simon (1979). For *migratory space* we mean the spatial dimension defined by the set of bonds that the protagonists of the migratory process constitute in their social relations in and across countries.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

GM and MD contributed to conception and design of the study. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

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To scrape or not to scrape, this is dilemma. The post-API scenario and implications on digital research

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Introduction: This article aims to investigate the potential impact of restricted social data access on digital research practices. The 2018 Cambridge Analytica scandal exposed the exploitation of Facebook user data for speculative purposes and led to the end of the so-called “Data Golden Age,” characterized by free access to social media user data. As a result, many social platforms have limited or entirely banned data access. This policy shift, referred to as the “APIcalypse,” has revolutionized digital research methods.

Methods: To address the impact of this policy shift on digital research, a non-probabilistic sample of Italian researchers was surveyed and the responses were analyzed. The survey was designed to explore how constraints on digital data access have altered research practices, whether we are truly in a post-API era with a radical change in data scraping strategies, and what shared and sustainable solutions can be identified for the post-API scenario.

Results: The findings highlight how limits on social data access have not yet created a “post-API” scenario as expected, but it is turning research practices upside down, positively and negatively. On the positive side, because researchers are experimenting with innovative forms of scraping. Negatively, because there could be a “mass migration” to the few platforms that freely grant their APIs, with critical consequences for the quality of research.

Discussion: The closure of many social media APIs has not opened up a post-API world, but has worsened the conditions of making research, which is increasingly oriented to “easy-data” environments such as Twitter. This should prompt digital researchers to make a self-reflexive effort to diversify research platforms and especially to act ethically with user data. It would also be important for the scientific world and large platforms to enter into understandings for open and conscious sharing of data in the name of scientific progress.

KEYWORDS

digital data, scraping, post-API, social media, digital methods

1. Introduction

How much have digital research practices changed in light of the changing accessibility of platform data? This is the main question that has been guiding the work and which aims to clarify whether and how much indeed we can speak of a post-API scenario, as is now the practice in the literature (Freelon, 2018; Bruns, 2019). The background hypothesis is that the closure of most Application Programming Interfaces (APIs) or their severe restriction by many social web platforms has, in some way, changed the practices of digital researchers. It all seems to have started with the well-known Cambridge Analytica (CA) scandal, which brought to light the ambiguous buying and selling of personal data from Facebook, for profiling users for political purposes. This scandal lifted the lid on a very severe privacy issue

in the digital world. The expected consequence was the stop of many social platforms on free access to their data (Freelon, 2018; Tromble, 2021; Özkula et al., 2022).

This has made the scenario of digital scholars much more complex, because empirical research, especially quantitative research, relies on the availability of data. The risk, which I consider in this contribution, is that the availability of data more or¹ less easily affects so much the way digital research is done, resulting in some platforms being “over-studied,” others being neglected by research, regardless of their popularity. From this premise arise the three questions of the paper: how much have constraints on digital data access changed research practices? Can we speak of an effective post-API era, that is, has there been an effective migration to other data scraping techniques? Finally, what are the possible shared and sustainable solutions for the post-API scenario? In the first case, I intend to explore the possibility that the difficulties in accessing data from popular platforms such as Facebook has actually radically affected how data is collected. In the second case, the hypothesis is that the scientific use of open platforms such as Twitter exploded after 2018. In the third case, this change since 2018 is possible that it has produced the need for a new consciousness toward data processing, especially from an ethical perspective.

Here, for simplicity of language and to follow most of the literature in the field, I mean by post-API simply the phase following the CA scandal and the consequences on data access limitations. In addition, I keep the concepts of “APIs” and “Web data scraping” (not infrequently used as synonyms) quite distinct, as for the former concept refers to the official applications provided by platforms for “controlled” data downloading. The second, on the other hand, is a concept that also embraces either manual data retrieval practices or handcrafted devices for scraping data from the Web.

2. Digital data and methods for scraping

The spread of Web 2.0 and social media have accelerated the process of “datafication” of society (Van Dijck, 2014; Amaturio and Aragona, 2019). They have become the information centers of our consumption, habits, and status. Therefore, social media are suitable for studying human and social phenomena, both for scientific research and for less noble issues such as marketing (political, economic, etc.). Social research today is increasingly convinced that the study of society cannot neglect digital phenomena and the content of social platforms. On the other hand, it no longer makes sense to divide the “real” from the “virtual” (Rogers, 2009). In other words, “digital” reality represents the evolution of our society that produces new data with which to interact through digital methods (Rogers, 2013; Amaturio and Aragona, 2019).

The epistemological issues surrounding digital data are particularly relevant to understanding the implications of API restrictions post-2018. Scholars such as Kate Crawford, Rob Kitchin, and Törnberg & Törnberg have explored how the

limitations on accessing and using digital data can have profound social and political implications. For example, Crawford has argued that the rise of algorithmic decision-making based on limited data can have negative consequences for marginalized groups (Crawford and Joler, 2018). Kitchin has also highlighted how the power to control and regulate digital data is not evenly distributed and can reinforce existing power structures (Kitchin, 2014). Törnberg and Törnberg (2018) highlight the need to move beyond a technologically deterministic view of digital data and instead consider the social, political, and economic contexts of data production and use. Similarly, Evelyn Ruppert’s work on the politics of data highlights how restrictions on data access and use can have far-reaching consequences for both researchers and the broader public (Ruppert, 2019). Understanding these complex issues is crucial for researchers seeking to conduct digital research post-2018 and navigate the limitations on API access and use.

It is a paradox, but this wide availability does not result in easy access to data. Restrictive privacy policies and the very nature of digital data (volatility, volume, size) make it difficult to obtain. Techniques and software for building digital databases are now highly desired. Two major families of data collection in the World Wide Web can be recognized. The first refers to digitized or virtual methods (Rogers, 2009), that is, social research techniques adapted to the online environment. For example, web surveys or long-distance interviews implemented with online services. On the other hand, the second includes digital methods, with Web data scraping (WDS) and techniques involving the use of Application Programming Interfaces (APIs). In general, WDS can be defined as the process of extracting and combining content of interest from the Web in a systematic way. WDS helps to take raw data in the form of HTML code from sites and convert it into a usable structured format. Not only that, manual extraction by simple copy-and-paste from Web pages is also part of WDS activities. Because a huge amount of heterogeneous data is constantly being generated on the Web, WDS is widely recognized as an efficient and powerful technique for collecting big data (Bar-Ilan, 2001; Mooney et al., 2015). To accommodate a variety of scenarios, current WDS techniques have become customized, moving from small *ad-hoc*, human-assisted procedures to the use of fully automated systems capable of converting entire Web sites into well-organized datasets.

WDS predates API extraction by more than a decade, but it has often been marginalized by APIs that have become easier to access. It is more flexible than API extraction because it can be used on most Web pages, not just those that offer APIs. Thus, it is a more versatile technique and, more importantly, more durable than API-based techniques, which, as will be seen below, are highly subject to the restrictive policies of platforms. Data scraping involves three main requirements that researchers must address. First, the scraping of social media data is a way to collect information from human subjects, so it must meet ethical standards accepted by the scientific community, such as preserving user privacy (Markham and Buchanan, 2012). Second, connected with the first point, a data scraping procedure should comply with the terms of service (TOS) of the platform from which the data is collected (Mancosu and Vegetti, 2020). Third, the data collected must comply with legal regulations that protect people’s data. In particular, as of May 2018, the European Union (EU) has issued a new regulation for individual researchers and companies, the General Data Protection Regulation (GDPR), one of the most stringent data protection laws

¹ API stands for Application Programming Interface, which acts as an intermediary, allowing websites and software to communicate and exchange data and information.

currently in place, which provides a set of restrictions to which scientific researchers using human subjects must adapt. And which, as will be seen below, is revolutionizing the way we approach data.

3. APIcalypse now?

For many years, the big corporate of the Web, such as Google and Facebook, have been exclusive owners of much of our data, handing it over to third-party companies with ambiguous goals. Up to that time, research made extensive use of this data, sometimes even with little care about privacy rules. The uncontrolled downloading of data was allowed mainly through filtering devices with platforms, called APIs, by which access keys were provided to the analyst to initiate scraping operations. APIs were the main tool by which researchers collected behavioral and digital trace data from Facebook (Fiesler and Proferes, 2018).

The scandal of CA, the company that has been using Facebook users' data for speculative purposes, has burst the bubble of precarious Internet privacy in 2018 (Hinds et al., 2020). Many web platforms have decided to beat a retreat on free data sharing. Shutting down the huge free flow of user data on major platforms has potentially reduced the prospects for studying an important slice of human society.

Among the likely consequences, discussed in the literature, at least four of them deserve to be highlighted. The first is that research would have flattened only on easily accessible data, thus neglecting varied and mixed approaches on different online contexts, at the expense of exclusively API friendly environments (Bruns, 2019; Caliandro, 2021). The second is that analyses are often conducted on secondary datasets, sourced on web depositories and thus often constructed with other goals in mind (Perriam et al., 2020). Finally, frequent violation of TOS has been reported, a consequence of researchers' attitude of circumventing social platform policies to retrieve data, such as through the use of unclear scraping techniques (Bruns, 2019). Also not insignificant is the possible contraction of data-based approaches, at the expense of less empirical approaches that bypass the burden of constructing digital data (Puschmann, 2019).

Researchers who have asked this kind of question while exploring the characteristics of the post-API scenario come to almost the same conclusion: the difficulty of finding data after 2018 has radically altered digital research, and the consequences, still in its infancy, could be traumatic and lead to heavy biases for present and future digital research outcomes (Freelon, 2018; Bruns, 2019; Caliandro, 2021).

Not everyone agrees with this negative hypothesis. Some data scientists and scholars of digital environments believe that this "apocalyptic" revolution has not occurred. On the contrary, the restrictions on platform data access probably can help improve the ethical and legal scenario on digital scraping (Fiesler and Proferes, 2018; Caliandro, 2021; Tromble, 2021). On the other hand, having unlimited data would have turned researchers away from their privacy obligations to users, and encouraged ambiguous data collection practices in violation of social media rules (Tromble, 2021).

Given the changes in research practices since 2018, it remains unclear to what extent these changes have affected different stages

of research (such as data construction and analysis). Prior to API restrictions, independent researchers had easy access to public user profile information, comments, and reactions to public posts *via* third-party APIs. This facilitated studies on the societal impact of social media. However, the discontinuation of these APIs has effectively prevented independent researchers from conducting observational studies on topics such as political and social behavior, as well as the spread of real and fake news, news network structure, and political engagement dynamics on Facebook's platform. As Facebook's APIs were the only means by which third parties were authorized to collect data from the platform, these restrictions have had a significant impact on research possibilities.

This has raised general concern among scholars, and sparked a debate around (potential) alternative ways to access crucial data to pursue social research on Facebook (Freelon, 2018; Bruns, 2019; Venturini and Rogers, 2019). Meanwhile, if one looks at the scholarly output built on digital data one realizes that progressively this is shifting toward Twitter, with a significant jump since 2018, the year of Facebook's closure (Figure 1). The paradox, however, is that information has not disappeared from the web, but instead is still publicly available. Scholars have also begun to discuss possible alternative methods of obtaining Facebook data, in what some scholars have already called the "post-API era" (Freelon, 2018; Bruns, 2019). Moreover, it appears that other platforms will follow suit by making it more difficult, if not impossible, to collect behavioral data easily and securely.

4. Materials and methods

4.1. Study and research questions

The study was created to explore the post-API scenario presented in the literature and to give, even if partially, an answer to these three questions:

How have constraints on digital data access changed research practices?

Can we speak of an effective post-API era, that is, has there been an effective migration to other data scraping techniques?

What are the possible shared and sustainable solutions for the post-API scenario?

To achieve this, we formulated three open-ended questions that asked participants to reflect on their experiences with digital research methods. The first question asked participants to identify any challenges they faced during the research process, while the second question focused on the most commonly adopted strategy for collecting data online. The third question sought to determine participants' preferred social platform for data collection.

The use of open-ended questions in research is a common approach and is advocated by several researchers, including Patton (2002) and Creswell (2014). Patton emphasizes the importance of open-ended questions in qualitative research, as they allow participants to express their experiences and views in their own words, leading to a more complete understanding of the phenomenon under investigation. Similarly, Creswell notes that open-ended questions are useful in exploratory research, as they allow the researcher to uncover a range of perspectives and experiences that may not be captured with closed-ended questions.

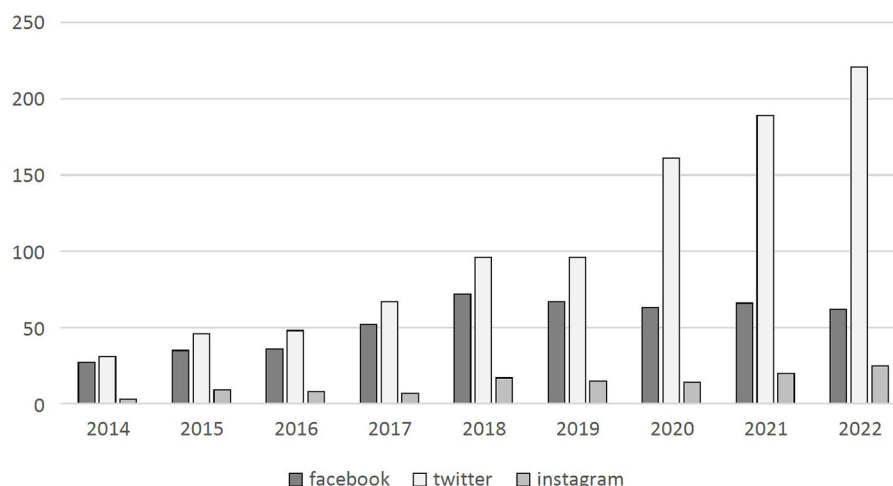


FIGURE 1
Publications on data scraping (2014–2022). Elaboration on dimensions data.

This method, which used asynchronous questions, encouraged the selected researchers to engage in an exercise of self-reflexivity on their digital research practices. This approach allowed the researchers to explore issues in-depth that are rarely reported in scholarly communications on digital research and are only mentioned in contributions to digital epistemology.

To provide more information on the methodology used to frame and analyze the responses, we can draw on the approach of Braun and Clarke (2006), which is a widely used framework for thematic analysis. This method involves several steps, including familiarizing oneself with the data, generating initial codes, searching for themes, reviewing and defining themes, and finally, producing the report.

4.2. Study group

The selection of researchers to be interviewed was done in the following way: the query search of the Scopus database was set up using certain keywords such as “digital methods,” “digital data,” “web analysis,” and “social media communication.” The top 18 Italian researchers by number of publications were contacted, considering the following quotas: 6 researchers for each of the three prevailing methodological approaches (mixed, qualitative and quantitative)². Within these quotas, a precise selection criterion was not to include researchers from the same department. An email was sent to the identified researchers, with a brief motivation and with the survey form attached, customized for each researcher, with a brief presentation of my cognitive purposes, guaranteeing the confidentiality of the responses. The 18 researchers contacted

all gave their willingness and returned the completed file within a maximum of 1 month.

5. Results

5.1. The three dimensions emerging from the responses

What are the three main macro-themes that emerge from the analysis of the responses regarding digital research? What are some of the challenges associated with collecting and interpreting data in digital research, and what are some of the strategies used to construct digital empirical material?

The three main macro-themes that emerge from the analysis of the responses regarding digital research are:

The complexity of doing research in digital environments, which involves dealing with different epistemological and methodological canons than traditional sociological research, and the challenge of constructing data due to the volatility and mutability of big data.

The use of WDS as an alternative method to APIs, which are secure but more constrained, and the impact on the platforms studied, such as the preference for social Twitter as an “easy data” environment for analysis of social phenomena on the web.

The use of web-scraping as a “necessary evil” for constructing digital empirical material, which can sometimes circumvent the terms and conditions imposed by the platform and raise ethical issues related to data privacy.

Some of the challenges associated with collecting and interpreting data in digital research include the accessibility of data due to API-related difficulties, the lack of cognitive access to the logic that governs algorithmic processes, and the risk of “banalization” in interpretation due to naive overenthusiasm toward the potential of digital methods. Some of the strategies used to construct digital empirical material include the use of digital

² The methodological placement of each scholar was decided by comparing myself with some more experienced colleagues in my department and, of course, by considering their scientific output.

tools found on the net and mostly free, learning mining scripts through programming software such as Python or R, and web-scraping techniques, which are sometimes seen as a necessary evil but raise ethical concerns related to data privacy.

5.2. The problematic steps of digital research: Collecting and interpreting data

The design of digital research shares much of the structure of traditional design. What changes is the way the different stages are processed, which are affected by the radically different nature of digital data. Typically, the formulation of research questions is different because they should consider new issues such as the digital divide, or the indeterminacy of the population studied, according to a post-demographic perspective (Rogers, 2009). In this very different scenario from traditional research, information gathering emerges as the most problematic because it is affected by the peculiarities of online environments.

The limitations, as revealed by multiple responses, mainly concern the accessibility of the data «due to the restrictions of APIs» (quantitative researcher 1). API-related difficulties are also epistemological: what are the processes that govern such applications? What impact do they have on the return of data and thus its fidelity? This invokes the general theme of data as a social construct and not as an object in its own right. It applies especially to algorithmic processes, which are seemingly “objective” but certainly lack neutrality because they respond to predetermined logics (Aragona, 2021).

The logic of how the API works is often unclear: for example, the Standard 1.1 version of the Twitter API states «(...) the Search API is not meant to be an exhaustive source of Tweets. Not all Tweets will be indexed or made available *via* the search interface» (Twitter, 2021). So not all Tweets are extracted, and what criteria excludes some of them? The data policy is unclear on this point. It is clear, then, how the issue of not having cognitive access to the logic that governs these processes excludes the possibility of having total control over the data collection phase. A condition, this, that cannot be ignored in the later stages of analysis and interpretation.

The issue of interpretation is precisely the other obstacle that insiders warn has a high risk of being oversimplified and losing its scientific rigor due to the «naive overenthusiasm toward the potential andgnoseological scope of digital methods» (qualitative researcher, 2). It is then pointed out that the real challenge is not «the possibility of retrieving a data or producing a result, the real challenge for researchers is to actually extract meaning, practical, critical and theoretical knowledge» (mixed researcher, 1).

This is the question, of absolute importance to the scientific community, of not falling victim to totally “data-driven” views but of not being impervious to perspectives that can play a decisive role in the interpretation of results.

All this needs an adequate problematization of the data, its limits and potential, its actual quality and its real cognitive power when theorizing on it is built with the intention of intervening on the reality under study to improve it or to allow a better understanding of it not only to insiders but also to gradually broader and broader audiences that can potentially be involved.

5.3. The construction of digital data. Web scraping as a “necessary evil”

What are the main strategies for constructing digital empirical material? Although some answers emphasize the relevance still of digitized methods *via* websurvey or digital ethnography, the difficulty of accessing digital data *via* APIs makes people devise a wide variety of Web-scraping strategies. Applications range from scripts in well-known programs (such as R and Python) to digital tools found on the net and which, depending on limitations or access, have enabled data retrieval on different sides (such as Crowdtangle, but also fanpagekarma and the similar). Again, digital tools available on the net and mostly free.

It is a fact that, indeed, the restrictions that started in 2018 have complicated scholars’ research tasks. However, this has by no means encouraged throwing in the towel. While for some the solution has been to rely on digital tools (in some cases for a fee) hooked into social APIs, others, on the other hand, have had to rediscover skills as true data scientists, learning mining scripts through programming software such as Python or R.

Still, in other cases the need for do-it-yourself solutions based on WDS techniques emerged, however, well aware of the ethical sensitivity of certain issues. Web-scraping is, in fact, always a risky data collection option as it can sometimes “circumvent” the terms and conditions imposed by the platform. API querying, which ensures that data is used/accessed in a manner compliant with the terms and conditions and, according to some, always preferable.

It is equally true that web-scraping is sometimes a «necessary evil (...)» as long as it is used under precise data collection and management conditions». Here is where the ethical issue of data privacy may become an important issue for researchers as well. Greater awareness on the topic certainly could have positive effects on the quality of doing research.

5.4. Twitter as the “easy data” platform

Among social media platforms, Twitter appears to be the most frequently studied by researchers. Simply because it is a platform from which data can be downloaded very easily, quickly and in large quantities. In addition, the data and metadata available and downloadable through Twitter’s API is in a format that is very easy to handle in analysis, whether qualitative or quantitative.

Twitter’s popularity among experts is due to the easy availability of the API, as the researchers interviewed confirm. They, in fact, are careful to point out that Facebook has much fewer public data and has stricter limits on its application programming interface. On the other hand, Tufekci (2014) calls Twitter the “model organism” of big data, precisely because the platform’s developers have implemented easy submissions to request APIs for tweets.

This “data gold rush” would lead researchers to use Twitter content (both tweets and profile information) to examine all kinds of aspects of human interaction. However, the non-randomness of the data acquired through these APIs means that Twitter studies have drawn conclusions based on substantially biased inferences. None of the public APIs guarantees the acquisition of all tweets matching the parameters of a query. Indeed, Twitter’s developer

TABLE 1 Typology of data scraping.

	API	WDS
MANUAL	Script (<i>R</i> , <i>Python</i>) → Twitter	Copy and paste → Facebook
AUTOMATIC	Tools API (<i>Storysaver</i>) → Instagram	Tools WDS (<i>Crowdtangle</i>) → all platforms

documentation makes it clear that the search API will not return all tweets, and the streaming API limits captures when query parameters correspond to more than 1% of the total volume of tweets produced globally at any given time (Twitter, 2021).

6. Discussion

The reflections that arise from this study can only be partial and, above all, not generalizable because the number of researchers interviewed is very limited and confined to the Italian scene, which could report even significant differences with the foreign world. Despite this, this exploration has tried to give an answer, although not definitive, to three questions that I try to develop below.

How have limitations to digital data access changed research practices? It is difficult to contest the thesis that restrictions to APIs have complicated the researcher's work in Web contexts. According to the direct accounts of those who “get their hands dirty” with digital data, indeed there has been a setback to empirical documentation construction practices. It has been perceived as the twilight of the “Data Golden Age” (Bruns, 2019). On the other hand, when it comes to the difficulties of retrieving data on the Web, the paradox is obvious: on the one hand, the humanities and social sciences are constantly increasing epistemological and methodological reflection on the availability of huge amounts of data (Amaturo and Aragona, 2019); however, on the other hand, the actual tools to retrieve these data are becoming more and more residual.

Can we talk about an effective post-API era? Some platforms more than others have restricted access to their data. The case of Facebook is exemplary: under the spotlight for the CA scandal, it has decided to turn around its API release. The closure of the data “spigot” by the most popular social media has evidently created discouragement and dissent in the scientific community. The outcomes, however, did not include a mass migration to non-API forms of extraction; rather, there was a shift to other, more “easy data” platforms such as Twitter. As confirmed by some responses, favoring certain platforms over others is also a predictable symptom of easier access to its data. The risk is that all of this may direct digital research, reducing the quality of scientific production.

What are the possible solutions for the post-API scenario? Web platforms that release their data easily and especially for free are becoming the preferred contexts of study. On the other hand, this invokes the epistemological urgency of having full knowledge of the construction process and theoretical foundations underlying

digital data (Amaturo and Aragona, 2019). There are two proposals that, between the lines, those who responded put forward. The first, in the shortage of applications to exhaustively collect digital data, research has sometimes been “encouraged” to bypass data privacy rules, often violating the platforms' terms of service. It is important, then, to create awareness of the ethical issues surrounding digital search, since it always involves data that refers to people. The second might be to create synergies between Academic Institutions and large Web platforms to promote the free sharing of data, at least at the scientific level. A few attempts have already been made in the past (e.g., Social Science One, founded by Facebook) but the results are not very appreciable, considering that the platform has the final say on research objects. This suggests that the transition to the post-API research world should be non-traumatic and should not completely disrupt the practices of digital researchers. As seen, the limited availability in accessing platform databases is creating a competition for those few environments that still leave their APIs open. A really important point, then, becomes the integration of scraping tools and platforms to preserve the “representativeness” of the research object. These mixed practices of data construction are gradually being consolidated.

The typology in Table 1 summarizes these concepts that have emerged from the content analysis of responses. On the one hand, there is the degree of researcher intervention (manual or automatic), on the other hand, there are the techniques (API or WDS). Four types of practices and related tools with predominantly adopted platforms emerge from the intersection. This typology suggests that each practice probably fits well with specific platforms. For example, those studying Twitter are more inclined to use programming scripts allowing the downloading of tweets, whereas, the known restrictions related to Facebook have probably pushed researchers of this social to migrate toward manual, copy, and paste type WDS strategies. As can be imagined, the methodological orientation of the researcher certainly plays a non-marginal role in the choice of data extraction strategies: while mixed researchers are comfortable among different modes of data retrieval (from API to copy and paste), quantitative researchers are more inclined to API forms of extraction (and thus more oriented to the Twitter platform), on the other hand, qualitative researchers are the ones who try experimenting with more varied forms of extraction (and also more specific Tools), to study emerging platforms such as Reddit or TikTok.

Constraints on platform data accessibility has certainly changed the scenario of digital research and digital methods. It has been observed, however, that this change has not meant moving out of the API era; rather, the ways of doing digital research have been reconfigured. Apparently, this change is resulting in a fragmentation of the ways in which digital data is being constructed, which, depending on one's inclinations (qualitative, mixed or quantitative) and, most importantly, on the availability

of time and money, is directed toward extraction strategies over others.

6.1. Conclusion

This article stems from a path of reflection that has accompanied and is accompanying me and my professorial colleagues' digital research work, especially in relation to the construction phase of empirical digital material. Although the Web is a gold mine of data, the data we need are not always immediately available to us and readily available. The Cambridge Analytica scandal of 2018 put a stop to the "gravity train" of digital data, especially for those on social platforms. Today, one has to undertake gyrations between applying for API access, subscribing to web scraping software, and good computing devices to create digital databases. These difficulties have not infrequently encouraged researchers to choose easier paths, perhaps reframing the questions and moving to analyse on the most "data-generous" platforms. Platforms such as Twitter, for example, still provide APIs with ease, putting doubts in the minds of proponents of the post-API paradigm. This, however, may have created quite a few biases: the most obvious one is that of the digital universe, only that small segment of users active on "easy-data" platforms would be studied. Therefore, it is not secondary for scholarly research to reason about the changes that take place in the big platforms' data policies, because these, as has been the case since 2018, can have very significant impacts on scholarly output and create relevant biases: do we study what is of interest or what is easy to study? API restrictions have had a major impact on academic research, and there is no doubt about that. However, rather than seeing it as a major loss, our research community can take advantage of this moment to critically reflect and improve. This initial exploration of the topic should stimulate digital research to reflect and rethink its scraping tools and the nature of digital data. These are pressing issues, because as heard directly from the voices of key research, there are indeed biases such as, for example, choosing one platform over another just because there is more accessibility.

Therefore, research should help explore new ways of scraping that are more ethical, that is, respectful of users' privacy; more sustainable, that is, open or low-cost; and, above all, more shared between the research community and the big platforms.

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Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Coordinated inauthentic behavior: An innovative manipulation tactic to amplify COVID-19 anti-vaccine communication outreach via social media

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Coordinated inauthentic behavior (CIB) is a manipulative communication tactic that uses a mix of authentic, fake, and duplicated social media accounts to operate as an adversarial network (AN) across multiple social media platforms. The article aims to clarify how CIB's emerging communication tactic "secretly" exploits technology to massively harass, harm, or mislead the online debate around crucial issues for society, like the COVID-19 vaccination. CIB's manipulative operations could be one of the greatest threats to freedom of expression and democracy in our society. CIB campaigns mislead others by acting with pre-arranged exceptional similarity and "secret" operations. Previous theoretical frameworks failed to evaluate the role of CIB on vaccination attitudes and behavior. In light of recent international and interdisciplinary CIB research, this study critically analyzes the case of a COVID-19 anti-vaccine adversarial network removed from Meta at the end of 2021 for *brigading*. A violent and harmful attempt to tactically manipulate the COVID-19 vaccine debate in Italy, France, and Germany. The following focal issues are discussed: (1) CIB manipulative operations, (2) their extensions, and (3) challenges in CIB's identification. The article shows that CIB acts in three domains: (i) structuring inauthentic online communities, (ii) exploiting social media technology, and (iii) deceiving algorithms to extend communication outreach to unaware social media users, a matter of concern for the general audience of CIB-illiterates. Upcoming threats, open issues, and future research directions are discussed.

KEYWORDS

coordinated inauthentic behavior, digital society, online manipulation, COVID-19 anti-vaccine debate, deceived social media algorithms, technology exploitation, online harmful behavior, authenticity of online public debate

1. Introduction

Coordinated Inauthentic Behavior (CIB) is an emerging manipulative communication tactic using a mix of authentic, *fake*, and duplicated social media *accounts* to operate as an adversarial network (AN) across multiple social media platforms. This article aims to clarify how CIB's emerging communication tactic "secretly" exploits social media technology to massively harass, harm, and mislead the online debate around crucial issues for society, like the COVID-19 vaccination.

Hiding the real identities of the *adversarial network's* leaders is part of the CIB deception. CIB campaigns mislead others about who they are and what they are doing by acting with pre-arranged or exceptional similarities (Cinelli et al., 2022). In late 2021, Meta removed an extensive anti-vaccine *adversarial network*, violently acting across multiple social media platforms to oppose COVID-19 vaccination (Gleicher et al., 2021; Graphika, 2021).

Hard-to-detect CIBs' manipulative operations, massively spreading disinformation, and attacking *unaware* targets and opponents could be one of the greatest threats to freedom of expression and democracy in the highly populated social media ecosystem (Woolley and Howard, 2016; Vo et al., 2017; Howard et al., 2018; Peretti-Watel et al., 2020; Hristakieva et al., 2022; Mehta et al., 2022; Nguyen et al., 2022).

Understanding more deeply the CIB online dynamics, extension, and technological failures is very important since there is a concrete risk that coordinated, repetitive, and harmful efforts “invisibly” impact attitudes and decision-making on crucial issues for our society without the general audience's clear knowledge of the problem. Consequently, reviewing recent work concerning CIB manipulative communication tactics becomes highly relevant to social scientists and the general audience, politicians, and policymakers.

Since CIB is an emerging phenomenon, it is still unclear how it “secretly” *operates via* social media and to what *extent* malicious agents' inauthentic (harmful) coordination could harm democracy and society. Moreover, how CIBs are deliberately organized, resourced, and reinforced by digital platforms' algorithms and paid services is still unclear, a little-studied phenomenon in social sciences that needs further investigation.

In order to clarify these issues, this article is organized into three parts: first, traditional theoretical frameworks that may explain vaccination attitudes and behaviors are considered. Second, current interdisciplinary and international literature is reviewed according to three research questions and dimensions: (a) CIB operations (contents, agents), (b) expansion, and (c) identification (challenges). In this context, a critical examination emerges from analyzing a rare case of COVID-19 anti-vaccination network removed from Meta at the end of 2021. Third, open issues, current limits, and a future research agenda on CIB manipulative tactics are discussed.

1.1. Hypothesis and research questions

The central hypothesis that moves this study's investigation is that emerging forms of coordinated inauthentic behavior exploit *platforms'* technology (features, *logic*, and vulnerability) to deceive the public communication debate.¹ Consequently, the research questions include the following:

(RQ1) How CIBs *operate*? Do CIB manipulative operations revolve around inauthentic content or malicious agents' tactics?

¹ These include but are not limited to organized tactics for psychologically silencing COVID-19 vaccination opponents and deceiving social media algorithms, online *anonymity* of perpetrators, and advertisement investments aimed at micro-targeting communication outreach.



FIGURE 1

The image is AI generated using a text to Artificial Intelligence art generator technology from deepai.org.

(i.e., psychological intimidation, mass harassment, and harmful behavior).

(RQ2) Could social media technology *extend* CIB's manipulative communication outreach? (i.e., exploiting current features, popularity index *metrics*, and social media paid advertisement services). How CIBs deceive social media algorithms?

(RQ3) What are the challenges in *identifying* CIB in the vast social media ecosystem? (Figure 1).

2. Vaccination attitudes and behaviors: From traditional theories to CIB

Vaccine opposition, hesitancy, and acceptance (Kata, 2012; Xu and Guo, 2018; Eichhorn et al., 2022) have existed as long as vaccination itself (Durbach, 2000) and date back to 1796 when the British doctor, Edward Jenner (1749–1823) invented the first vaccine against viral disease (smallpox) in the UK.

Theoretical frameworks and constructs based on empirical observations of human argumentations emerged over time (Murero and Rice, 2006). However, previous research (Fishbein and Ajzen, 1975; Brehm and Brehm, 1981; Moscovici, 1987; Kunda, 1990; Goertzel, 1994; Bandura, 1997; Blume, 2006; Hobson-West, 2007; Lunt and Pantti, 2007; Gobo and Sena, 2019; Vochocová et al., 2022) shows that traditional sociological and cognitive theories have not yet sufficiently evaluated the *manipulative* role of CIB on COVID-19 vaccination attitudes and behaviors in contemporary online debates.

The theoretical gap could be due, in part, to the fact that CIB has appeared in the social media ecosystem only recently. Since the

Cambridge Analytics scandal emerged,² organized manipulative campaigns have been rising on digital platforms.

3. CIB operations and expansion

3.1. Coordinated content and fake news

In 2017, Meta introduced the term “Coordinated Inauthentic Behavior”.³ CIBs have grown exponentially, in the last five years. CIB *coordination* appeared as a deliberated and resourced orchestration of malicious actors tactically exploiting technology features to reach specific goals (Gleicher, 2018). In online manipulation studies, the term *coordination* is essential because reaching a certain number of social media users is crucial to obtaining a successful communication outreach (Cinelli et al., 2022). The second term, *inauthenticity*, is still under discussion in the literature (Szczesniak et al., 2020; Zinovyeva et al., 2020), although in association with *harmfulness* has a more distinctive connotation for the analysis of online manipulation exploiting contemporary technology.

Early research on CIB operations concentrated on two essential aspects: fake *content* and malicious *actors*. Initially, research focused on *inauthentic content* since the CIB's operations often correlate with misleading and fake news. In this context, the broad definition of “fake” and “news” (Caplan et al., 2018; HLEG EU Commission, 2018) encouraged the development of alternative terminologies to narrow the issue (Wardle and Derakhshan, 2017). For example, terms such as “fake news commercially motivated” (Silverman, 2017) have described CIB as aiming at economic fraud (Mazza et al., 2022). Other authors have *expanded* the meaning of the term “fake,” including problematic information (Jack, 2017), while others have looked at contact points among similar occurrences. Examples include fake news and propaganda (Giatsoglou et al., 2015; Vo et al., 2017), propaganda and misleading information (Hristakieva et al., 2022), *disinformation* (Del Vicario et al., 2016; Lazer et al., 2018; Zhang and Ghorbani, 2020), *misinformation* and *malinformation* (Dame Adjin-Tettey, 2022), harassment and hateful speech (Zinovyeva et al., 2020; Hristakieva

et al., 2022), and personal opinions and radicalization (Santos et al., 2021).

3.2. Malicious agents: The case of COVID-19 anti-vaccine adversarial network

Over time, research on inauthentic and fake content pointed to a second danger: *malicious actors* (Borges do Nascimento et al., 2022; Dame Adjin-Tettey, 2022). Their coordinated efforts appeared to successfully spread inauthentic content by acting as an adversarial network (AN) harassing and intimidating the opponent's view.

In December 2021, a large adversarial network was removed from all Meta platforms (Gleicher et al., 2021) for *brigading*. Brigading activity “can range from highly sophisticated intimidation operations to stifle dissent, to crude harassment campaigns to drown out opposing viewpoints”.⁴

The network secretly coordinated repetitive operations, violently harassing and psychologically intimidating *supporters* of COVID-19 vaccination. The removed AN was interconnected to V_V, an anti-vaccination group that originated in Italy and France, which publicly reported engaging in violent online and offline coordinated operations.

CIB anti-vaccine malicious agents followed a structured *pyramidal hierarchy* of power, using a common language, and often adopted the same profile pictures within the group, coherently with previous research on manipulative networks' communication (Vo et al., 2017; Peretti-Watel et al., 2020). In this context, the AN removed by Meta appeared to rely on a structured combination of online agents (real, fake, and duplicated *accounts*) opposing what they called “the healthcare dictatorship” (Graphika, 2021, p. 5) and attacking the “Nazi supporters” (active vaccination promoters).

The leading actors used Telegram secret chat with self-destructing message features to spread orders and pre-arranged content, evade detection, and secretly train new members.⁵ Unlike their leaders, AN supporters often revealed their identity to promote genuine anti-vaccination active engagement in online and offline contexts, coherently with previous research (Hristakieva et al., 2022) on CIB proselytism.

3.3. CIB operations: Psycho-tech manipulation

The anti-vaccination network removed by Meta operated according to at least two manipulation tactics, often appearing together, to expand CIB's communication outreach: (1) psychological harassment

2 In 2018, when the Cambridge Analytics scandal emerged, concerns about the strategic use of online personal data, micro-targeting, and coordinated manipulation to influence attitudes and behaviors developed significantly, particularly in research analyzing CIB in online political debates and economic fraud.

3 Meta security policy states, “We view CIB as coordinated efforts to manipulate public debate for a strategic goal where fake accounts are central to the operation”. There are two types of these activities that we work to stop: (1) coordinated inauthentic behavior in the context of domestic, non-government campaigns, and (2) coordinated inauthentic behavior on behalf of a foreign or government actor. When we find campaigns that include groups of accounts and Pages seeking to mislead people about who they are and what they are doing while relying on fake accounts, we remove both inauthentic and authentic accounts, Pages, and Groups directly involved in this activity. Source: Meta on CIB Report, October 2021. <https://about.fb.com/wp-content/uploads/2021/11/October-2021-CIB-Report-Updated-Nov-5.pdf> (accessed December 9, 2021).

4 “We will remove any adversarial networks we find where people work together to mass comment, mass post, or engage in other types of repetitive mass behaviors to harass others or silence them”. Source: Meta, <https://about.fb.com/wp-content/uploads/2021/12/Metas-Adversarial-Threat-Report.pdf> (accessed June 14 2022).

5 Through videos, audio, and live interviews.

and (2) exploitation of technology *logic* (van Dijck, 2013) and features.

According to Gleicher et al. (2021), the anti-vaccine network's members identified themselves as “warriors” fighting a *psychological* war against COVID-19 vaccination sustainers in Italy, France, Germany, and other countries. The anti-vaccine *leaders* coordinated actions across multiple digital platforms (Facebook, YouTube, Twitter, and VKontakte) to psychologically mass-harass specific targets in online and offline contexts. For example, the removed network aimed at misleading and silencing specific *targets* who had publicly sustained vaccination—journalists, health care providers, politicians, actors, and social media influencers.

The psychological fight involved sophisticated intimidation operations in repressing dissent and violent harassment campaigns to obscure opposing viewpoints. CIB's psychological harassment included a massive use of techno-features such as *dislike buttons* (to disapprove of pro-vaccine posts), orchestrated negative comments to opponent's *posts*, or even requests to “suspend” specific (pro-vaccine) accounts by inauthentically and massively reporting misconduct (Porreca et al., 2020). The “psychological war” extended to *offline targets* too. Examples of online–offline coordinated destructive campaigns included intimidation of doctors and vaccination hub vandalism. Moreover, people were encouraged to book vaccine appointments and not show up in the hope that unused doses would expire and be thrown out.⁶ Images of offline vandalic acts were posted to social media as “proof” of success to share with others and achieve rewards in terms of hierarchical advancements (Graphika, 2021, p. 21).

The second manipulative tactic, in part already emerged in the previous examples, focuses on CIB's ability to exploit social media *technology* to extend communication outreach, coherently with previous literature (Zhang and Ghorbani, 2020; Mehta et al., 2022). Malicious attempts to harm the online debate on COVID-19 vaccination showed *interdigital* (Murero, 2014, 2022) disinformation patterns. Inauthentic coordination aimed at reaching different goals and media to spread disinformation (Graphika, 2021, p. 13) by using pre-arranged content, hyperlinks (Giglietto et al., 2020; Santos et al., 2021), and identical blocks of hashtags.

Explicit knowledge of the digital platform's *logic* and weaknesses seems to represent an opportunity for manipulative communication outreach (Nguyen et al., 2022). For example, COVID-19 anti-vaccine campaigns were repetitively posted on Meta's popular pages *unrelated* to the vaccination debate (music and entertainment, pop culture, and food) to tactically gain *digital visibility* and therefore increase algorithmic “popularity” ranking metrics (Hristakieva et al., 2022).

⁶ For example, in Northern Italy, thousands of “warriors” booked their vaccination spot online and then did not show up to get vaccinated, resulting in deserted vaccination hubs, a significant economic waste, and an impediment to others willing to get vaccinated, particularly during the beginning of the COVID-19 vaccination campaign, in 2021.

3.4. The degree of extension of CIB

The strategic use of social media *connectivity* in popular pages unrelated to vaccination appeared to successfully outreach vast networks of subjects, beyond anti-vaccine groups, through personal ties among friends and family members (Howard et al., 2018). However, the degree of *extension* a CIB communication campaign can reach still needs to be clarified in the international literature. In recent studies (Giglietto et al., 2019; Mehta et al., 2022; Nguyen et al., 2022), the extent of CIB operations seems to dramatically change, depending on at least three aspects: (1) the sum of each malicious actor's “popularity metrics” on social media, (2) the available budget to invest in digital paid services (i.e., advertisement), and (3) the role of digital platforms' deceived algorithms.

First, the actor or account “popularity” is a measure estimated by the platform's algorithms (quantity of followers, shared content, views, likes, comments, and more). Individual metrics mainly depend on two aspects (a) the *extension* of the digital activity each account can reach and (b) the *reactions* of others, such as the number of comments a post reaches, the number of likes/dislikes obtained, the type, and the number of emoji reactions and more.

A second aspect influencing the degree of *extension* a CIB communication campaign can reach is economic. Social media offer a range of paid advertising services that users can purchase to promote their posts for specific micro-targeting actions beyond their followers' reach. Questionably, but coherently with the social media business *logic*, a significant investment could enormously extend the range of communication outreach.

3.5. Deceived algorithms and communication outreach

Adversarial network attacks using CIB have already exposed the vulnerability of social media platforms' ranking and recommendation algorithms, both theoretically and empirically. By ranking and recommending “interesting” (or sponsored) content to the platform's users, social media algorithms can significantly advantage those interested in amplifying visibility and information outreach. However, combining paid ads or *quantified attention* (Phillips, 2018) and viral content could *deceive* digital platform algorithms' ranking and recommendation systems. For example, when CIB misleading contents reach “good-performing” quantity attention criteria and become *popular* and “interesting” to others, then (deceived) algorithms could spread disinformation faster (Mehta et al., 2022). Therefore, there is a concrete risk that *deceived* algorithm technologies may fortify CIB's manipulative tactics and communication outreach.

4. Challenges in CIB identification (and removal)

After several months of malicious activity, Meta announced that an extensive anti-vaccine network, inauthentically behaving as a “brigade,” was *identified* and removed from all its platforms.

Detecting CIB manipulative operations is challenging (Borges do Nascimento et al., 2022; Broniatowski et al., 2022; Curley et al., 2022) for digital platforms' security algorithms in the current scenario, where almost 5 billion people interact *via* social media.

In the last years, interdisciplinary studies have used sophisticated mixed methods (Amaturo and Punziano, 2021) to identify online communication issues, including artificial intelligence (Murero, 2020) to differentiate between authentic and inauthentic (manipulating) coordination of online campaigns (Vo et al., 2017; Jiang et al., 2021; Mazza et al., 2022).

The availability of adequate computational, economical, and human resources still limits rapid advances in CIB identification research.

Safeguarding the authenticity of the online debate is crucial for *unaware* social media users, the general audience, and society as a whole (Mazumdar and Thakker, 2020). Emerging sophisticated tactics may further threaten online debate's authenticity (Rao et al., 2021). Within this context, recent studies have shown that posting a substantial number of coordinated automated messages (i.e., *social bots*) can influence opinion trends (Howard et al., 2018) and amplify low-credibility information outreach (Shao et al., 2018). This evidence shows that recent CIB campaigns using a mix of artificial intelligence, innovative automated communication, and human-operated accounts (i.e., trolls) are becoming harder to identify (Boneh et al., 2019; Starbird, 2019). Social media corporations counter-measure CIB attacks on their platforms and remove emerging identified threats. However, it is still being determined to which extent digital platforms' security tactics are effective, over time, in protecting social media users' communication from CIB attacks since public access to private corporate platforms' security data is currently very limited (Broniatowski et al., 2022).

5. Final remarks

Coordinated Inauthentic Behavior is an innovative manipulation tactic that amplifies COVID-19 anti-vaccine communication outreach *via* social media. CIB has emerged as a worrisome and challenging phenomenon in three domains: (i) operative coordination, (ii) techno-manipulation extensibility, and (iii) identification/removal.

CIBs' manipulative communication could be one of the greatest threats to freedom of expression and democracy in the social media ecosystem (Woolley and Howard, 2016; Vo et al., 2017; Howard et al., 2018; Peretti-Watel et al., 2020; Hristakieva et al., 2022; Mehta et al., 2022; Nguyen et al., 2022). Recent evidence from the international and interdisciplinary research analyzed in this study clarified that *hard-to-identify* CIB manipulation could be dangerous to democracy and society because of how it is deliberately *organized*, resourced by malicious actors, and *reinforced* by digital technologies. CIBs mislead others, following manipulative goals and communication tactics, and hiding the identity of their leaders.

CIBs are a severe threat to unaware individuals interacting online, who might discuss public health policy issues with networked malicious agents,

sharing pre-arranged content and disinformation rather than with genuine opponents, debating in a democratic scenario.

The removal from all Meta platforms of an extensive adversarial network (*brigading*) revealed a violent attempt to repetitively manipulate the COVID-19 vaccine debate in Italy, France, and Germany by exploiting current technology opportunities and weaknesses (Gleicher et al., 2021; Graphika, 2021). CIB operations are not limited to online digital environments but extend to society (home- harassment to intimidate *influencers*, medical professionals, and their family members). Sabotage of the vaccination hubs booking system resulted in economic damage, public health challenges, and an impediment to others willing to vaccinate, particularly fragile and older people.

We should note that Meta has not (yet) authorized this author's request to access (big) data from the removed anti-vaccine adversarial network, limiting the possibility of empirically analyzing the phenomenon. To overcome this limit, in the present article, CIB dynamics were observed in different contexts to identify emerging threats to online/offline communication internationally. The manipulative influence of CIBs is rapidly growing in political debates (Howard et al., 2018; Giglietto et al., 2019) and online economic frauds (Cinelli et al., 2022; Mazza et al., 2022). Research on CIB and public health issues is rare and should be further developed in different contexts. Responses to cope with this complexity and its effects are in urgent demand.

Future research should address the social implications of repetitive harmful CIB operations and their extensions in different social contexts over time, across multiple media, and on specific targets (particularly social media heavy users). Also, traditional theoretical frameworks explaining online vaccination issues (hesitancy, opposition, and acceptance) should evaluate the intervening role of CIB manipulative campaigns on individual attitudes and decision-making. The measurement of the impact of CIB on individuals and society could offer crucial evidence to understand manipulative tactics and counteract them in depth.

In an emerging digital environment where machines can generate text in online discussions, and people expect to interact with genuine opponents, this study suggests that communication campaigns of public health initiatives should consider more deeply the role of malicious agents' coordinated efforts in massively exploiting (still) unregulated sophisticated technology and outreach communication goals. Safeguarding the *authenticity* of the online debate and identifying emerging online/offline threats due to advances in sophisticated technologies like Artificial Intelligence (Hagen et al., 2020; Murero, 2020; Rao et al., 2021) is crucial not only for the online communication debate but also for the whole of society. Multi-platform interdisciplinary research, rapid identification of upcoming digital threats, and strict regulation involving stakeholders may help design innovative, private, and public policy responses that mitigate, instead of increase, the potential manipulative effect of CIB in the pandemic time and beyond.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships.

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The social impact of distance learning in Roman schools: “Success,” social innovation, teaching practices

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Faced with the national emergency linked to the spread of COVID-19 in Italy, digital technologies have made it possible to carry out the ordinary activities of the various educational agencies through the main tool of Distance Learning (DaD). The intensive use of information and communication technologies (ICT) and the guarantee of accessibility represent an enabling prerogative for current education systems, enriching training in a variety of ways and opportunities which must be accessible to all. ICTs take on a propulsive function for change in schools because they make it possible to affect the school setting, to transform the learning environment by redesigning space, reorganizing time, modifying communication and socialization processes, encouraging, in students, the development of key competencies in digital literacy and media education. Considering the context of a school transformed and renewed by the teaching and training potential of ICT, it becomes central to reconstruct the requests and needs developed by the practitioners of educational policies to cope with the reorganization of teaching methods and times at the time of DaD. Starting from these premises, the paper focuses attention on the social impact (Stern, 2016) of DaD to evaluate: the extent and intensity of the methodological-didactic innovation required of teachers for the organization and conducting remote lessons; the increase—in students—of transversal and digital literacy skills (team working, problem solving, etc.) potentially associated with the use of ICTs; the involvement and collaboration of families in the process of assessing and verifying learning. The reflection is part of a broader research project by the University of Sapienza University of Rome entitled “The social impact assessment of DaD after COVID-19”; a 3 year evaluation research addressed to a typological sample of upper secondary schools in Rome classified on the basis of the Infrastructure and Equipment indicator of the Rav and the social effect of the school (school effect) on the academic performance of students in the tests Invalsi. The evaluation aimed to identify—from the DaD experience—indications useful in re-designing the school’s intervention strategy in the phases following the pandemic; for this reason it adopted an analysis perspective that valorized the positive and most successful aspects in the testimonies of the teachers and students involved in the first phase of the research (conducted in May–June 2021). Within the framework of the Positive Thinking Evaluation, the empirical evidence—collected through the administration/conduction of semi-structured interviews, focus groups, online ethnographic observation of the lessons in DaD—will allow us to reflect on some dimensions of success and of particular social innovation for the teachers’ teaching practices and the students’ learning processes in DaD. In the Positive Thinking Evaluation, success is a positive effect (not just a “good practice”), even an

unexpected one, of an activity that has produced a positive change in the context of program implementation.

KEYWORDS

distance learning, social impact, Positive Thinking Evaluation, digital skills, didactic innovation

Introduction

This paper focuses attention on the social impact (Stern, 2016) of DaD (Distance Learning during COVID-19 pandemic) in order to assess: the extent and intensity of the methodological-didactic innovation required of teachers for the organization and delivery of distance learning lessons; the growth—in students—of transversal and digital literacy skills (team working, problem solving, etc.) potentially associated with the use of ICT; the involvement and collaboration of families in the process of assessing and verifying learning. The reflection returns the first results of the background research conducted as part of the University project (Sapienza, University of Rome) on “The social impact assessment of DaD after COVID-19”; addressed to a typological sample of schools in Rome with students aged 14–19. The evaluation aimed to identify—from the DaD experience—indications useful in re-designing the school’s intervention strategy in the phases following the pandemic; for this reason it adopted an analysis perspective that valorized the positive and most successful aspects (Stame and Lo Presti, 2015; Lo Presti, 2019) in the testimonies of the teachers and students involved in the first phase of the research (conducted in May–June 2021).

Within the framework of the Positive Thinking Evaluation (Lo Presti, 2020), the empirical evidence—gathered through the administration/conduction of semi-structured interviews, focus groups, online ethnographic observation of the lessons in DaD—made it possible to reflect on some dimensions of success and of particular social innovation for the teachers’ teaching practices and the students’ learning processes in DaD. It is useful to point out that Distance Learning is not an entirely new practice in Italian educational contexts.

Other studies have focused their attention on the dominant role that falls to teachers as practitioners of educational policies and technological-didactic environments (Grimaldi, 2006) in order to transform the didactic and training potential of the Internet into good net-education practices—the latter defined as the set of didactic activities and learning processes that make massive use of the Internet as a technological infrastructure, and the web as a cultural repository. The interest regarding these policies and environments relies in their aim toward the needs of a generation of students—the digital natives—born within the context of the change taking place, accustomed to socializing with the school environment through digital technologies (Prensky, 2001; Ferri, 2011). Central to this research is the capacity of the new learning environments to stimulate student interaction, enhancing the cognitive and also the emotional component of learning, in order to guarantee the concrete development of transversal competences (social, citizenship, learning to learn) and of digital literacy—which appear increasingly central within the school curriculum.

Materials and methods

Evaluative thinking and social impact of digital in schools

Awareness of the multi-dimensional and changing nature of an educational program such as the DaD required the construction of an evaluation plan that took into account the elements of complexity and uncertainty, linked to the changes that educational policies have undergone and may undergo depending on the progress of the pandemic and the connection with other economic and social policies, which are having—and are expected to continue to have—a very significant impact on the life-worlds of students and their families.

The OECD DAC Network on Development Evaluation (EvalNet) has defined six evaluation criteria—relevance, coherence, effectiveness, efficiency, impact and sustainability—and two principles for their use. In this perspective, social impact evaluation means the qualitative and quantitative evaluation, in the short, medium and long term, of the effects of the activities carried out on the reference community with respect to the identified objective (Stern, 2016).

These criteria provide a normative framework used to determine the merit or worth of an intervention (policy, strategy, program, project or activity).

The adoption of evaluative thinking (Stame, 2007; Van der Knaap, 2017; Vo and Archibald, 2018) if useful for trying to capitalize on what is being experienced and learned from the DaD experience. From this crisis situation the adoption of a positive thinking approach—open to reconstructing the most successful stories (Tendler, 1992; Lo Presti, 2020) found in the testimonies of the teachers, students and families involved in the observation processes—has been able to offer, right from this first phase of background research, a relevant contribution to the understanding and critical analysis of complex programs (e.g., distance learning). The reconstruction of the actions and operational strategies implemented by the teachers allowed i. the functioning of distance education; ii. the improvement of student interaction and understanding in the new digital learning environments; iii. the reconciliation of the vital worlds that revolve around the student (school and family). In order to take a snapshot of the initial effects of DaD and DDI (blended or hybrid learning during the COVID-19 pandemic) on schools, students and families, an initial research phase was planned to reflect on how the interactions between teachers, families and students involved in the new DaD learning environments have evolved/are evolving.

In the digital inequality framework (Büchi and Hargittai, 2022; Decataldo and Fiore, 2022), it’s very important to transform the didactic and training potential of the Internet into good

net-education practices—that defined as the set of didactic activities and learning processes that massively use the Internet as a technological infrastructure, and the Web as a cultural source—other studies have focused their attention on the dominant role played by teachers, as practitioners of educational policies and technological-didactic environments (Grimaldi, 2006; Gui and Büchi, 2019) aimed at the needs of a generation of students—the digital natives—born within the context of change in act, used to socialize with the school environment through digital technologies (Prensky, 2001; Ferri, 2011). Central to these researches is the ability of new learning environments to stimulate student interaction, enhancing the cognitive and at the same time emotional component of learning (Buckingham, 2003), in order to guarantee the concrete development of transversal skills (social, citizenship, learning to learn) and digital literacy—which appear increasingly central to the school curriculum (Büchi, 2021).

Starting from this theoretical framework, the background research conducted in February–June 2021 involved seven schools in Rome with students aged 14–19, classified on the basis of a typological indicator that took into account: (a) the level (high, medium, low) of infrastructural and technological endowment of the schools (RAV, 2019–2021) and (b) the school effect (positive or negative) on the scholastic performance of 2nd grade students on the Invalsi tests in the basic disciplines (Italian and mathematics; RAV, 2019–2021/Source INVALSI).

In the inter-temporal comparing we have: (i) exploratory research phase (full emergence from COVID-19); (ii). extensive research phase (exit from emergence).

The exploratory research involved seven upper secondary schools in Rome and included an articulated research design, with the carrying out of focused interviews with class teacher coordinators; netnographic observation of lesson hours carried out in distance/blended learning (DL/BL) mode and focus groups with the students of classes that had gone back to presence in the 2020/2021 school years.

In terms of the activities carried out, the details are as follows:

(i) Twenty-six interviews with teachers; (ii) Seventeen hours of observation (1 h for each class); and (iii) Three focus groups.

The information collected through the interviews, focus groups and netnographic notes was organized through the use of a *meta-data sheet* that allowed for an indepth study of the experiences of the teachers and students with reference to the changes that occurred (in DL/BL times) on: (i) teachers' educational practices; (ii) students' learning modes; and (iii) teacher-student and student-student relations.

The indicators used for the ranking of schools reflect the importance of valuing infrastructural and contextual factors—such as the availability of a good internet connection and the social and cultural background of the students—, on which the main effects of digital didactics in terms of their effects on the strengthening/weakening of learning processes are assumed to depend.

The hook-up activities for recruiting schools took place during the months of March–June 2021; with the School contact persons of the reached schools it was agreed to involve two sections (one with higher students' academic performances and one with lower ones) from which two classes would be drawn to be included in the analysis and observation activities. More closely, 26

semi-structured interviews were carried out with the coordinating teachers of the selected classes, 17 h of online ethnographic observation (1 h for each class) of the lessons held in DaD/DDI mode and three focus groups with the classes returned to 100% attendance after the school decree adopted in May.

During the interviews, particular attention was paid to the reconstruction of the didactic-educational practices developed by the teachers in order to trace the first effects of DaD/DDI:

- On the technological and methodological-educational innovation of school communities;
- On the level of student learning in terms of increasing transversal skills and digital literacy;
- On the strengthening of the “teacher–student” “student–student” relationship and “school–family” communication.

Results

The social effects of DaD on teaching practices

The background investigation made it possible to understand the extent to which the starting conditions of the schools, in terms of technological and infrastructural endowment, represented diriment variables for reconstructing the first effects of DaD/DDI on the didactic/educational practices followed by the teachers—including in the analysis the germination of new geometries of school-family and student collaboration.

The information collected through the interviews, focus groups and netnographic notes was organized through the use of a meta-data sheet that allowed for an in-depth study of the experiences of the teachers and students with reference to the changes that occurred (in DL/BL times) on: (i) teachers' educational practices; (ii) students' learning modes; and (iii) teacher-student and student-student relations.

The three profiles of didactics that emerged from the analysis are articulated, and differ, in relation to: (i) organizational aspects concerning the methods of didactic delivery; (ii) the construction of the didactic pathway, highlighting the different declinations of learning assessment in the new digital learning environments; and (iii) relational aspects, highlighting the ambivalent responses of students to digital didactics.

The thematic analysis made it possible to reconstruct three teaching configurations: *innovative*, *traditional*, and *depowered*.

Innovative didactics

The contexts included in this first configuration present the following characteristics: (i) virtuous classes (higher academic performances), which belong to experimental sections; (ii) inserted in Istituti di Istruzione Superiore (I.I.S.) with both low and high technological endowment, located in central and more peripheral municipalities of Rome—but with both an average and positive school effect on students' scholastic performance. The effectiveness of participation in digital didactics at the time of COVID-19 is presumed to depend on social dynamics and family background. Although each school/class context is internally heterogeneous

from this perspective, within this first configuration some structural factors appear to be diriment for an analysis that wishes to reconstruct mechanisms (Pawson and Tilley, 1997) and indicators of change linked to the interaction between the characteristics of the didactic offer and the needs of teachers, students and their families. In detail, the classes involved in the observation/focus group processes reproduced virtuous examples of teaching strategies that, even in pre-COVID times, stood out for: (i) an integrated use of traditional and laboratory teaching; (ii) an intensive use—by both teachers and students—of digital applications; (iii) an assiduous involvement of students in project-based learning; and (iv) an openness to peer-to-peer assessment. On the other hand, on the infrastructural front, the acceleration of the school's digitization would seem to have been facilitated by the multiple funding provided by ministerial decrees, issued during the COVID-19 period, together with other resources from the National Digital School Plan (PNSD). Focusing on the characteristics of the settings, the internal coherence of this first profile of didactics appears evident, considering the strength of the association between the innovation of teaching practices and immediate receptivity of learning. A diriment dimension that undoubtedly contributes to the characterization of this profile is represented by the intensive use of innovative teaching methodologies, to which is associated an attentive, active and proactive participation on the part of the students. With reference to the process of assessing and verifying learning, teachers' reflections on the use of innovative teaching methodologies, such as those that resort to peer-to-peer assessment that empower and engage the student more on the learning process than on performance, focus on the meanings of distance assessment. Under emergency conditions, the rethinking of the teaching strategy implied a revision of the learning assessment criteria, together with a shift of focus from performance to process, with a view to a profound reworking and enhancement of the teacher/student relationship.

The functionalities of the digital applications (optical reader, speaker) and the new features of the teaching offerings (availability of audio files, videos, etc.) have increased the involvement of students with BES (Special Educational Needs) certifications to whom, in times of "normality," have not always been offered the possibility of benefiting from the preparatory functionalities of digital teaching.

From the characteristics drawn from this first configuration of DaD/DDI, conditions that do not always facilitate the development of sociality and interaction emerge sharply. Digital didactics, when enabled by favorable material conditions (e.g., adequacy of connection and home space), has brought about considerable changes, sometimes upheavals, in the way relationships within the classroom and within the family are experienced:

"Very often, during questioning, my parents would stop and listen, and I would be scolded if I did not get the grade they expected of me... This situation, although I maintained a high average, made my life more difficult." (FG_03)

The student's testimony denotes an interference of the private sphere in the school sphere, which is also reflected in the families' definitions of their approach: motivating but uncooperative during the learning assessment; purposeful but interfering in matters

pertaining to the teacher; demanding about profit but justifying their children's shortcomings and low performance. These are the pairs of ambivalent adjectives that recur most often in the teachers' words. On the one hand, if these adjectives refer to the positive changes that digital communication would have imprinted on the school/family relationship (in terms of immediacy and the sought-after involvement of parents), on the other hand, they highlight the problematic effects of parental interference on the evaluation of students' performance, such as complaints about the teaching load and contestation of grades (aspects that make the teacher/student relationship more complicated). Nevertheless, in spite of the difficulties, in conditions of innovation of the educational offer, the students' approach to digital didactics appears aware (of the merits and difficulties of the situation) and proactive (with respect to the ways of using digital opportunities). In reactive/relational students, the use of distance learning can open up various opportunities, including that of re-appropriating their free time, mixing study and passions. The need for relationality, which emerges in the contrasting definitions of the DaD experience (FG_01), can be articulated in responses that are as creative—such as the organization of online communities of students through meeting spaces in which it becomes important to value being together in emergency conditions—as aware of the difficulties encountered, in terms of performance and relationships, in the most vulnerable students.

Traditional teaching

The second configuration includes virtuous and non-virtuous sections/classes of the selected schools. The analytical criterion, adopted to trace recurrences and inter-sectionality in the reconstruction of the first social effects of DaD, is once again represented by the didactic-educational practices of the teachers that, in a manner distinct from the profile outlined above, provided/supplied the didactics with a traditional type of approach—which seems to work best especially in the mathematics and physics hours. Within this configuration, DaD/DDI appears to be an adaptive type of response to COVID-19 pandemic: the (remote) arrangement of the classic traditional lesson can have both positive repercussions (on the more motivated students, especially in the 2nd and 3rd year classes), and negative ones (at the relational level: horizontal interaction between students would appear to be penalized, while the only possible interaction would be vertical, between teacher and student).

In terms of teaching practices, the organization of group work took place without the preparation of innovative teaching methodologies; the use of materials to support the lesson (such as power points, videos and audio-recorded lessons) on the one hand allowed the most willing and motivated students to better understand teachers' explanations, on the other hand it represented an obstacle to the involvement and participation of the "less talented." The DaD/DDI experience can then be considered a "sounding board" of social inequalities, which has amplified and sharpened cultural and social differences between students who are more or less equipped with those tools that are indispensable for interacting with the new way of doing school (appropriate devices, stable Internet connection, capacious home spaces).

Students' participation and effective performance in lessons and in group work depended indeed on both the adequacy of material resources and the presence of motivational ones. The difficulties in managing a distance lesson (not only infrastructural but also relational) made the process of assessing and verifying learning more complicated. A critical aspect of assessment—directly connected to the physical distance from the student—is linked to the performance of learning tests, which are very often distorted by the dynamics of collaboration and copying. For this reason, teachers have remodeled the format of the tests, organizing tests to be carried out within a pre-established timeframe, or preferring assessment by oral tests (taking the written ones at school, during DDI periods). In the teachers' testimonies, the conjunctural aspect of digital didactics can be fully grasped considering that, when delivered in conditions unfavorable to learning, it would seem to amplify the gap between students that are more or less motivated to study, and students more or less provided with material resources.

At the specific level of academic achievement, there is an improvement in transversal skills—especially digital literacy, but also communication and critical thinking—for the most motivated students, who are also those who show a greater propensity to participate during the lessons. Another part of the class, on the other hand, tends to “exile.” Non-participation is explicitly referred to material problems with devices and Internet connection: material difficulties that made it impossible for the teacher to intervene and which it is plausible to assume have weighed on the students' motivation and interest in actively participating during distance learning lessons.

Especially with reference to the more difficult students who could be defined passive-demotivated for behavioral traits and reaction to the situation, participation in DaD was defined as imperceptible and passive. Demotivation to learning, in some cases, may represent a consequence of performance anxiety disorders, linked to the health emergency in progress and to the relationship difficulties associated with it, with very strong consequences on the predisposition to resume school rhythms with serenity (in DDI) and to fit into the class group. Students' demotivation and performance were also greatly affected by students' relationship with their parents, who were present but not motivating: for some, there was a tendency to interfere in matters of profit assessment, ordinarily the responsibility of the teachers; for others, there was a propensity to interfere, with suggestions, during questions or class assignments. Logistical difficulties—lack of space and the presence of other family members attending DaD or remote working—and Internet connection difficulties also negatively affected the pupils' motivation.

Depowered teaching

In the last configuration, DaD/DDI appears as a response dictated by the emergency: device problems (experienced by the students) and poor technological and infrastructural endowment of the school are factors that influence the course of the lessons (in terms of duration, possible thematic insights and desirable involvement of the students) and the expectations of teachers, students and their families. The delivery of

training content is deficient in the way it is organized, due to infrastructural problems.

The organization of DDI was affected by a series of scheduling difficulties, partly related to the shortage of space (classrooms were not always capacious and therefore capable of guaranteeing spacing; LIMs (Interactive Whiteboards) did not always guarantee perfect interaction between in-presence and distance groups); partly due to the interruption of laboratory activities, given the re-functionalization of the spaces adopted to comply with the anti-COVID regulations (very often, laboratories and libraries were used to accommodate the largest classes). The lack of digital skills, especially in teachers with a higher average age, contributed to slowing down the school's process of adaptation to digital teaching: it could happen that entire lesson hours were skipped due to technical impediments (malfunctioning of the links for connecting to the virtual classrooms, obsolescence of the devices, drops in connection, etc.) that diverted the students' attention, inevitably reducing their motivation.

In general, there was a reduction/limitation of written skills and a prevalence of the assessment of oral skills, which can be explained by virtue of the multiple organizational difficulties of managing remote assessments (difficulties that, in part, would seem to be due to connection problems and in part would seem to be consequent to the non-transparent relationship of the students during the assessment of learning, such as attempts at defection and collaboration during tests). 2nd year classes were the ones that suffered more than all the other classes in terms of assessment, with a general decline in the level of learning. Also, in this case there was a change in the assessment criteria, with the introduction of an emphasis to the relational aspects linked to participation, dialogue and interaction between the students while carrying out the tasks.

For teachers, digital teaching has acted as a sounding board for pre-existing fragilities, amplifying the discomfort of the less fortunate, some of whom “got lost” because of the most diverse reasons: unjustified absences, performance anxiety, isolation. The organizational decisions taken during the DDI period, and the choice to alternate the weeks that some students attended online while other at school and *vice versa*, contributed even more to the breakdown of the class group.

These lost students (who could be defined opportunist-closed students) experienced a withdrawal into themselves. They lived in a comfort zone; they derogated from relationships. This closure is due in part to the absence of motivation to study and of family support, in part to fragile backgrounds with a lack of good Internet connection and of a suitable study environment.

The *extensive research*, carried out in the years 2022/2023, responds to the aim of reconstructing the main changes in the three dimensions of interest in the research (teaching practices; learning modalities; social relations) through a comparison between the pandemic emergency phase (background research) and the phase of exit from the emergency (extensive research).

Starting from the seven schools included in the previous research phase, a total of 14 schools were involved in this phase. The following were carried out in the schools: (i) One hundred eleven interviews with the teacher coordinators of the 10 selected classes; (ii) Thirty-one focus groups—for a total of 154 students involved. Interviews with the families of the students involved are currently in progress.

Discussion

Opportunities and criticalities of distance learning

In the [Box 1](#), it's possible to analyze the types of teaching.

The analysis of the first data obtained from the background research made it possible to highlight some opportunities and criticalities of the use of digital technologies in Distance Learning. In the teachers' experience, the fast interconnection to the new digital learning environments has had the merit of strengthening the relationship between schools and territorial realities (e.g., Universities and training organizations), widening and enriching the educational offer for students: "thanks to Google Meet we have allowed students to participate in conventions and conferences organized abroad... If it wasn't for the DaD experience we wouldn't have been able to do it!". Interconnectivity and reduced distances to remote places had a positive impact on the range of students' activities: "DaD allowed us, for example, to connect easily with the United States." Professional development is undoubtedly one of the most striking positive results of the last period; the intensive use of ICT has stimulated opportunities for dialogue and discussion among teachers on the most appropriate ways to respond to the needs of the "new school," strengthening solidarity and cohesion within the school community.

The intensive use of ICT has led to an improvement in teachers' communication speed, collaboration and didactic innovation. The experimentation with digital technologies, albeit in an emergency phase, has enabled an unprecedented acceleration of the process of professional development and training, bridging the digital skills gap in teachers less inclined to the use of computer aids and devices in the classroom.

Together with the opportunities, a series of critical aspects referring to the period of emergency teaching can represent the keystone around which to reflect on the development of improvement interventions. These interventions invest the teacher's profession and strengthen the relationship of trust with the students, a true and proper load-bearing dimension for overcoming the difficulties encountered in times of pandemic. Quite apart from the difficulties of managing a distance lesson (due to the precariousness of the connection or to relational problems that made it complicated to affect the attention and concentration of the students—especially those who attended online in the DDI period), the production of audio-visual material can be a useful support to the lesson, provided that this commitment (in word) represents a deepening for the students and not the cause of an excessive extension of school time (a sore point, for the students,

is represented by the afternoons spent listening to audio-recorded files; additional study hours added to the ordinary ones).

Among the criticalities attributed to the digital teaching experience, most of the interviewed teachers reported the negative impact of the loss of relational aspects on students' academic performance. In situations of emergency, of lack of alternatives, DaD/DDI would seem to have encouraged "the lazy to become lazy" (Gul_03). Attention and concentration deficits during lessons and loss on the personal decorum front (given the possibility of entering the classroom at the click of a mouse) are the consequence of that always-on condition, of perennial connectedness, which if experienced without awareness can subtract value from the educational and social dimension of school. On the social level, the laxity and withdrawal of the students into themselves, if on the one hand can be considered a consequence of the particular organization that digital education has assumed over the months, on the other hand can also be a reflection of social fragilities pre-existing in the pandemic period. The students were disoriented by the sudden changes (both managerial and organizational) adopted during the months in which DaD and DDI alternated. The students' laxity/refocus on themselves was compounded by learning problems due to poor attention and concentration.

Concluding remarks

Within the innovative framework of the positive thinking evaluation ([Lo Presti, 2020](#)), the background research illustrated has made it possible to interpret the criticalities linked to the DaD experience as a possibility for a participatory reflection—with teachers and students—on the importance of innovating the return to school presence, enriching the educational offer with new instances and awarenesses that have emerged in a time of strong changes, still in the consolidation phase.

In a small way, the three different didactic configurations reproduce the enabling factors, otherwise hindering, that facilitated/depowered learning, its assessment and the emotional component linked to the specificity of interactions in the new digital learning environments. In spite of the difficulties in managing digital didactics, whether for technical reasons, motivation reasons, or linked to the cultural and family background of the students, the interviewed teachers agree in attributing to DaD the function of engine and driving agent of change in the school system. The intensive use of ICT and the guarantee of accessibility for all—teachers, students and their families—have undoubtedly enriched education in a variety of ways and with a variety of opportunities.

BOX 1 Types of teaching.

Innovative teaching
Traditional teaching

Depowered teaching

DL/BL is an opportunity; teaching/educational practices are innovative; students perform highly the DL/BL is an adaptive reaction; the (distance) setting up of the classic traditional lesson can have both positive effects on the more motivated students (and negative effects on the relational level). Horizontal interaction between students seems to be penalized, while the only possible interaction is vertical (between teacher and student) the DL/BL is an emergency response; problems of devices, scarce technological and infrastructural resources, influence the course of lessons (in terms of duration, possible thematic insights, desirable student involvement...) and the expectations of teachers, students and families

In conclusion, ICTs, employed in the age of digital didactics, can take on a propulsive function for change in schools because they have enabled/will enable an impact on the school setting and by transforming the learning environment through the enhancement of technological equipment (PC + LIM + camera in classrooms).

The digital didactic has redesigned space and reorganized time through the decompression of lesson duration, exploiting the opportunity to combine synchronous and a-synchronous even in the presence, using digital environments to enrich the frontal lesson. Digital technologies have improved, and will continue to improve, the processes of communication and socialization by stimulating, in students, the development of key competencies of digital literacy and media education and by strengthening (or laying the foundations for strengthening) communication with families; iii. have facilitated, and are expected to continue to facilitate, the work of correcting texts and assignments by teachers, making dialogue and reflection with students more interactive.

However, the initial results reconstructed represent only the start of an informed reflection on the trajectories of change that will be consolidated in schools in the coming years, and that much will depend on the evolution of the pandemic and the organizational decisions taken by ministerial bodies and individual educational institutions. The complexity of digital educational environments, which emerged from the research, draws attention to the importance of resorting to a reasoned, and not emergency, school planning, in which reflection on the use of digital devices, from being ancillary, becomes central within the educational curricula, in response to the increasingly felt need to consolidate the digitalization of educational processes, through a conscious use of digital tools and collaborative learning methods.

Data availability statement

Raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Ethics statement

The studies involving human participants were reviewed and approved by Settore Privacy—Area Affari Legali Sapienza Università di Roma. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Dematerialized participation challenges: Methods and practices for online focus groups

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This study explores the limitations and benefits of different approaches to conducting online focus groups and illustrates an online focus group protocol used within the Value for Schools project in Italy. According to the project evaluation design, 13 online focus groups were organized, with the participation of 101 teachers and 37 school principals. The protocol setup, incorporation, and reorganization of the indications have been discussed in the literature, addressing the methodological and practical issues, such as the selection of participants and preliminary communication with them; the web conference platform (Zoom Business); timing, as well as access times and mode; the roles of the researchers involved (moderator, co-host technical assistant, co-host-observer, co-host-animator) and their integration spaces; technological support; and animation tools. The recording and transcription tools and subsequent analysis of the textual corpus are presented. Finally, the authors discuss the validation and reliability of online focus group protocols.

KEYWORDS

online data collection, online focus group protocol, methods in qualitative inquire, organizational setting, textual analysis, school principals, teachers

1. Introduction

In the digital era, new research methods use online technologies based on web applications and computer-mediated communication (Morgan and Lobe, 2011). In the field of social sciences, data collection is possible through different methodologies and tools in the online environment, such as web surveys, online qualitative interviews, virtual ethnographies, and online focus groups (OFG). While for some of these methodologies (questionnaires and interviews), the Internet is now replacing previous media such as mail and telephone, moving online is more problematic for others. In the preparation of OFGs, some scholars drew a continuum among methods that can be moved online with minimum adjustments while others needed to be deeply adapted to function in an online version. While some researchers note that collecting qualitative data online is limited by the lack of information about the physical environment and non-verbal behaviors, others have provided results that contradict such criticisms and show the same rigor in computer-mediated communication as in face-to-face communication (Morgan and Lobe, 2011).

The restrictive measures imposed by COVID-19 require that research strategies respond to changing needs. Online strategies should be considered “less as an adaptive compromise within pandemic restrictions” and more as an opportunity for innovative methodological paths (Keen et al., 2022, p. 2).

In this study, we describe, discuss, and validate a procedure related to 13 online synchronous focus groups, which were originally designed to be conducted in person but were moved online due to the COVID-19 pandemic. In the following section, we present a literature review on OFG, discussing its benefits and limits. Therefore, the study design, management protocol, step-by-step procedures, and technological tools are indicated. Then, we discuss the elements of method validation, including precision and accuracy. The results in terms of focus group validation, evaluation, limitations/benefits, and lessons learned are presented. Finally, conclusions are presented regarding how to capitalize on online video conferencing knowledge to further implement best practices for the benefit of similar studies in the future.

2. Online focus group

The focus group is a research method developed by Robert Merton and his colleagues. It serves to collect more in-depth qualitative data on participants' experiences, and it is a "research technique that collects data through group interaction on a topic determined by the researcher" (Morgan, 1997, p. 6). The focus group uses a group discussion on a specific topic or issue, guided by a moderator. The focus groups with 8–10 participants allow for richer and deeper information to be gathered because the participants may gain insights from the answers already provided by others (Agan et al., 2008; Krueger and Casey, 2014). According to the theories of symbolic interactionism, "all focus group participants simultaneously conceive their own role in relation to the roles that others play, finding the meanings of their actions in the reactions of others" (Morgan, 2012, p. 161). The interactions between participants are influenced by the group context and the processes of sharing and comparison with other participants. Therefore, social context cues are essential in establishing high-quality interactions in focus groups (Lobe, 2017, p. 236).

An OFG is a computer-mediated communication event (Albrecht et al., 1993; Lobe, 2017); it can be defined as "a selected group of individuals who have volunteered to participate in a moderated, structured, online discussion in order to explore a particular topic for the purpose of research" (Peacock et al., 2009, p. 119). The literature distinguishes between asynchronous focus groups, synchronous ones, and virtual world focus groups. In the asynchronous focus group, participants do not interact in real time. It requires minimal time to read and review questions. In synchronous focus groups, people participate in real time *via* instant messaging or videoconferencing (Williams et al., 2012; Tuttas, 2015). In focus groups in virtual worlds, Massively Multiplayer Online Games (MMOG), or avatar-based focus groups, participants interact in computer-simulated environments through personal avatars (Bartle, 2003; Houliez and Gamble, 2012). This method requires participants to be able to attend a specific platform and have sufficient expertise to engage with it.

According to Lathen and Laestadius (2021), OFGs can ensure full and equal participation for people who might otherwise face barriers. From a theoretical point of view, validity could be improved because participants can participate anywhere. It may also provide more opportunity to recruit an adequate and appropriate sample to add rigor to a study (Higginbottom, 2004;

Morse, 2015), avoid selection bias, and optimize external validity (Kerr and Murthy, 2004; Bruüggen and Willems, 2009; Krueger and Casey, 2014; Wilkerson et al., 2014; Rupert et al., 2017; Daniels et al., 2019). OFGs make it possible to expand the audience of potential participants, recruiting them from remote places or in precarious health conditions, who might otherwise be excluded from the traditional recruitment process. This consideration is particularly important when researchers attempt to engage vulnerable populations to obtain adequate information on sensitive issues, such as opportunities for access to care (Dos Santos Marques et al., 2021). According to some scholars, virtual methods such as online focus groups can enhance studies in marginalized communities and, thus, mitigate the effects of social desirability evoked by unknown institutional contexts (Daniels et al., 2019). Sessions can be conducted over a variety of electronic devices (desktop, tablet, and mobile) with audio and text options available for those with insufficient bandwidth or technology.

Data collection through OFGs can be beneficial in terms of cost reduction (Joinson, 2005; Cater, 2011) and time investment (O'Connor and Madge, 2003; Jankowski and van Selm, 2005). OFGs can also bring together participants from different parts of the world, allowing for alternative time slots optimized for different time zones (Muttiah et al., 2016). From a technological point of view, the OFG offers advanced audio and video recording capabilities; it allows automatic transcription, including live captions. During the focus groups, different tools can be used to support discussions, such as instant messaging options or screen sharing, taking advantage of the support of virtual whiteboards/bulletin boards and being able to share images, files, etc. in real time. These tools expand the possibilities for supporting discussions by stimulating creativity and can remedy the lack of conventional facilitation supports for thematic focusing (e.g., blackboards). However, the use of virtual artifacts may be less natural than their physical equivalents, requiring the selection of user-friendly tools and staff with advanced tool management skills. According to the literature, it is necessary to carry out a preliminary setup/verification: indeed, any difficulty translates into the emotional detachment of the participants and, therefore, their further isolation. Based on these technological constraints, new and different responsibilities are identified for the people who support the moderator. In the literature, two or more support figures in addition to the moderator are often reported, both for the management of any technical problems and as support to the moderator to effectively lead the discussion (Wilkerson et al., 2014; Dos Santos Marques et al., 2021).

As for the limitations, first, the online focus groups are exposed to greater risks associated with dematerialized participation. Some scholars have argued that the absence or reduction of non-verbal or paralinguistic communicative elements reduced spontaneity, resulting in boredom, distraction, and stress generated by computer use, which can lead to a participation deficit, the latter aspect being particularly important when attempting to elicit further comments (Oringderff, 2004; Morgan and Lobe, 2011; Stewart and Shamdasani, 2017). Despite the possibility of reproducing an interactive situation, like a face-to-face one, some relational aspects are not guaranteed in the OFG, such as the use of all the senses directly involved, or some elements of the "pleasure of being there," which is indispensable for generating trust and catalyzing "group

energy". Research in this area has shown, for example, that while participants in online meetings tend to provide shorter comments and offer brief hints of agreement during the discussion, in the case of face-to-face meetings, some participants tend to speak at length while others remain relatively silent (Bruüggen and Willems, 2009; Lijadi and van Schalkwyk, 2015). However, other research has shown that online focus groups are able to obtain an equivalent quality of data from participants (Underhill and Olmsted, 2003; Reid and Reid, 2005; Woodyatt et al., 2016; Abrams and Gaiser, 2017), and there are many similarities, including reliance on social cues and stereotypes based on gender, race, attractiveness, and age (Groom et al., 2009; Hoffman et al., 2012).

Second, OFGs can exclude communities and individuals without technical skills or access to appropriate devices and software (Namey et al., 2020). Participants may have various levels of digital skills, and even those who regularly use the Internet for other purposes may not have used video conferencing software. Participants unfamiliar with the technology may present additional challenges to the research team (Lobe and Morgan, 2021). In these cases, at the start of the focus group, it is advisable to train participants to use the relevant software. When setting up the focus group, researchers must consider how to correct socioeconomic, age-related, and individual disparities in the access to and the use of computers, the Internet, and video-calling technologies.

Third, there are also some methodological disadvantages. According to some scholars, the use of automatic transcription in virtual research may indicate that researchers become less familiar with their data than those who undertake manual transcription because deciphering interviews helps researchers absorb their content. Since researchers do not visit the contexts under investigation in person, they should explore the cultural context in alternative ways (Roberts et al., 2021). Additionally, participants in online focus groups are likely to be susceptible to distractions if they are in home environments: from childcare and pet care to work email notifications. Some participants also reported distraction due to seeing themselves on screen (Deakin and Wakefield, 2014). Additionally, video calls can tire participants faster (Epstein, 2020). It is also difficult to support remote participants if they experience emotional distress during interviews.

Finally, new technologies require updated ethical scrutiny (Salmons, 2016) in terms of consent, data confidentiality, stored focus group registrations, or automatic data transcriptions. While some scholars believe that most ethical concerns are the same as those in face-to-face research (Lobe et al., 2020), others have raised concerns over data confidentiality and cyber safety (Roberts et al., 2021).

3. Study design

In this study, we present and validate the protocol of 13 online synchronous focus groups, which were originally designed to be conducted in person but were moved online due to the COVID-19 pandemic. Synchronous OFGs allow for more fluid discussion, providing a closer approximation to traditional in-person focus groups (Tran et al., 2021). We considered both the target group's familiarity with the tools to be used and the habits

of a category (teachers and school principals) in relation to the use of technologies. Indeed, during the pandemic period, due to the need to implement new distance learning strategies, teachers' familiarity with IT tools increased and greater preferences were noted for web platforms but not for instant messaging and group chat tools (Perazzolo, 2021; Zoja, 2022).

We adapted the salient aspects of the traditional focus group to the online versions, recognizing the importance of considering both methodological indications drawn from the traditional focus groups and the more recent online adaptations to properly combine and organize the elements. The challenge then is to be able to model, even in an online environment, conditions that support creativity within work paths that are necessarily more structured and tend to be less interactive and spontaneous than face-to-face meetings. The response to this challenge requires a careful preparatory organization, which is not limited to translating the work techniques used face to face but reflects in depth the ways in which communication is conveyed between facilitators and participants and between participants. The different phases of the focus group must be planned, all the proposed activities structured, and the tools able to support them identified, clarifying their usability, limits, strengths, and implications. The challenges, therefore, are regarding not only how to use technology to build an online focus group but also what methods of interaction and technological tools are most suitable for the research objectives of the focus group.

In the following paragraphs, we attempt to provide some answers to these questions by illustrating the building process of the OFGs within the Valu.E for Schools project (VfS). The VfS project has allowed the activation of three training paths—one for each macro-region of the country (northern, central, and southern)—with the double aim of strengthening the evaluation and improvement design skills of the teachers and school principals and of offering guidance to policymakers on networking, training, and support models in the field of school self-evaluation (Gomez Paloma et al., 2020).

The project involved 42 Italian schools, including 42 school principals and 400 teachers. Through the 13 OFGs carried out, a merit sample of project participants—principals and teachers—debated together the strengths and limitations of the training course and the medium-term progress of the project. The sample (recruited as explained in paragraph 3.1) consisted of 101 teachers and 37 school principals distributed in the 13 OFGs, as shown in Table 2. Of the teachers selected, 92 were women and 9 were men, with an average age of 52.4 years, an average career of 23 years, and an average seniority in the same school of 14 years. They were all permanent workers: nine working in a kindergarten school, 49 in a primary school, 41 in a lower secondary school, and two in administrative positions. Among the teachers, 95 of them held positions of responsibility within their own school and/or were members of the school self-evaluation teams. Among the school principals, 10 were men and 27 were women, with an average age of 54.7 years, an average career of 7 years, and an average seniority in the same school of almost 5 years.

The spatial-temporal context of OFGs was the pandemic, specifically in the spring of 2021.

TABLE 1 Software used and their purposes.

Software	Purposes
Microsoft 365 suite (Word, Excel, PowerPoint)	Drafting the cover letter/invitation to OFG and participants' data collection form, manual review of automatic transcriptions (Word); composing the lists of participants and building the database (Excel); creating a technical guide for the staff and multimedia presentation to be used during the OFGs (PowerPoint).
Zoom	Videoconferencing tool.
Bitly	Creation of a shorten, customized, and human-readable invitation link to every Zoom meeting.
Whatsapp (group)	Parallel/external communication tool reserved for staff.
Google Web Speech API and Dictation.io	Automatic real-time transcriptions of the meetings.
Voyant Tools	Filtering the automatic transcriptions of meetings by stop-word list and generation of word clouds.
Cabolo	Accurate automatic transcription of each meeting from the audio-visual recording.
QDA Miner	Text coding and analysis.

The protocol identified some implementation indications, such as group capacity, the web conference platform used, the communication model for the participants (cover letters, emails with the link), the length of the meetings, the roles of the researchers involved (moderator or host and co-hosts) and their integration spaces, technological support, and animation tools. Among these indications, the following played an important role: the multimedia presentations of the stimuli; the chat (with the possibility of posting comments relating to interventions and of intervening despite video connection problems); the private chat between researchers; the final word cloud (generated by the real-time automatic transcription of the speeches); and the final group photo.

3.1. Step-by-step OFG protocol

We detailed the OFG protocol using a three-step approach: Step 1—Online focus group design and planning, Step 2—Online focus group implementation, and Step 3—Online focus group postproduction and analysis.

3.1.1. Step 1—Online focus group planning

The first step included four main activities: the definition of the aims of the focus group based on the research design; the recruitment of participants; the preparation of the technological tools; and an online focus group pilot test.

We identified four research questions and we modulated the focus group stimuli in relation to the professional roles of the participants. In the meantime, we selected the online platform most suitable for our purposes, we reflected on the technological and animation tools to be used during the meetings and drafted a protocol as a supporting tool and outline for work development (see below, par. 3.4). Lastly, we planned the communication procedures with participants.

The participants in the focus group study were selected based on their participation in VfS training. Recruitment was done *via* an email invitation to the principals and teachers. Names, email addresses, and professional roles of the participants were collected. Other data were collected from the surveys that the participants had filled out in the previous months. The confirmed participants of the OFGs were emailed the online meeting details, including the date, time, and video conferencing platform login instructions.

Then, a pilot test was conducted with the moderator, co-hosts, and two volunteers as participants. The OFG pilot tested the suitability of the platform and other technological tools along with the format and content of the session; it was useful to become familiar with all the features of the video conferencing platform and to practice the staff roles (moderator, co-host animator, co-host observer, co-host assistant).

The OFG planning step lasted 2 months, and it was carried out by six researchers to address the methodological, technological, and contextual aspects of the method.

3.1.2. Step 2—Online focus group implementation

The focus groups were scheduled in the afternoon sessions, starting at 4.30 pm, for a duration of 90 min. On the morning of each scheduled OFG, an email reminded participants of the meeting URL. On the scheduled meeting date/time, participants clicked on the URL to access the online meeting. Participants were sent an alert 15 min before the start of the focus group (4.15 pm). Arriving 15 min early ensured participants were logged on successfully and could troubleshoot any technical issues. According to the literature, this is a good practice to increase the likelihood of starting and ending on time, thereby demonstrating respect for participants' time (Tuttas, 2015, p. 126).

Upon starting the focus group, an introductory slide was shared containing the name of the session. The moderator began the session by introducing the aims of the focus group and provided a brief reference to the rules of interaction during the meeting (Figure 1A). During this phase, participants were informed that the focus group would be recorded for transcription purposes (Figure 1B). The staff had their camera on all the time, and the moderator invited everyone to join the meeting with video, even though it was not mandatory. Almost all the participants kept the video active after the start (Figure 1C). Within the focus group script, four questions were provided along with relative comments that were used to guide/ensure comparable conversation among the various OFGs (Figure 1D). The moderator maintained an active role by asking questions, clarifying the answers, and ensuring that every participant was given opportunities to participate. The final part of the focus group session included a summary of the issues that had emerged, exemplified through a word cloud (see below, paragraph 3.4.2). Before the final goodbyes and thanks, a screenshot of the videos of all the participants (which counts as a "souvenir photo") was presented. The representative keyword of the focus group, from the participant's point of view, was written on each participant's photo (see below, par. 3.4.3).

Following each focus group session, the staff held a debriefing discussion to identify aspects of the protocol that went according to plan and which aspects could be improved.

The OFG implementation step lasted 2 months.

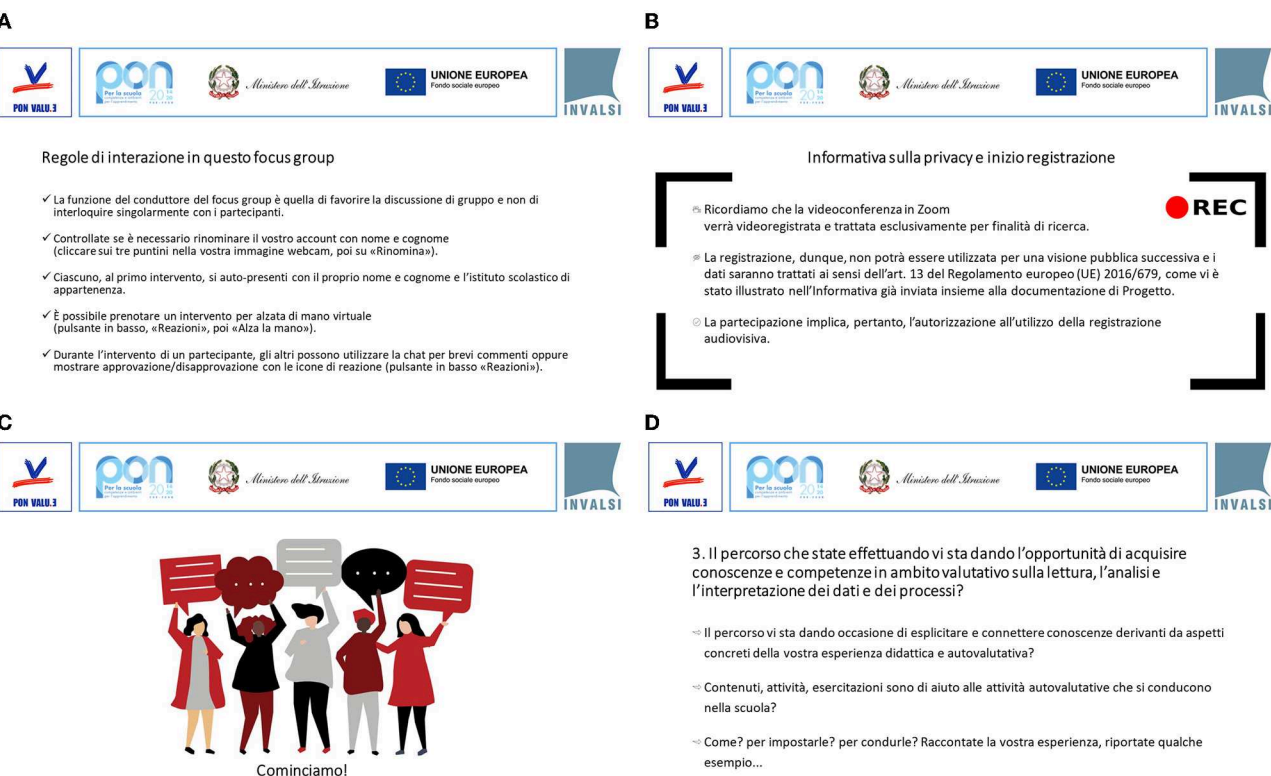


FIGURE 1
Examples of slides shared on-screen during the OFGs: to illustrate the interaction rules **(A)** and the privacy policy and to signal the start of video recording **(B)**, to start the discussion **(C)**, and to launch stimuli and related sub-questions **(D)**.

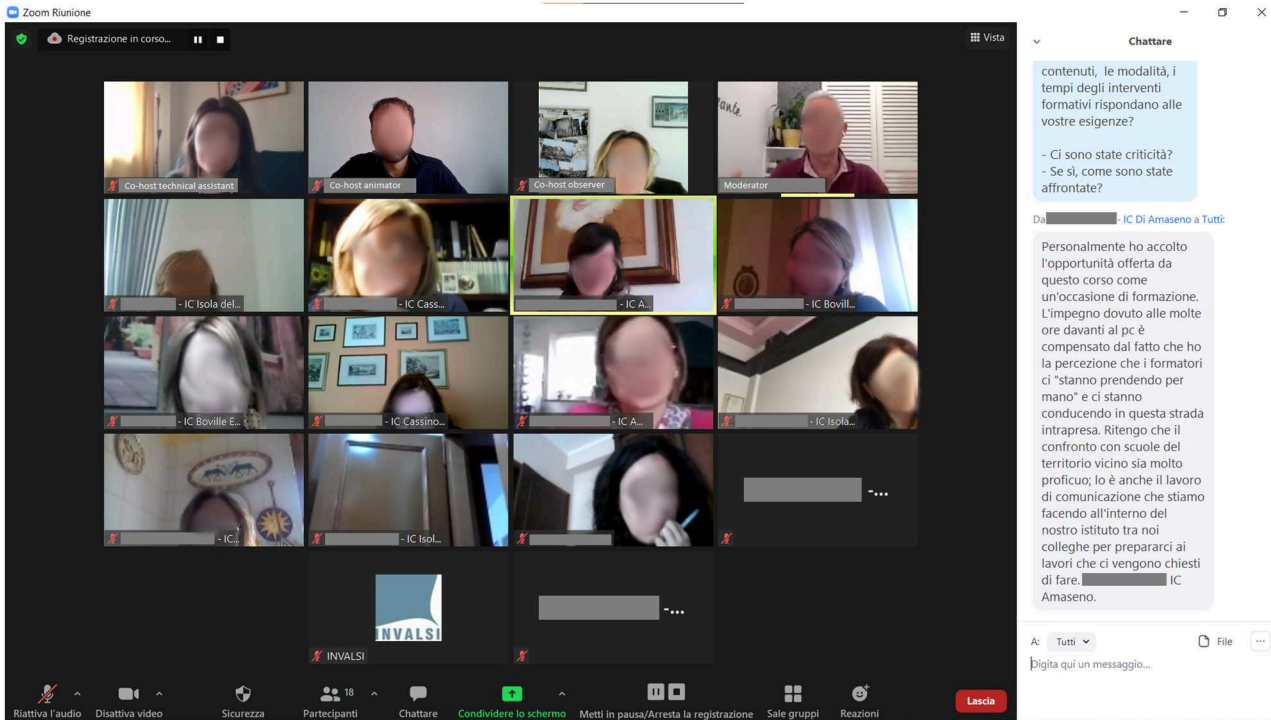


FIGURE 2
Example of a screenshot with a chat window that illustrates some interface setups of Zoom.



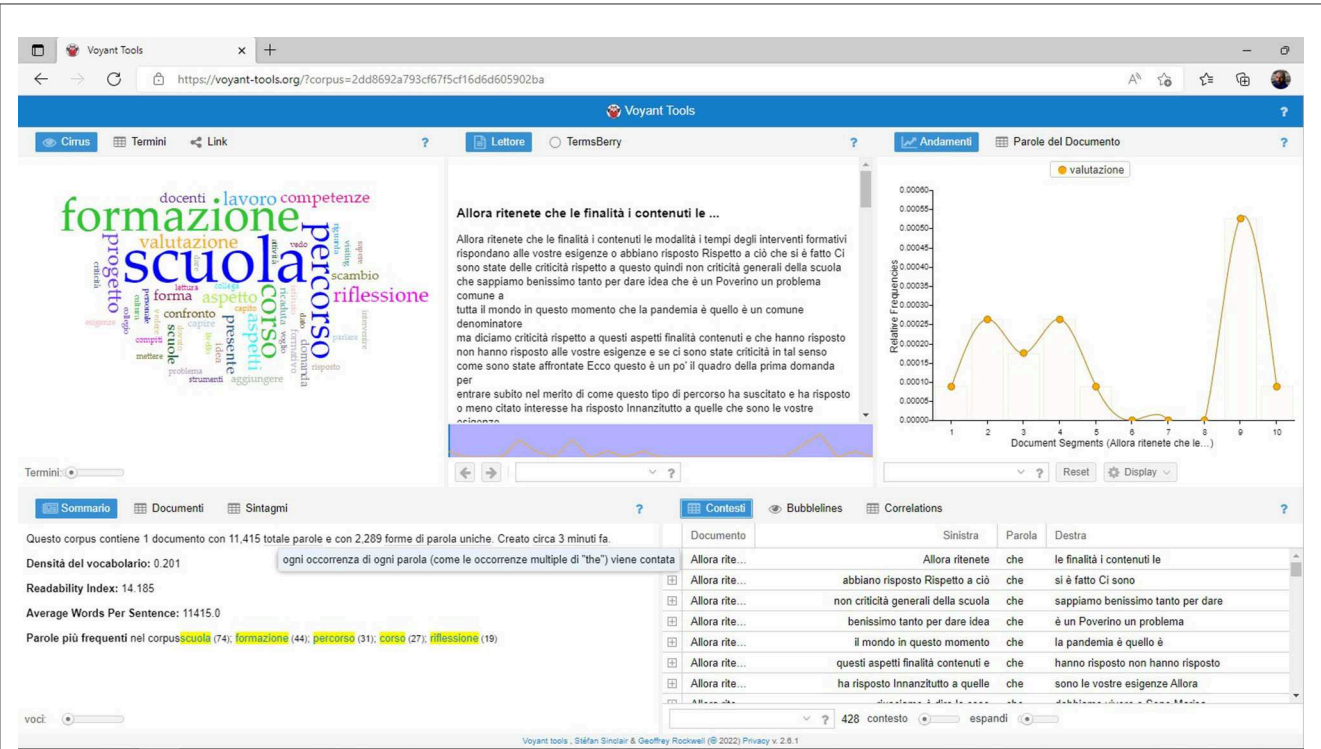


FIGURE 4
The work environment of Voyant Tools, a web-based text data mining suite used during the OFGs.

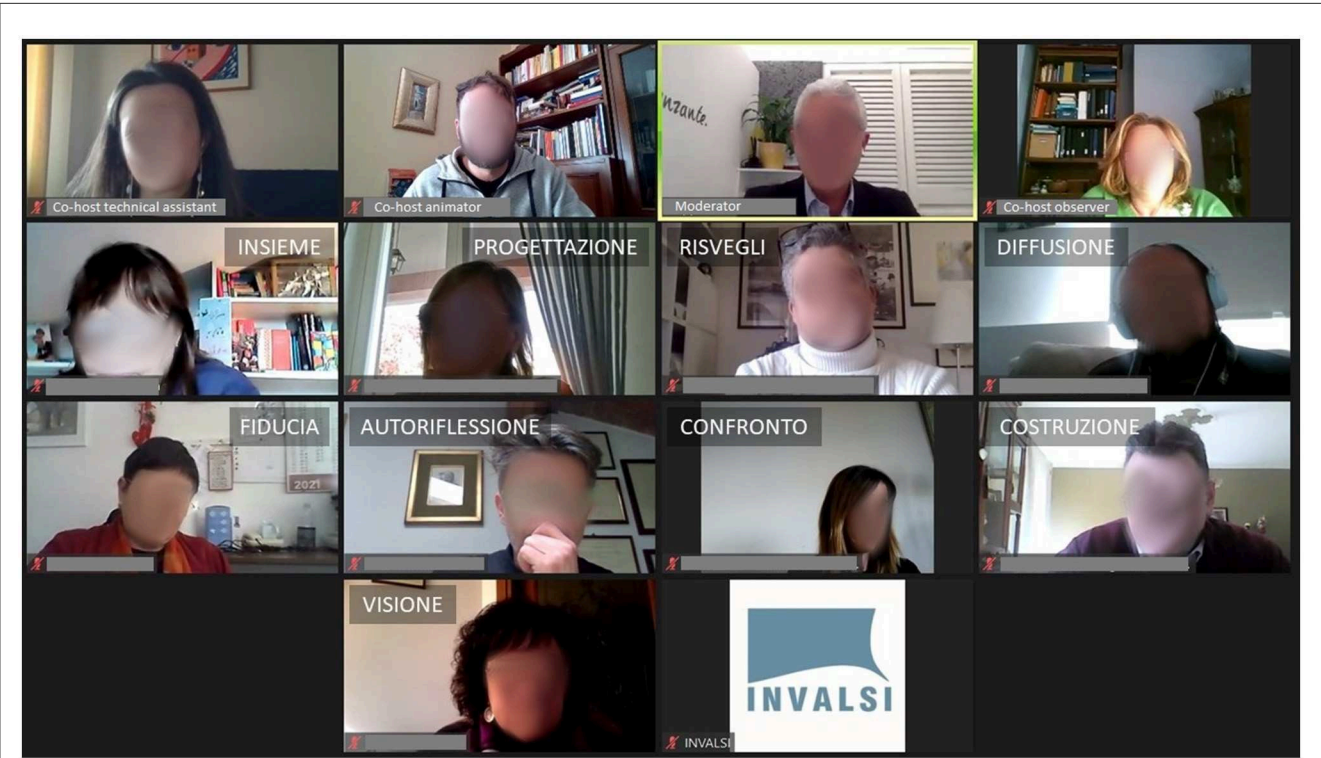
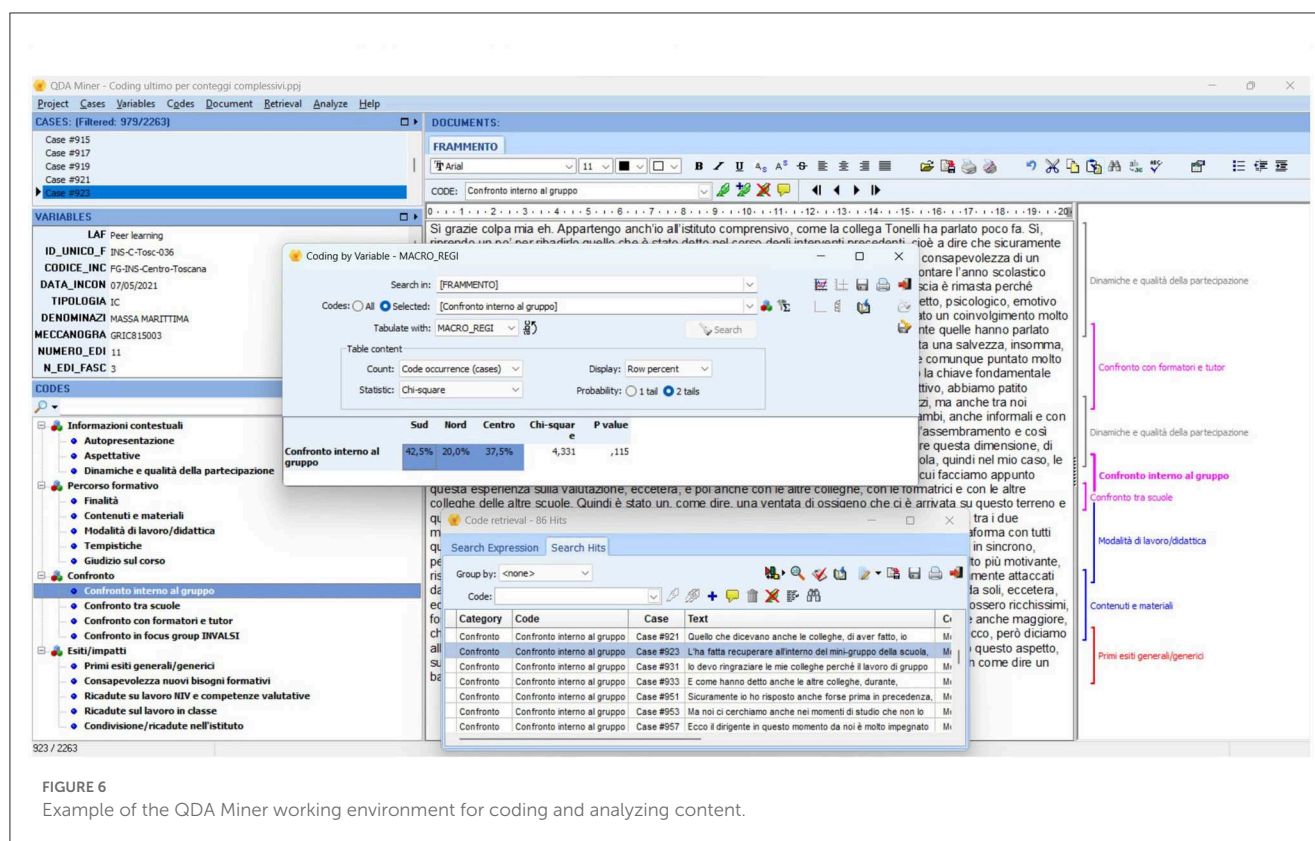


FIGURE 5
School principals' group photo with participants' keywords (macro-region: Center of Italy). From **top left** to **bottom right**: together, planning/design, awakenings, diffusion, trust, self-reflection, confrontation, construction, vision.



conversations through the technological environment selected (Lijadi and van Schalkwyk, 2015). Managing an online participatory process can be quite complex because there is a greater risk of losing participants' attention. There may be background noise, distractions, and situations such as participants entering late and participants having problems with their connection, video, or audio, even mid-session. At the same time, some constraints due to the lack of physical proximity that may affect the conduct of online groups, e.g., absence, or reduction of non-verbal or paralinguistic communicative elements, boredom, and computer stress (Morgan and Lobe, 2011) should be managed to ensure effective interaction among participants, communicative quality of verbal exchanges, and fluidity of interactions. Furthermore, non-verbal or body language must be taken into account because, in light of these signals, the moderator should evaluate the answers as well as adapt their own behavior in response to the signals received from the group. Participant engagement is essential to the success of a focus group, and it is important that the moderator remains engaged to demonstrate that discussions are being followed up and taken on board. Participants can abandon or limit their effective participation if they are not involved, if they do not perceive the active role of the moderator, or if the environment created is not stimulating and pleasant (Terrell, 2011; Murgado-Armenteros et al., 2012; Stewart and Shamdasani, 2017).

OFG co-hosts must generally provide logistical support: they admit and organize participants in the waiting room, manage late arrivals, and help participants with technical problems during the session. Moreover, they can monitor the development of the ongoing session, observing which participants have contributed

and which have not (Stewart and Shamdasani, 2017), checking and noting if there is any participant who has not yet spoken, and reporting this information to the moderator.

In our study, OFG management was carried out by four researchers; their roles were organized as follows.

- **Moderator:** The moderator moderates the discussion by paying attention to the participants and the indications of the staff. The moderator should therefore be very skilled in controlling the group, guiding the discussion, introducing, returning to questions, sharing summaries, providing feedback, guiding participants' interventions, and making sure that the conversation flows as smoothly as possible.
- **Co-host assistant:** The co-host assistant supports the technical management of the meeting, especially in the starting phase (supports the management of late arrivals), and shows the slides with the presentation of the event, the working group, the stimuli, etc.
- **Co-host animator:** The co-host animator manages the technical aspects of the meeting (setting up the environment, videoconference tools and materials, admission of participants) and technical problems faced by the participants, helps in the management of work tools such as shared blackboards and concept maps, and uses an automatic real-time transcription of the web conference to process one or more word clouds, etc.
- **Co-host observer:** The co-host observer keeps track of chat interventions and focuses on non-participating observation

TABLE 2 Characteristics of focus groups, participants, and metrics of textual database.

	Length (min.)	Schools	Participants	Speeches	Average speeches per participant	and STD DEV	Speeches per participant in 60 min.	Token	Type	Token/min
North-Emilia-Romagna, Teachers	109	6	14	78	5.57	3.59	3.07	15,289	2,492	17.77
North-Lombardia, Teachers	90	4	7	61	8.71	5.96	5.81	12,560	2,214	15.86
North-Piemonte, Teachers	96	3	10	84	8.4	4.93	5.25	13,245	2,117	15.34
Center-Lazio, Teachers	110	5	13	89	6.85	4.22	3.73	15,592	2,490	17.57
Center-Toscana, Teachers	106	3	9	80	8.89	3.06	5.03	14,411	2,273	16.72
Center-Umbria, Teachers	103	4	10	73	7.3	3.59	4.25	15,342	2,489	16.71
South-Campania, Teachers	116	5	18	97	5.39	1.91	2.79	16,007	2,565	18.59
South-Puglia, Teachers	117	4	10	111	11.1	6.47	5.69	17,250	2,603	17.66
South-Sardegna, Teachers	103	4	10	109	10.9	5.72	6.35	14,270	2,257	16.29
Nord-School Principals	105	9	9	70	7.78	3.19	4.44	14,167	2,244	16.63
Center School Principals	102	9	9	70	7.78	3.77	4.58	14,567	2,436	17.06
South-School Principals	116	9	9	101	11.22	4.02	5.80	15,366	2,545	19.20
All area-School Principals	99	10	10	116	11.6	7.2	7.03	14,331	2,439	16.85
Total	1,372		138	1,139				192,397	31,164	
Average	105.54	5.77	10.62	87.62	8.58		4.91	14,800	2,397	17.10

of group dynamics by privately and briefly sharing support information in real time with the moderator for the management of the discussion (see paragraph 3.4.1).

3.3. Ethical consideration and researchers’ positionality

Regarding the ethical aspects, participants were informed of the OFG purpose by email invitation, and they were informed that the focus group would be recorded for transcription purposes. Participants were reassured about privacy and data procedure processing. All participants signed the informed consent provided for participation; all consent forms were collected and stored. The consent form informed participants about their right to withdraw from the study at any time.

According to Jacobson and Mustafa (2019), in qualitative research, it is important to map the social identities of researchers to support a better understanding of the data relations and account for them in a responsible and respectful way. Keen et al. (2022)

suggests that researcher positionality in virtual research is based on the same considerations as in-person research (e.g., Salmons, 2016). In our virtual study, we believed that our outsider positionality—no members of the research staff were teachers or principals—required intentional actions to deeply understand our study context. Meanwhile, the research staff was part of the institution that financed the training course on which the participants were asked questions. For this reason, we carefully considered our positionality in relation to the participants’ freedom to speak and express themselves, and we recruited an OFG moderator from outside our institution with a background as a school principal to support the process, starting from the definition of the stimuli.

3.4. Materials and equipment

3.4.1. The videoconferencing system

Regarding the technical solutions to implement OFGs, it should be remembered that the choice of a particular videoconferencing system among the many possibilities, the activation of additional

features, and/or the use of external applications to expand its functions must be subjected to careful evaluations. Electronic video-communication tools and their specific functions or add-ons (chat, file-sharing, blackboards, billboards, bulletin boards, surveys, etc.) can certainly make up for the lack of conventional physical media for organizing and facilitating meetings and create a good degree of social presence, even in an online environment (Stewart and Shamdasani, 2017). Moreover, depending on the objectives of the focus group, they can expand the possibilities to support the discussion and stimulate creativity and collaboration among the participants (UXalliance, 2020). Nonetheless, the interaction with and through virtual interfaces presents a lower degree of naturalness than that based on similar physical artifacts in face-to-face meetings. Thus, any difficulty in electronic communication would result in an emotional and cognitive detachment of the participants and, therefore, in their further isolation (Murgado-Armenteros et al., 2012; Daniels et al., 2019). For these reasons, it appears necessary

- to consider the levels of digital literacy among the audience and the potential impacts of a digital divide;
- to select tools that are as user-friendly as possible;
- for the staff to possess or develop advanced expertise in the chosen virtual interface and electronic tools;
- to set up, fine-tune, and test all the tools and their settings in advance.

Considering these premises and the purposes of our OFGs, we opted for maintaining a simple and intuitive digital architecture, focusing simply on the videoconferencing system without external tools, except for a WhatsApp group, limited to internal staff communications (e.g., to suggest that the moderator solicit contributions from participants who have not contributed or that he explores a particular theme).¹ After careful consideration (Wilkerson et al., 2014; Lobe et al., 2020)², and much like several other experiences reported in literature (Kite and Phongsavan, 2017; Lobe, 2017; Matthews et al., 2018; Archibald et al., 2019; Daniels et al., 2019; Dos Santos Marques et al., 2021), our choice fell on the well-known Zoom platform (Figure 2), for the following main reasons: (a) our research institute already had a subscription to the “Business” version, which allows unlimited meeting time and was equipped with any additional functionality deemed necessary to support the meetings (integrated chat, shared whiteboard, on-screen document sharing, etc.), as well as the possibility of advanced configuration of the meeting and saving both the audio-visual flow of each OFG and its complete chat log; (b) although dedicated software (client) that can easily be downloaded and installed on a variety of devices and operating

systems is available, this is not necessarily required of participants when using Zoom, who can easily access the meeting *via* a web-browser too; c) the target audience was highly familiar with this videoconferencing system, which was used extensively in schools during the pandemic period.

Among the measures taken in the Zoom platform settings:

- choice of the “meeting” (not “webinar”) mode because the focus group is a highly interactive event;
- setting up the meeting video-recording feature using the cloud space provided by Zoom’s “Business” subscription;
- preparation of a “waiting room” with customized text and logo;
- access to each meeting using a specific ID and password or through a specific pre-coded link generated by Zoom and forwarded to the participants in an abbreviated, human-readable, and customized way, through the free service offered by Bitly³;
- accreditation of the accounts from which the three co-hosts were connected as “hosts” of the meeting, thus endowed with special privileges such as the admission of other participants and screen sharing;
- manual admission of participants from the waiting room to the meeting room by the co-hosts;
- participants’ access to the meeting room with muted microphones;
- activation of the integrated chat feature, to report verbatim on it, from time to time, the stimulus, and sub-questions of the corresponding discussion phase (after they had also been presented through shared-screen slides) and, for participants, to not only make written comments on others’ interventions and send technical support requests but also to join the discussion if there were connection problems⁴;
- activation of the instant survey feature, tested “on the fly” only in some OFGs, to support some moderators’ extemporaneous requests for specifications⁵;
- activation of the multimedia whiteboard, used exclusively by the co-host animator, as specified below, to support the back-talk phase.

Several of the previous settings can be saved in a template so that they can be recalled immediately for the preparation of a subsequent meeting. Overall, Zoom

1 Using a chat external to the videoconferencing environment (such as a WhatsApp or Telegram group) is advisable not only if the environment has an exclusively private one-to-one chat (as in our case) but also to avoid sending a message to all participants or a private message to one of them due to trivial errors of distraction.

2 Refer, in particular, to the second reference for a review of the videoconferencing services available and a guide on what services might best suit a project’s needs.

3 Bitly (<https://app.bitly.com>).

4 Chat was little used, presumably because, with up to 12–13 participants, in a time frame of approximately 2 h, one can intervene quite easily when one wishes. Chat, on the other hand, proved to be a useful emergency tool for the inclusion in the discussion of a few participants with audio-visual connection difficulties due to bandwidth problems with their Internet connection.

5 Purposes for the programmatic use of the instant survey in OFGs could include: gathering information on the participants; breaking the ice at the beginning of the meeting (when there is often a bit of embarrassment/awkwardness in intervening directly); and briefly collecting the group’s differences of opinion on a stimulus or its particular aspect (proposing alternatives or reporting the main opinions that have emerged on the issue) to encourage/foster discussion, to probe, or to synthesize.

(with a Business license) proved to be an excellent choice, both in programming and in managing the OFGs. Apart from a few rare slowdowns when sharing the screen, there were never any hiccups or problems attributable to the platform or difficulties in its use by the staff or participants.

3.4.2. The word clouds

In addition to supervising and supporting the meeting from a technical point of view, the co-host animator had the task of implementing the technical procedures for preparing a word cloud as a summary representation of the discussion.⁶ This was mounted on a slide and shared on-screen in the final phase of the OFG, with the aim of offering a final synthesis and supporting the moderator's back-talk (Figure 3).

To generate the word cloud, the co-host animator, after appropriately configuring the audio settings of their computer, automatically transcribed the audio stream of the meeting in real time, thanks to the free Web Speech API offered by Google⁷, as the analogous Zoom function is currently supported only for the English language. However, we recommend using this solution in conjunction with other free online applications that exploit its potential, since the dictation is interrupted whenever the window is dropped or minimized if you use the Web Speech API within its "natural" web application, i.e., Google Docs. Among the various online tools based on Web Speech API, tested with very similar results, we opted for Dictation.io.⁸ Web Speech API plus Dictation.io, used on the Google Chrome browser, have demonstrated an acceptable level of accuracy for Italian, provided that the audio stream is of good quality and volume.

Once the transcript has been obtained and copied or saved in a text file, there are several possible solutions for the generation of word clouds, even free and web-based ones.⁹ One of the best solutions used in our case was the one offered within Voyant Tools¹⁰, an online text data mining suite (Figure 4) that presents, among many features, the possibility of quickly uploading and using a stop-word list to filter the corpus.¹¹

6 A word cloud – as defined in the Collins English Dictionary – is "a visual representation of the words used in a particular piece of text, with the size of each word indicating its relative frequency".

7 Web Speech (<https://www.google.com/intl/it/chrome/demos/speech.html>).

8 Dictation.io (<https://dictation.io/speech>).

9 Some of the best free solutions include: <https://www.wordclouds.com>, <https://www.visual-thesaurus.com/wordcloud.php>, <https://worditout.com>, <https://wordart.com>, <https://wordsift.org>, <https://monkeylearn.com/word-cloud>, <https://www.jasondavies.com/wordcloud>.

10 Voyant Tools (<https://voyant-tools.org>).

11 The stop-word list, previously prepared in txt format, contained the so-called empty words (articles, prepositions, conjunctions, demonstrative adjectives, etc.) and participants' names and surnames.

3.4.3. Souvenir photo with the keywords

In the closing phase of each OFG, the co-host assistant chose one of the best screenshots taken during the discussion (paying attention/taking care that all faces were clearly visible and did not show grimaces, closed eyes, etc.), mounted it on a slide, and projected it on the shared screen as the group photo. At the same time, the moderator invited each participant, in turn, to summarize what the meeting had represented for/meant to them in one word, which the observer/technical assistant noted on the slide with the group photo, next to the portrait of the corresponding person (Figure 5). The slide could be sent to the participants as a souvenir photo.

3.5. OFGs evaluation form

To enhance transparency in our overall empirical study (Daniels et al., 2019), the OFG staff, at the end of each focus group meeting, documented their reflections in a specially developed and structured analysis form. The form was organized into four sections which reproduced the order of the presentation of the stimuli during the focus groups; in the last part, other evaluation notes on the conduct of each meeting were included, such as information on each focus group, including timing and any events during the group (e.g., technical problems), observations on the atmosphere of the meeting, and elements relating to participation and management. In this way, we noted, through progressive categorization, the strengths and differences highlighted by the participants with respect to the set of stimuli (Poliandri et al., 2022). These forms facilitated the first discussion among the research staff and the evaluation of the effectiveness of the methods implemented to collect data (Daniels et al., 2019). They allow us to reflect on the factors that facilitated the behavior of the group and to evaluate whether the adopted protocol worked out well.

According to the evidence collected, all OFGs took place in an atmosphere of great serenity, cordiality, and a spirit of discussion. All or almost all the participants showed pleasure in participating and willingly engaged in reflection, and they became progressively more relaxed and involved. Participants rarely talked over each other, and very rarely did the moderator have to intervene to stop someone's talkativeness. The moderator was able to create a relaxed atmosphere and put everyone at ease, also repeatedly emphasizing the usefulness of dialogical moments such as these. Sometimes it was necessary to solicit the interventions of the participants, but very little was enough for the moderator to set in motion a correct debate and to ensure that all participants expressed their opinions.

3.6. Data analysis protocol

3.6.1. Transcription and database building

As research staff, we carried out corpus preparation work consisting of the following steps: automatic transcription (I), manual review of transcripts (II), and database building (III).

- I. The audio recordings of the OFGs were automatically transcribed using a special online service called Cabolo.¹²
- II. The text files containing the automatic transcripts were manually checked and deposited on a server with shared access by staff.¹³ The review was conducted by coming back to video recordings to
 - a. correctly attribute each intervention to a speaker, identifying them by name and surname,
 - b. fix punctuation, and
 - c. correct semantic errors in the interpretation of the transcription software.
- III. The revised transcripts were transferred to an MS Excel spreadsheet. The database thus built (henceforth DB) was structured in such a way that each row (a record) corresponds to a speaker's intervention, defined as a "fragment", and endowed with a univocal, sequential, and *speaking* code ("unique fragment ID"), acknowledging that, with this code, the fragment can be identified at any time and possibly relocated according to the specific meeting to which it belongs and to the order of the interventions within it. The other variables, that populate the DB columns, have been variously obtained (preparatory materials, transcripts themselves, and satisfaction questionnaires administered to the entire sample of participants at the training courses).¹⁴

3.6.2. Textual content coding and analysis

We set up the analysis of the OFGs according to a phenomenological-interpretative perspective (Moustakas, 1994; Merriam, 1998), proceeding using a qualitative approach to the textual content analysis (Losito, 2002; Mayring, 2014).¹⁵ Considering what the literature in the field proposes (Fereday and Muir-Cochrane, 2006; Adu, 2019), an abductive text coding methodology was developed, which combined

- I. an inductive/bottom-up approach (first-level specific descriptive codes, emerging from the reading of the text) and
- II. a deductive/top-down approach (second-level interpretative categories, grouping codes thematically related).

The inductive work of code construction and attribution was carried out by three researchers, as coders, and a coordinator. They worked exclusively on participants' fragments (920, stripping them of any final greetings from each meeting), while the moderator's interventions were used only for better understanding and contextualizing the emerging meanings. This research group, through a series of recursive steps operated on some focus groups used as tests (independent exploration and coding, comparison, construction of a code-set with label and a definition for each code, re-coding, analysis of inter-coders agreement, re-definition of the code-set, independent re-coding, etc.), came to an agreement on a definitive code-set that was used to independently code all other focus groups.

The sentence—understood as a single clause/proposition or a group of them between one full stop and another—was taken as the minimum unit of analysis for the attribution of a code. However, since punctuation marks were, to a certain extent, arbitrarily inserted (during the automatic transcription phase and subsequent manual revision, interpreting speakers' pauses and changes of speech), it became necessary to define certain rules to deal with coding in particular situations.¹⁶

The entire coding process outlined above as well as the main subsequent analyses were computer-aided, feeding the MS Excel DB (see above, par. 3.6.1) to QDA Miner (Figure 6).¹⁷

Starting from the coding work, we developed several in-depth studies, focusing on individual codes or categories to clarify participants' expectations and elements of satisfaction and dissatisfaction, to study the processes of collaboration and exchange of experiences, examine the various types of training outcomes, and offer information on which topics and which training methodologies work according to specific target group characteristics. These studies used QDA-Miner mainly to apply techniques for analyzing co-variations/correlations (contingency tables, chi-square, Spearman's Rho, Pearson's R) between the coded cases and the background variables presented above in par. 3.6.1.

12 Cabolo (<https://www.cabolo.com>), developed by Cedat85 (<https://www.cedat85.com/it/product/cabolo>), is an automatic transcription system based on artificial intelligence technology capable of correctly recognizing a certain number of speakers. The service was purchased in its web version after a comparative evaluation of several similar products.

13 The progress of the transcription and revision work, carried out by two researchers, was gradually recorded in an MS Excel file and shared with the staff.

14 The other variables are data on the training course attended (macro-region, methodological learning approach); data on the meetings (the date and a code identifying their type, primarily teachers' or school principals' OFGs); information on the speakers' affiliations (school denomination, technographic code, region, province); a series of data on the participants themselves (name, surname, gender, age, school role, school grade, length of service, seniority in their school, attendance of other training courses on evaluation and their duration).

15 Text data mining techniques could be used on a later stage in a confirmatory key to verify and support the evidence to be obtained from the qualitative analysis and as an in-depth study of specific and circumscribed aspects.

16 If contiguous units of analysis attributable to the same code occur within the same fragment, the code must be assigned without interruption, extending the unit of analysis; conversely, if, within the same fragment, there are two or more non-contiguous units of analysis attributable to the same code, the code must be assigned separately; if the same unit of analysis presents different clauses/propositions that can be clearly traced back to different codes, then the coder will proceed with the minute coding of such clause/proposition, breaking down the unit of analysis; if the same unit of analysis presents two or more topics that have to be traced back to different codes but cannot be clearly attributed to distinct clauses/propositions (i.e., it is not possible to apply rule c), the coder will overlap such codes on the same unit of analysis.

17 QDA Miner, a qualitative data analysis software, developed by Provalis Research (<https://provalisresearch.com/products/qualitative-data-analysis-software>).

4. Discussion

4.1. Validity and reliability

From the early stages of planning research, it is useful to ask questions regarding how much the techniques identified to be used in the survey can provide valid and reliable data (Silverman and Gobo, 2002). This resulted in the need to explain the procedures used to ensure both the reliability of the technique used for our research and the validity of the conclusions. For this reason, we developed a protocol for OFGs that already facilitates the evaluation of the effectiveness of the method we used and, therefore, its validation.

To evaluate the effectiveness of the OFG protocol, we used Krueger and Casey's (2014) criteria for the constituent components of a proper focus group as a measure. The six key characteristics identified by Krueger and Casey were: (1) focus groups involve people; (2) focus groups are conducted in series; (3) participants are reasonably homogeneous and unfamiliar with each other; (4) focus groups are ways of collecting data; (5) focus groups make use of qualitative data; and (6) focus groups have focused discussion. According to Turney and Pocknee (2005), these criteria were in turn evaluated in relation to the online focus groups we conducted, clarifying the elements supporting the validity and reliability of the method (see below, paragraph 4.2).

Although the problem of validity and reliability is crucial in qualitative research as in any other type of empirical study, it is an often-overlooked problem (Lucidi et al., 2008). Similarly, the need to generalize the descriptions or explanations that qualitative research offers of a certain phenomenon is neglected (Bryman and Burgess, 1999). According to the classification of Kirk and Miller (1986), as far as validity is concerned, we can summarize that, in this study, we refer in general terms to validity as (a) a semantic correspondence of the results with the context from which the data are taken (*semantic validity*); (b) a concordance of what is highlighted through the use of different tools (*instrumental validity*); and (c) a method of reasoning based on criticism and continuous questioning of the conclusions reached (*theoretical validity*), if they can be valid outside the contingent condition in which they were obtained (*theoretical generalization vs. distributive generalization*; Hammersley, 1992). As far as reliability is concerned, we considered it as the replicability of procedures, distinguishing between internal and external reliabilities (Seale, 1999).

Within our OFG protocol, the semantic validity was evaluated through the so-called validation of the respondent (Lincoln and Guba, 1985), both through the first results emerging from the focus groups and the main research findings, to evaluate the degree of coherence attributed by the subjects studied to the meanings of the interpretive categories identified by the researchers. Our protocol allows for (1) collecting direct feedback from focus group participants through the souvenir photo tool where some keywords are highlighted; (2) collecting indirect feedback from the participants through tools such as the researchers' analysis form highlighting the climatic aspects; the word cloud (which represents an indirect measure of attention to the stimuli presented by the researchers and the return of words that have taken up the overall script of the proposed

stimuli); and some quantitative measures of participation in focus groups, such as average speeches per participant and speeches per participant in 60 min (see Table 2); (3) carrying out computerized textual analysis of the transcripts made automatically in the focus groups, which highlight specific participation references; and (4) organizing seminars to present findings to evaluate the interpretative categories created by the researchers. In our opinion, the use of technology enhanced the aspects of semantic validity, offering a wide range of direct and indirect feedback for semantic validation.

As far as instrumental validity is concerned, we can consider it the degree of agreement established through triangulation between the results of different data collection and/or analysis tools with respect to the same object of study. The basic idea is that, if some aspects of the phenomena and/or relationships between the phenomena are highlighted with more than one method, these are valid. In our protocol, we constantly verified the concordance between the issues that emerged in the focus groups and those investigated by design in the online survey, highlighting the consistency between the two.

In our study, with the aim of identifying coherent relationships between the initial hypotheses or those developed during the study and the results obtained to strengthen the theoretical validity, the definition of the sample of participants was a reasoned choice. Cases were selected based on their status in one or more properties, exemplifying the research topic. Participants were selected with the aim of clarifying some aspects of the general theory underlying the research. Therefore, the OFG sampling we conducted is theoretically significant. We attributed crucial relevance to the choice of cases (Flyvberg, 2006). The type of generalization that we evaluated in our protocol can also be referred to as "transferability" (Guba and Lincoln, 1989) or analytic generalization (Yin, 2000), i.e., beyond the contingent differences of context, the possibility of identifying a set of statements that can shed light on the behaviors, values, beliefs, typical of cultures of similar life forms (organizations) (Ricolfi, 1998). While on the one hand, the organization of online focus groups may have facilitated participation given the possibility of participating without moving, on the other hand, we do not know if some subjects may have chosen not to participate due to the digital device. If the theoretical validity manifests itself in the attempt to verify the hypotheses that are progressively formulated based on the empirical relationships traceable in the data (Silverman and Gobo, 2002) and the provisional analytical scheme must always be compared, even with the negative (even absent) or deviant cases, due to also not being able to determine a priori, the non-participations can constitute a threat to this type of validity. Surely this is an aspect that will have to be improved in the future to strengthen the theoretical validity of OFGs.

The extensive use of technologies, both for the management and animation of OFGs and for the construction of the empirical base and data analysis, greatly increases the reliability of the technique, as this essentially depends on the explicit description of the observational procedures and the transparency of the analysis process. Most innovations that tend to be predominantly technological (audio-video recordings, automatic transcription software that allows text to be structured and therefore information

to be inserted into structures and transformed into data, also for carrying out quantitative analyses) can allow for an increase in the degree of inspection/explorability of the empirical base. Furthermore, technologies facilitate greater recurrence by switching back and forth between theory, collection, and data analysis, which is one of the characteristics of qualitative research, helping to make it more rigorous (Ricolfi, 1998). In our study, we defined the protocol that we present in this study to exhaustively explain all the procedures used and systematically organize the data collected. The use of technology has made it possible to strengthen and enhance the external reliability of the focus groups we have conducted, increasing the likelihood that all the needed information has been provided so that other researchers can replicate the procedures of our study, not necessarily to obtain the same results but to understand differences.

Furthermore, the possibility of having an immediate transcription of the texts available has increased our ability to conduct computer-aided textual analysis, being able to operate a continuous return to the empirical base constituted by all the audio-video material, increasing the degree of stability, reproducibility, and accuracy of the results achieved (Lucidi et al., 2008).

4.2. OFG evaluation effectiveness

4.2.1. Focus groups involve people

As shown in Table 2, 37 school principals (out of 42 eligible) took part in four online focus groups, and 101 teachers (of 126 eligible) took part in nine online focus groups, one for each region involved in the project. An average of 10.7 people took part in each focus group: from nine to ten in those for school principals; from seven to 18 in those dedicated to teachers. A higher number of participants took part in OFG for the Campania teachers, because during the admission of the participants to the session, the staff was hesitant to exclude participants who had not confirmed.

On average, across all OFGs, there were 8.58 speeches per participant (Table 2).

The participation experience and feedback on the focus group by participants were categorized into a specific code called “focus group internal debate”, through computer-aided textual analysis (QDA-Miner software). This analysis found that the participants reported enjoying the online focus groups. For the participants OFGs were (1) a way to connect people who attended the V/S training; (2) an opportunity for comparisons between different schools; (3) an opportunity for further reflection and meta-cognition on the training experience; (4) a learning phase; and (5) a synthesis phase of the meanings attributed to the training by the beneficiaries and the research group. Participants recognized the moderator's role of true listening and effective synthesis. Several times, the moderator and co-hosts received congratulations for the organization and appreciation for the educational value attributed to the implementation of the focus group itself. These findings are related to studies where OFG participants reported enjoying having their voices heard and connecting with others during the pandemic and finding online focus groups to be supportive (Lathen and Laestadius, 2021; Keen et al., 2022).

Finally, in the souvenir photo, participants summarized in one word what the meeting meant to them: out of a total of 135 occurrences, 87 words were used, all with positive connotations, such as orientation, sharing, motivation, course, pleasant, innovation, change, imagination, training, trust, reflection, debate, surprise, collaboration, inclusiveness, introspection, relationship, together, planning/design, awakenings, diffusion, production, and vision. The most frequent words highlighted were sharing (14), debate (13), reflection (8), and productive (4).

4.2.2. Focus groups are conducted in series

In this study, 13 OFGs were carried out, between the end of March 2020 and May 2020; four OFGs involved school principals, one OFG for each macro area (northern, central, and southern Italy) plus one for recovery. Nine OFGs were held for teachers. Each focus group lasted on average 105 min. Overall, the OFGs consisted of a total of 1,339 min of video recordings (see Table 2). The same script and outline for each OFG steered the debate around the research topic. According to Krueger (1994), it is necessary to run multiple groups with similar participants to optimize the data collection and group trends. The adoption of a protocol for the management of focus groups facilitated the possibility of giving uniformity to the various sessions of focus groups, which were held on different days and with different participants.

4.2.3. Participants are reasonably homogenous and unfamiliar with each other

In this study, each focus group involved groups of homogeneous participants. We organized two kinds of OFG based on the homogeneity of the role and course attended by participants: one targeting school principals grouped by macro-regions and the other, teachers grouped by region. At the same time, the participants did not know each other. Indeed, as Krueger (1994) says, it is necessary to recruit participants with shared interests, because it allows them to focus the debate and to express controversial or private points of view. However, on the contrary, Krueger and Casey (2014) argued that familiarity tends to inhibit debate.

4.2.4. Focus groups are methods of data collection

In this study, the OFG was used with the specific goal of collecting data on the strengths and limitations of the V/S training course and the medium-term trend of the project. Video recordings and text transcription made it possible to record participants' responses accurately and automatically. The revised transcripts were transferred to an MS Excel spreadsheet, in which each row (a record) corresponded to an intervention, defined as a “fragment”, with a univocal, sequential, and speaking code (“unique fragment ID”). This allowed researchers to explore the data reliably. The DB consisted of 2,263 fragments, including the moderator's interventions; 713 fragments were related to the four principal OFGs, and 1,550 fragments were related to the nine teacher OFGs. At the same time, the research team recorded comments made using Zoom's online chat facility.

As regards the lexicometric measures of the various focus groups, they demonstrated that their development is quite similar in terms of words. The lexicometric data relating to the various focus groups showed that, in general, the focus groups had a similar development in terms of words spoken by the participants and by the moderator (total number of words, tokens, are in fact the total occurrences of a focus group). However, as was noted in the debriefing sessions, in some regions, there was a greater number of words (e.g., South school principals, Campania teachers, Emilia Romagna teachers, respectively 15,366, 16,007, 15,289 tokens), and the number of words was also relatively independent of the time duration (as indicated by the token/minute ratio) (respectively 19.21; 18.59; 17.77).

According to one of the main lexicometric measures of the size of the corpus, the whole database consisted of 192,397 tokens and 9,658 types. It is a medium-sized corpus that is positioned almost at the limit of a large corpus¹⁸ (Giuliano, 2004, p. 64–65).

4.2.5. Focus group data are qualitative

Focus groups are designed to collect more in-depth qualitative data on the participants' experiences through group interaction on a topic determined by the researcher (Morgan, 1997, p. 6). These participants' attitudes and points of view are gained through predetermined stimuli submitted by the moderator. The research team defined stimuli wording that was adjusted to an online setting; the stimuli were shown on slides and after that put in the chat. In this way, participants could read the stimuli in the chat and engage in debate, without distraction. The following analysis of the OFGs was carried out according to a phenomenological-interpretative perspective (Moustakas, 1994; Merriam, 1998), thus proceeding by means of textual content analysis (Losito, 2002; Mayring, 2014). An abductive approach was developed for computer-aided text coding, which combined a bottom-up and inductive approach, emerging from the exploration of the empirical base (textual corpus), with a deductive and top-down approach, based on interpretive categories of the project reference framework (Fereday and Muir-Cochrane, 2006; Adu, 2019).

4.2.6. Focus groups constitute a focused discussion

An OFG is a computer-mediated communication event in which a select group of individuals participates in a moderated, structured, online discussion to explore a particular topic for the purpose of research (Peacock et al., 2009). According to Turney and Pocknee (2005), the OFG, much like the face-to-face focus group, being very natural, is a focused approach, because participants can engage in debate on specific topics by invitation.

The research team defined four stimuli based on the hypothesis of the VJS case study. Stimuli were used to guide/ensure comparable conversation through all 13 OFGs. In our study, the moderator's role was most important in setting the context, guiding the discussion, and engaging participants in an interactive conversation.

¹⁸ A medium-sized corpus is between 50,000–100,000 occurrences; a corpus greater than 200,000 occurrences is large-sized.

5. Conclusion

COVID-19 prompted discussion on conducting qualitative research in the pandemic era, and there exists a growing body of literature on the practical, technical, and ethical protocols of virtual research modalities, such as video interviews or OFGs. Reflections have included considerations on participant recruitment, ethical consideration about data privacy, and participant digital literacy (Nobrega et al., 2021; Keen et al., 2022; Monaco, 2022). OFGs can become a methodological tool to conduct high-quality and rigorous qualitative research in a context of crisis and beyond, involving a large audience of people by dematerializing participation and thus encouraging green investments.

In this study, we drafted an online focus group procedure with teachers and school principals and used it to process the evaluation of the VJS Project. Online modality adjustment of focus groups affected many aspects of the study: (1) designing research stimuli, (2) choosing the technological tools, (3) recruiting participants, (4) scheduling the workflow, and (5) scheduling data analysis. This OFG protocol made it possible to keep methodological and procedural choices under control. It can be used as a working tool for creating upcoming versions of focus groups to assist in the evaluation of what has been achieved up to a certain point and to proceed forward by summarizing strengths and weaknesses. The protocol enabled scheduled phase development and careful definition of the facilitation roles, which is very important in making an OFG successful. The most important elements that made the work positive were (a) the presence of several figures with different roles and complementary functions and (b) the management of the four researchers, which made the meetings extremely fluid, especially concerning the first running-in phases. Using one moderator and two co-hosts was effective for allowing debate, managing participant interactions, directing stimuli presentation, steering other facilitation tools, controlling audio recording, and timekeeping. Assigning a fourth researcher as a co-host observer was useful for collecting data about the facilitation process, participation, and the non-verbal language of the participants. A strength of the protocol was that 13 OFGs were conducted, which allowed the staff to make iterative improvements with each session.

The audio-visual tools facilitated clearer recordings, and the technology-assisted transcription tools captured precise dialog. Participants' webcams were always on; the souvenir photo with the keywords offered a less formal and more convivial final moment.

The Zoom platform (with a Business license) was confirmed as an excellent choice, both in scheduling and managing online focus groups (meeting mode).

The time available was not always sufficient to answer calmly in a well-articulated way and with diversified rhythms. The scheduled time of 1.5h proved to be rather tight and was almost always exceeded: on average, the duration of the focus groups was approximately 2h or a little less. The staff identified some areas for future improvement, including fewer stimuli and adjusting participant numbers to relax the pace of discussion. A further limitation of the generalization of the OFG findings is that the participants represent a specific professional sector (teachers and principals) who

already had experience using videoconferencing for teaching during the COVID-19 pandemic. It's likely that the protocol could be enhanced for less experienced participants with videoconferencing technology.

In the context of this study, the online focus group as a formal research method met the key criteria of traditional focus group methods, as outlined by Krueger and Casey (2014). Turney and Pocknee (2005, p. 39) “recommend using [virtual] online focus groups more regularly and evaluating their usage in a variety of contexts to confirm these findings”. To increase the validity and reliability of the findings, in our opinion, it is necessary: (1) to pay ever greater attention to the choice of cases, also considering negative (or absent) and deviated cases; (2) to encourage researchers to clearly document their protocol, procedures, setting, equipment, data collection, and analysis methods for others to learn from Tran et al. (2021); (3) to develop innovative methods that enhance participant interaction and build social context through strong moderator leadership skills; and (4) to include effectiveness measures in the protocol.

Further evidence of validity, suggestions, adaptations, and limitations of use for online focus groups can derive from quasi-experimental approaches that include a control group using traditional face-to-face modalities. These research designs could also highlight any differences between online and traditional focus groups in terms of analysis depth, variety of ideas, expressions, and the dynamics of participation.

Data availability statement

Raw data supporting the conclusion of this article will be made available by the authors, as well as further reflection with other researchers.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

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Author contributions

DP was responsible for discussion, validity and reliability, OFG evaluation effectiveness, and conclusion section with LG. MP was responsible for the step-by-step OFG protocol, OFG management, and ethical consideration sections. GP was responsible for the materials and equipment, the videoconferencing system, the word clouds, souvenir photo with the keywords, data analysis protocol, transcription and database building, and textual content coding and analysis sections. LG was responsible for the introduction, online focus group, study design, OFG evaluation form, and conclusion sections with DP. All authors contributed to the study design and approved the final version of the manuscript for submission.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Examining the emergence of digital society and the digital divide in India: A comparative evaluation between urban and rural areas

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Contemporary digital society has become a critical agent for transformation in various spheres of life and a new methodological framework for interdisciplinary research. It has emerged as a parallel entity alongside conventional society, where an individual's membership is not only limited to the physical world but also extends to the digital realm. In fact, a person's membership in the physical world is incomplete without their connection to the digital society. Digital technology is instrumental in driving social transformations in areas such as the economy, politics, culture, and religion. The striking feature of digital society is digital data production in the form of big data. Unlike in a conventional society, people's every move and behavior in a digital society are calculated and recorded as data. In this global context of a digital society, India has created opportunities for digitalization for its people since 2000, with significant strides made between 2015 and 2016. Reliance Jio, a telecom company, helped to accelerate this process by offering free unlimited Internet packages on a mass scale. This led to a tremendous surge in service industries and the emergence of new sectors, as well as a digital revolution in the conventional systems of the economy, politics, culture, education, religion, and law. However, this transformation has also exposed a significant challenge—the digital divide or digital inequalities, which cannot be overlooked or undermined in sociological research. It would be wrong to reduce digital inequality to a mere technological divide; it is a complex issue shaped by prevailing socioeconomic conditions, digital inequalities, and capability inequality. The study revealed that India's prevailing socioeconomic divide is the source of its wide digital divide. This digital divide exists across both rural and urban areas, affecting access to digital education and economic opportunities. The digital divide is also found between under-resourced urban areas and affluent residential areas. This study's theoretical framework draws on the studies of Castell on the information society and Dijk's concept of the network society.

KEYWORDS

digital society, digital divide, digitalization in India, social transformation, digital inequality

Introduction

The growing global socioeconomic divide and the digital divide are currently the most pressing issues that sociology is grappling with. The world is undergoing a digital transformation. As a result, digital society, digital space, digital capital, digital relations, digital access, and so on have become increasingly relevant to sociology, like any other

societal aspect and social relations. The digitalized world is described using various terms, such as information society (Dijk, 2006) and network society (Dijk, 2006; Castells, 2010). These terms are used to denote the society that has emerged from the impact of information and communication technology. The most commonly used term is information society. Castells (2010) and Dijk (2006) have used the terms “information society” and “network society” to describe this type of society.

In the 1970s, the information and communication technological paradigm in the United States initiated a technological development that resulted in the digital revolution. This new paradigm shifted European and Western societies' political and economic conditions. The new technological paradigm surpassed the early rise of the electronics industry in the 1940s–1960s, as it fostered a culture of freedom, individual innovation, and entrepreneurialism (Castells, 2010, p. 4). An important question to consider is whether technology has developed uniformly on a global scale. Did technology determine different levels of development? Did society determine different levels of technological advancement? The digital divide question makes us consider societal or state intervention in technological advancement and vice versa. Castells (2010, p. 5) believes that technology does not determine society but society does determine the course of technological change because many factors, such as individual inventiveness and entrepreneurialism, are involved in the process of scientific discovery, technological innovation, and social applications. However, the results depend on the complex interaction pattern between technology and society. He further argues that technological determinism is a false problem because technology is society, and society cannot be understood or represented without its technological tools.

Society and technology are inevitably linked, and society determines technology and its advancement. Digital society can be viewed as a parallel to physical society, in which individuals voluntarily become members. However, its membership is as important as the membership of the physical society. Physical society refers to the material existence of social institutions and the physical appearance of social relations. We accept that abstract entities, such as norms, values, and customs, are essential societal elements. In the physical society, human actions and relationships are regulated socially, culturally, and legally, while in the digital society, online behavior is governed by simple legal guidelines. However, these guidelines cannot be equated with social control mechanisms present in physical society.

A question then arises: Does society determine the digital divide? The answer to this question is yes, because the prevailing socioeconomic divide is the root cause of the digital divide in any society. In this context, it can be argued that the digital divide cannot be understood in isolation but rather in relation to the global socioeconomic divide. India has been part of the digital society since the beginning of the 21st century with the introduction of the Internet and information and communication technology. However, it was not until a significant shift occurred in 2016 with the launch of Reliance Jio Infocomm Ltd. by Reliance Communication Ltd. that a true digital revolution took hold. This revolution marked the beginning of a new age of digitalization in India, leading to a subsequent smartphone revolution.

Materials and methods

The study is based on qualitative methods such as unstructured interviews, case studies, and participant observation. The present study conducted a review and interpretation of published studies and also included an empirical study. The study selected Guwahati, the capital city of Assam, and Buribail village (District Cachar) in Assam as its locations. The respondents were students, working youths, professionals, and rural dwellers. In the unstructured group interview, 80 interviews were conducted in both villages and cities. Case studies were conducted in under-resourced areas in Guwahati city where the living conditions of some houses and dwellers were analyzed. Additionally, participant observation methods were used among students and youths in urban residential areas, such as apartments. The study, which focused on a city and a village, can serve as a hypothesis for further research on the issue of the digital divide. Moreover, this study mainly focused on interpreting the inevitable link between socioeconomic disparity and the digital divide in India. The theoretical framework of this study highlights the interconnectedness of digital society and physical society, emphasizing that the digital divide cannot be reduced to a mere technological problem but must be understood as a complex techno-social problem.

Results

The results of the study revealed that digital society is a new techno-social phase that has emerged globally, and India has become a part of it. However, India has not been able to address the issue of socioeconomic inequality. India's prevailing socioeconomic divide is the source of a wide digital divide. The digital divide was found to exist primarily in the educational and economic aspects of both rural and urban areas. There is a wide digital divide between rural and urban areas, as well as between affluent cities and under-resourced urban areas. The digital divide mainly includes poor digital infrastructure in villages and under-resourced urban areas, limited access to digital facilities, and poor socioeconomic conditions. However, cities and affluent parts of cities are technologically advanced and have access to digital facilities. A detailed discussion is made in the sections below.

Digital society: A new techno-social phase

The first question that arises is as follows: Do we differentiate digital society from network society or information society? Our approach was not to consider the digital society as a distinct entity but rather as an extension of the network society or information society. An important issue that has been highlighted is how digital society encompasses societal dimensions and turns into a parallel society. Instead of focusing on defining the digital society as a separate physical entity, it may be more useful to revisit Castells' (2010) concept of the network society. He elaborated on how the emergence of a new technology or technological paradigm, based on the development of information and communication technology, has transformed the world since 1970 and diffused unevenly across various regions of the world. Technology does

not determine society; rather, it is a society that determines technology. This indicates that technology is regulated by the values, norms, and needs of people within society, as stated by Castells (2010). Castells (2010) coined the term “network society” and referred to the emerging society as a network society. He preferred this term over information society or knowledge society because microelectronics-based networking technologies brought new capabilities to an old form of social organization in the knowledge society or the information society. He claimed that digital communication networks are the backbone of the network society (Castells, 2005, p. 4). The network society is based on communication networks that transcend boundaries, making the network society global. The network society is based on global networks of capital, goods, services, labor, communication, information, science, and technology. Due to their programming, networks are selective, and as a result, while the contemporary network society has diffused throughout the world, it still does not include everyone. Although global networks have an impact on all human beings, they have excluded large sections of the population in the early 21st century (Castells, 2005, p. 5). Dijk’s (2006) concept of information society and network society signifies the contemporary development of modern society, characterized by widespread information exchange and the use of information and communication technology in every sphere of life. His classification of society as an information and network society also corresponds with concepts such as capitalist society and post-modern society. Information is a fundamental aspect of an information society that permeates all aspects of society. In an information society, the societal organization is based on science, rationality, and reflexivity; the economy (agrarian and industrial) increasingly leads toward information production, and the labor market is based on information processing skills that require knowledge and education. Culture in the information society is determined by media and information products through various symbolic entities and meanings (Dijk, 2006, p. 19). The network society is defined as a social structure that relies on social and media networks as its infrastructure, with organizational networks existing at the individual, group, or organizational and societal levels. The network function serves as a means of linking all units, including individuals, groups, and organizations. Individuals are the fundamental unit of a network society in the West, whereas families, communities, and workgroups may be the network units in Eastern societies (Dijk, 2006, p. 20). A network is defined as a collection of links between unit elements, where nodes represent the elements and the unit systems. A single link between two elements is called a relation(ship). Networks are a mode of organization for complex systems in nature and society (Dijk, 2006, p. 24), with the individual as the basic unit of a network society. Traditional collectivities such as joint families, communities, and tribes have become fragmented. Different kinds of communities have emerged that are connected through larger-scale networks, even though they continue to live in their traditional families, neighborhoods, and organizations. This development has made the work environment more extensive and connected due to the networks (Dijk, 2006, pp. 35–36).

Tim Berners-Lee’s leading innovation, the World Wide Web, came along in 1989 and played a critical role in the digitalization

of the world, which transformed Internet technology from a small network of computers into global communication systems. Until then, the Internet was used only for military and research purposes, but the World Wide Web broadened its network. With this technological transformation, the material foundation for a new society was laid: a digital society (Redshaw, 2020). Information flow is the key feature or basis of a digital society. Digital society and the information age have a definite pattern of social relations and communication (fundamental structural elements of society) derived from a complex system of relations in the physical society. On the one hand, the term “physical society” refers to a society where people live in systems of physical contact and have face-to-face relationships. On the other hand, digital society is a virtual system of social relations that allows individuals to gain membership and citizenship through the use of the World Wide Web and the Internet. The establishment and operation of a physical society require physical infrastructure and an environment. Similarly, the establishment and operation of a digital society require digital infrastructure such as computers, mobile phones, the World Wide Web, the Internet, and applications.

The digital society is characterized by a flow of information through global networks at unprecedented speeds. The “superconnected” life through the “Internet of things” is the most striking feature of digital society, where big data and data mining play a crucial role (Redshaw, 2020). The digital society became a global transformation due to the fourth industrial revolution, known as Industry 4.0. This techno-social transformation is closely linked with consumerism, and it aligns with the current advanced industrial age for greater market benefits and industrial benefits. Late capitalism or advanced capitalism extensively regulates society, political economy, and everyday life to the extent that all human activities are digitalized and become objects of profit for industries. The digitalization of life has undoubtedly upgraded the standard of living, but, at the same time, it has raised many questions regarding digital use and consumption, digital trends or commercial trends, power games, and so on. The consumption trend, particularly in popular culture and social media in India, has been growing fast, raising questions about digital space, the capitalization of digital space, digital activism, and the digital divide. The culture industry or popular culture (Horkheimer and Adorno, 1944; Marcuse, 1964) is legitimately utilized or rationalized with the notion of “entertainment” in an advanced industrial society. In contemporary society, social media is not just a medium of communication but rather an industry that generates its audience and produces content. Social media has recently become a new reality and a digital phenomenon. Industry 4.0 marked the beginning of a new digital society where people’s access to technological infrastructure and the Internet is inevitable. Industry 4.0 refers to a digital, data-driven, interconnected industry that transforms production, marketing, labor, healthcare, and human relations, among others (Banholzer, 2022). Those who cannot access technological infrastructure and the Internet are cut off from mainstream society and the global village. From the point of access and capability of people, digital inequality and the digital divide appear as major global phenomena. The European Commission (2021) planned a highly innovative and

ambitious industrial strategy for Europe. The main focus was on creating an economic transformation in Europe to augment the change. Industry 4.0 was coined in Germany in 2011 as a future project of the country and an integral element of its high-tech industrial strategy. It mainly focused on the stability of employees in production systems and ecological dimensions in the form of “green production” for a carbon-neutral and energy-efficient industry (European Commission, 2021, p. 8). The network society is instrumental in developing the digital society. The evolution from a network society to a digital society is referenced in Dijk’s (2006) analysis of the development of information and communication technology. The most striking foundation of a network society is microelectronic technology, which enables telecommunications, data communications, and mass communications to be carried out. This technology is the basis for the improvement of communication capacities in the new media, including speed, storage capacity, accuracy, stimulus richness, and complexity of operations. The second fundamental structure of network society is the use of a uniform language in microelectronics for exchanging signals. This uniformity is the language of digital signals. Digitalization is the binding structure for all new telecommunication, data, and mass media networks (Dijk, 2006, p. 43). Digitalization refers to the process of converting analog signals, such as sounds and images, into digital signals made up of ones and zeroes (bits). This allows for the fast and uninterrupted transmission and connection of these signals with the help of microelectronics. Digital signals can be easily processed and manipulated to improve the quality of data, texts, sounds, and images (Dijk, 2006, p. 44).

The digitalization of the network society is a new technological development in the world’s communication system. Questions that arise are as follows: Is it only about communication or more than this? To take a critical theory, or the Frankfurt School’s stance of “techno-rationality” and “democratic unfreedom,” we can claim that, although the technology of communication and networking is created by the subjective state of human beings, it has been determined by the objective social structural mechanisms of society. Objective social structural elements may be industry, statism, economic policy, the political power system, and so on. Therefore, communication in a network society or information society is not simply a mechanism of human relations and exchanges but rather a source of a new mode of control. Techno-rationality legitimizes democratic freedom by creating the mechanisms (digital nodes) of a lack of freedom in an industrial system. Humans use digital technology that is already programmed in such a way that its result will meet the desired goal of the industry.

The digital society and physical society cannot function separately because elements such as social relationships, societal structure, social institutions, norms, values, culture, and social control are redefined as complex techno-social systems in the new digital world. This technocratic social structure of the digital society has significantly altered the traditional activities of the physical society. The digital society represents a blend of techno-social and economic progress. This advancement is what neo-Marxists like Adorno and Horkheimer (1944), Marcuse (1964), and Ralf (1957) called an advanced industrial society. Membership in a digital society is not mandatory, and individuals having

the option to choose is just as crucial as being a member of a physical society. However, its membership is as important as the membership of the physical society. This is because the vast influence and widespread integration of digital technologies into human life make it impossible for any individual worldwide to remain isolated from the digital society. In short, the term “physical society” refers to the tangible presence of social institutions and the observable connections within social relationships. However, it is important to recognize that abstract entities such as norms, values, customs, and so on are also inevitable elements of society that have no physical existence but appear in the social activities of human beings.

Conceptualizing the digital divide in the Indian context

Just as the globalization of technology and digital society reshaped the world, the digital divide added a new dimension to the persisting global socioeconomic divide. Addressing the digital divide has become a global concern due to the significant role that technological progress and techno-consumption play in the global political economy (Figure 1).

Bridging the digital divide is beneficial for businesses because the marketplace is online, and, in this case, having more online customers is profitable (Riggins and Dewan, 2005). There are three levels of analysis of the policy and managerial implications of the digital divide (Riggins and Dewan, 2005, p. 300).

Individual level: At the individual level, the “digital divide” refers to a lack of access to IT due to technological, sociological, and economic disadvantages. The gap exists between individuals who have access to IT as an integral part of their lives and those who do not. Access to technology also varies across geographical areas. For instance, rural areas have poor access to the Internet (Riggins and Dewan, 2005, p. 300).

Organizational level: At the organizational level, the “digital divide” refers to the disparity in digital management among industry organizations.

Global level: At the global level, the “digital divide” refers to the inequality in investment and policies for both corporate and individual adoption of ICT among different countries (Riggins and Dewan, 2005, p. 300).

The analysis of the digital divide at these three levels considers two types of effects: first-order effects, which relate to inequalities in access to ICT, and second-order effects, which relate to inequalities in the ability to effectively utilize ICT, among those who already have access (Riggins and Dewan, 2005, p. 300).

The digital divide refers to the gap between individuals, households, businesses, and geographic areas at different socioeconomic levels regarding opportunities to access information and communication technologies (ICTs) and their use of the Internet for a wide variety of activities. However, access to telecommunications is a precondition for the access and use of the Internet (OECD India, 2021, p. 5).

The pattern of the digital divide in India is found at three levels:

Social group or class (lower caste and lower class): The digital divide between higher and lower castes is a socio-technical issue that highlights how higher castes tend to be more affluent and

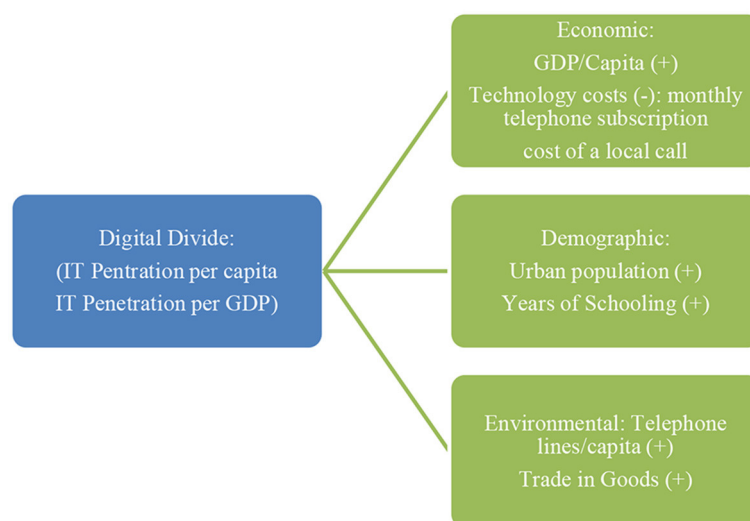


FIGURE 1

An empirical framework for examining the digital divide. Source: Kraemer et al. (2005), p. 414.

digitally advanced than lower castes. The class or socioeconomic gap is vast in Indian society; therefore, the digital divide is a kind of extension of the prevailing divide (Understanding the Digital Divide, 2001).

Individual: The digital divide is determined by an individual's ability to access digital resources, their level of digital literacy, their reasons for using digital platforms, and their consumption habits.

- **Institutions** (education, governance, and local economy): At the institutional level, the digital divide can be observed in three areas: public and private schools, colleges, and universities. The digital divide in governance refers to the divide between local self-governance (Panchayati Raj Institution) and people's access to digital governance. The digital divide is also visibly prevalent in the local economy.

The interface of the socioeconomic and digital divide in India

The digital divide in India cannot be analyzed as a single issue. Considering that pre-existing socioeconomic divides is also important, India is characterized by various socioeconomic divides, such as caste stratification, the rural-urban divide, capability inequality, and class disparity. Dalits are considered to be the lowest stratum of caste groups in India, whose social and economic position is much worse than that of any other population in India. India's rural areas are still highly under-resourced and poorly managed compared to its urban areas, which are much more developed and technologically advanced (Figure 2).

Capability inequality is another serious issue to consider (Sen, 1993, 2009). India exhibits various patterns of living standards based on capability. The class gap and social stratification in India are concerning, as there is a clear divide between the affluent and poorer sections of society, both in rural and urban areas.

Fields of the digital divide in India

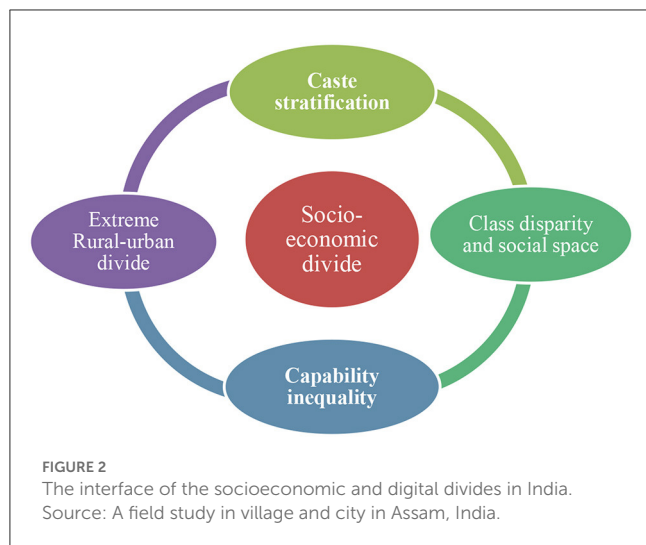
Economic: The economic situations of individuals and social groups are based on their occupations. In any society, people maintain two kinds of economic bases: job/work and skills. India has a serious issue with work opportunities due to a lack of skills or poor technical skills. In contemporary society, static skills are no longer relevant; individuals need to continuously upskill themselves to survive in the competitive market. Unfortunately, the low attainment of education is a problem, resulting in a limited number of technically skilled laborers. Therefore, digitalization may not be able to bring about significant changes in the working conditions and overall economy of manual workers (India Skills Report, 2021).

India's employment trend is largely informal, with a large percentage of the workforce engaged in informal jobs. This informal workforce in India encompasses individuals working in private enterprises, daily wage laborers, domestic helpers, and manual laborers in the formal sector who work without any socioeconomic security or benefits. The total population employed in India is 461.52 million, of which 415.23 million have informal jobs. Of the total number of people employed, 90% of men and 92% of women are informally employed. The education of workers in the informal sector is low. Educational attainment is also low among domestic laborers, street vendors, sweepers, and manual construction workers. Of these workers, over 60% of women and 35% of men had dropped out of primary school (World Bank Report).

Education: The digital divide is also evident in certain aspects of education.

Institutional Difference: This is the difference between public and private educational institutions in digitalized learning.

Unequal access to digital infrastructure: Affluent sections have the necessary digital equipment to pursue education, but poorer sections are unable to take advantage of these resources.



Unequal access to e-learning: E-learning platforms, such as BYJU'S, Unacademy, and WhiteHat JN., have become very popular in India. However, due to unequal access to digital infrastructure, not all sections of the population have equal opportunities to benefit from these platforms.

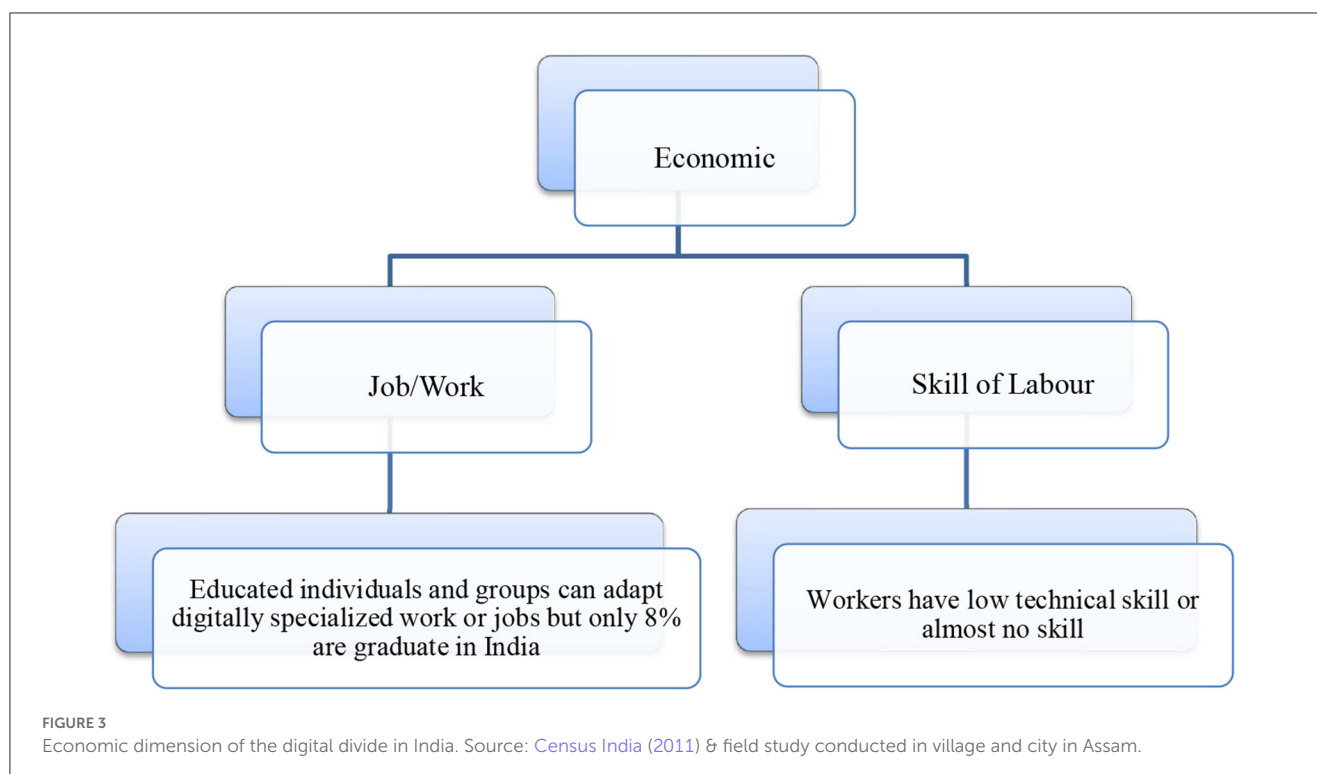
The social environment for digitalized education: The social environment in under-resourced villages and under-resourced urban areas is not conducive enough for education even if mobile phones are available; the quality of education remains poor (Figure 3).

Digitalization and the trend of popular culture consumption in India

In 2007, Reliance Jio sparked a revolution in India by providing unlimited 3G and 4G Internet access at an affordable price. This Indian telecommunications company, also known as Jio, launched its commercial 4G services in 2016 with free data and voice services, a strategy that was later adopted by other telecom companies such as Airtel, BSNL, and more. Moreover, the partner policy of mobile phone companies that began offering 4G smartphones at much lower prices also played a significant role in contributing to the growth of Jio, Airtel, BSNL, etc. The availability of smartphones from Chinese mobile companies in the Indian market changed the entire consumption pattern. Compared to Nokia and Samsung, Chinese companies (Oppo, Vivo, Huawei, Karbonn, etc.) offered smartphones at a significantly lower price, which was easily affordable for most people in India. Later, Nokia and Samsung also followed the same policy to create a greater customer network. These Chinese smartphone companies ensured the purchasing capacity of mobile phones for workers such as rickshaw pullers, daily wage laborers, and factory workers. Thus, Reliance Jio's data plans and a new policy among smartphone companies, particularly Chinese companies, contributed to the advancement of consumer networks that eventually helped popular culture and social networking to grow exponentially. The social network transformed after the advent of Web 2.0 in the early 21st

century, evolving into comprehensive platforms for data collection, analysis, and content creation. The integration of social networks with popular culture has been instrumental in the massive growth of the digital population, ultimately positioning India as a leading consumer trendsetter in the world.

Upon examining the widespread use of social media, it becomes apparent that it functions as both a component of the culture industry and a commercial media industry. O'Reilly and Battelle (2009) concept of Web 2.0 has shed light on the evolution from "network as service" to "network as platform." "Network as platform" refers to harnessing the power of networks to create applications, which is key to attracting and engaging users. The industry encompasses huge organizations that facilitate software provision and a community of users connected by social networking platforms such as Facebook, YouTube, etc. Mandiberg's (2012) concepts of "amateur media" and "user-generated content" showed us how social media had enabled user participation in media in two ways: as both producers and consumers. Media consumption has changed from a unidirectional to a multidirectional system. Mandiberg (2012) noted the massive growth of social media use because of the affordability of computers, software, and the Internet in the early 21st century. Data scientists have claimed that "media analytics" (Manovich, 2018) is the basis for the consistent growth of the culture industry. Social media has changed the prevailing media system from a unidirectional media-audience relationship to a multidirectional communication process. People are presently not merely passive audiences but active participants; technological advancement has enabled the majority of people to use social media to produce and distribute content. Until the end of the 20th century, media was a professional organization, and people were simply audience members. However, this relationship has become less distinct because of the multidirectional broadcasting started by new media forms such as blogs and social networking sites, which focus on active audience participation instead of unidirectional broadcasting. This happened mainly because of the affordability of computers, software, and the Internet; the majority of people were able to purchase these for personal use (Mandiberg, 2012, p. 1). Significant technological innovations in social media have led to the development of participatory systems such as messaging applications, like and dislike buttons, sharing options for various types of content (photos, videos, blogs, and other contents), and comment features. Mandiberg called these types of social media content "user-generated content" (Mandiberg, 2012, p. 2). It is interesting to note that technological intelligence creates a huge community of users of applications and produces user-generated data in real time, which is useful for social networks, culture industries, and business platforms such as Amazon, Google, and so on. Seeing the massive change in network applications (software), Tim O'Reilly (2012) conceptualized Web 2.0 to describe the network as a platform for user-generated and industrial use of real-time user-generated data. Web 2.0 harnesses collective intelligence and can be considered a mature stage of the web (formally known as the World Wide Web) (O'Reilly and Battelle, 2009). Network applications are systems for harnessing collective intelligence that depends on managing, understanding, and responding to massive amounts of user-generated data in real time, which include data subsystems such as location and identity (of people, products, and



places). The smartphone revolution further widened the web as it moved from desktops to people's pockets. The most remarkable addition to Web 2.0 is the use of sensors in web searches instead of manual human searches; motion and location sensors extensively record human activity and store it as data. In this day and age, people's every activity, including their choices of food, clothing, and places; their engagement with popular culture items; their time spent using social media; the nature of the content they follow; and their current locations or previously visited locations, are recorded as data (big data) in the era of advanced Web 2.0. The culture industry, social media, and other service industries collect, present, and use this data in real time (O'Reilly and Battelle, 2009, p. 1).

Real-time media analytics represents a major technological breakthrough in service industries. Companies sell cultural goods and services through websites and apps (such as Amazon, Apple, Spotify, and Netflix) that organize searchable information for their users. This is made possible through platforms such as Google, Baidu, and Yandex. To increase sales and attract more consumers, these companies utilize social communication and information-sharing tools such as Facebook, QQ, WeChat, WhatsApp, and Twitter. Additionally, they use media-sharing platforms such as Instagram, Pinterest, YouTube, and iQiyi. These companies rely on the computational analysis of massive media data sets and data streams. The practice of analyzing large amounts of content and interaction data across the culture industry began in 1995 and matured in 2010 when Facebook reached 500 million users. These data include information on users' online behavior, physical activity, media content created by companies, and media content created by users of social networks. People's online behavior is monitored through browsing pages, link tracking, post sharing,

post linking, content viewing, content playing or reading, and ad clicking. Physical activity data pertain to social network and online platform usage, including the time and location of use. Media content created by companies are, for example, songs, movies, videos, and books; and media content created by users of social networks includes posts, conversations, images, and videos (Manovich, 2018). Companies have used two kinds of data: "data sets" (static or historical data) and "data streams" (data in real-time). However, currently, industries are increasingly using real-time data analysis. Sociology, digital humanities, and computational social sciences analyze data sets or historical data.

When widespread poverty, hunger, unemployment, and poor living conditions are prevalent, the apparent poor status of social wellbeing in India becomes the topic of discussion. As such, the consumption of popular culture and social media in India may not be entirely justifiable, as leisure and entertainment are often reserved for industrial workers or employees in the United States and other advanced industrial societies (started by Fordism), who have the means and material wellbeing to consume popular culture for relaxation. Therefore, the consumption of popular culture and the notions of "entertainment" and "free time" are linked (Horkheimer and Adorno, 2002), which is the basis of labor management for mass production (Fordism) in an advanced industrial society. In India, a large number of people are unemployed and struggle to maintain a basic standard of living and access to education and healthcare.

The Oxfam International (2021) revealed that the top 10% of the Indian population holds 77% of the total national wealth, indicating a vast class gap and extreme inequality. Therefore, mere consumption growth does not necessarily validate progress in a nation like India. Despite these challenges, India had a digital

population of 468 million in 2020, which has been continuously growing due to the country's large population. The culture industry has benefited from this growth, as popular culture production and consumption are widespread. The entertainment business in India has thus been growing rapidly, albeit against a backdrop of inequality and socioeconomic challenges. According to the [FICCI and EY \(2020, 2021\)](#) report on Media and Entertainment in India, Indians spent 4.5 h a day on their phones in 2020, a significant increase from 3.5 h in 2019 and a 25% increase from 2017. With 4.5 h per day, India held the 3rd position in the world for the most time spent on phones in 2020, surpassing China, Mexico, Argentina, and South Korea. Additionally, consumers in India spent 1,669 billion minutes online in 2020, a 32% increase compared to 1,261 billion minutes in 2019.

The digital divide in terms of geographical areas in India

Rural–urban digital divide

The digital inclusion policy aims to expand the reach of the digital network to cover more areas. Given that the rural population constitutes nearly 70% of India's total population, including rural areas in the digital network would benefit the telecom and service industries. However, there is currently a lack of initiatives to enable rural people to adopt digital facilities. What can we teach a rural person with low literacy skills about technology? Will he/she be able to use Google or any app? In the survey, it was found that rural areas have inadequate digital infrastructure, limited access to the digital world, and insufficient capability to make use of digital facilities. Although Internet connections are available in villages and smartphones are available to almost everyone, they are mostly used for making phone calls and consuming entertainment content.

A total of 50 urban respondents and 30 rural respondents participated in the study. Of the 50 urban respondents, 30 were from under-resourced urban areas. A set of questions related to education and the economy were used in the study, with a focus on unstructured group interviews and observation to obtain a better understanding of the issue. The data were presented in a qualitative form, as the study did not use statistical analysis. The digital divide between rural and urban areas was found to exist mainly in two aspects: education and digital economy.

Education: Rural youths were found to be fascinated by the world of new media and popular culture. However, their usage patterns were more for entertainment than for productive, learning-oriented, or skill-oriented purposes. The schools in the surveyed village were found to be functioning with minimum facilities and without any digital infrastructure. The teachers were not well-versed in technology related to teaching and learning. The absence of colleges and vocational and training institutions in villages is another major issue that hinders the participation of villages in global digitalization. In contrast, urban schools and colleges have better access to digital technology, and teachers are well acquainted with the use of technology. An interesting fact is that urban children use facilities such as e-learning and other digital learning platforms such as BYJU's, Unacademy, WhiteHat Jr., and so on, while rural children are unable to access such facilities

mainly due to a lack of proficiency in using technology, poor digital infrastructure, and a lack of resources.

Digital economy: The poor condition of digital agriculture and the lack of access of rural dwellers to digital agriculture are the main causes of the divide between rural and urban areas. The economy in urban areas is relatively more developed at the micro level. In contemporary society, small businesses are regulated on digital platforms, and digitalized service industries have transformed people's economic situations. Almost the entire rural economy in India is dependent on agriculture; therefore, its digitalization is inevitable, but it has been found that villagers are still unaware of digital agriculture. There is no evidence of digitalized agriculture, so rural dwellers' access to it is still a distant dream. Villagers hardly keep track of the market price of their products; they sell them to middlemen or traders in the local market at very low prices. Villagers have no knowledge of local branding of their products, marketing on digital platforms, or online business; they conduct payment through Google Pay/Phone Pay. The irony of the situation is that rural dwellers sell their agricultural products to traders who take them to nearby towns and cities. The same products are purchased by villagers working in towns at a price much higher than the price his/her fellow village dwellers levied.

Under-resourced urban areas and urban areas

Social stratification and the digital divide in the urban areas of India are evident. There is a wide distinction between city dwellers (the sophisticated urban population) and dwellers of under-resourced urban areas. The population in under-resourced urban areas has been increasing in India, with poor quality of life, limited digital access, and inadequate digital life facilities. As of 2022, the number of people living in under-resourced urban areas reached ~100 million, which is greater than the entire population of Australia ([India Housing Report, 2022](#)). Under-resourced areas in Indian cities are widespread and attract a large population working in the unorganized sector, including those who are unemployed, homeless migrants, daily wage laborers, baggers, and vendors. We found a wide gap between the affluent residential areas of the city and under-resourced urban areas in terms of facilities, living conditions, and standards of living. People living in under-resourced urban areas are very poor. Although digitalization has penetrated under-resourced urban areas, it has not brought significant changes because people are already vulnerable in many social and economic aspects. People who live in under-resourced urban areas do not have access to digitalized education, e-health care, the digital economy, or technology-based skills. They own smartphones, but the study revealed that they mostly use them to consume popular culture and social media. Even school-going children are often found loitering and using mobile phones for various non-social and unethical activities.

Their counterparts in the affluent residential areas of the city are enrolled in prestigious schools such as international schools, convent schools, and residential schools, among others. These schools are equipped with advanced digital technology, and students have no issues accessing digital facilities. However, children living in under-resourced urban areas face difficulties accessing digital facilities. The schools in which children from

under-resourced urban areas are enrolled have inadequate physical infrastructure and digital infrastructure, and the academic environment is so poor that children often come only for midday meals (a government scheme for providing lunch to children). Most people who live in under-resourced urban areas have low literacy skills and lack any basic knowledge of the digital economy or technical skills. Their living conditions are so impoverished that socioeconomic development should be prioritized over digitalization. They prioritize access to drinking water, personal toilets, a hygienic house, and sanitation. We found that almost all households in under-resourced urban areas have access to television and smartphones, but this does not equate to digitalization. Under-resourced urban areas have been included in the digital market as consumers, but digitalization has not acted as an agent of socioeconomic transformation. Manual laborers with education up to at least secondary and senior secondary are switching to technical fields and undertaking training programs to upgrade their skills. However, in under-resourced urban areas, the highest level of education attained is often only up to the 12th grade. Most residents have either no literacy skills or have a limited education that barely allows them to write their own names. This significant digital divide between affluent city dwellers and those who live in under-resourced urban areas has made the challenge of creating a smart city even more difficult and uneven. Although a city may be considered smart, because digitalization has not been able to transform the entire urban society, it could be argued that a smart city lacks a smart society.

Conclusion

India's digital divide is not just a technological challenge but a reflection of the country's longstanding socioeconomic disparities. Digital inclusion efforts must focus on developing the capabilities of all sections of society rather than simply expanding digital infrastructure. This requires a concentrated effort to improve educational attainment, socioeconomic status, and digital literacy. Without these efforts, the benefits of digitalization will not be fully realized. It is important to recognize that a smart city cannot exist in isolation from broader society, and efforts must be made to address the realities of under-resourced urban areas and other marginalized

communities. Ultimately, the goal should be to create a smart society in line with the concept of Society 5.0, where technology is used to enhance the wellbeing of all members of society.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical approval was not required for the study on human participants in accordance with the local legislation and institutional requirements, as confirmed by the Sociology Department Research Committee of the University of Science and Technology, Meghalaya. The participants provided their written informed consent to participate in this study.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Contributions of digital social research to develop Telemedicine in Calabria (Southern Italy): identification of inequalities in post-COVID-19

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The paper discusses the role that sociology and digital social research methods could play in developing E-health and Telemedicine, specifically after the COVID-19 pandemic, and the possibility of dealing with new pandemics. In this article, we will reflect on an interdisciplinary research pilot project carried out by a team of sociologists, medical doctors, and software engineers at The University of Calabria (Italy), to give a proof of concept of the importance to develop Telemedicine through the contribution of digital social research. We apply a web and app survey to administrate a structured questionnaire to a self-selected sample of the University Community. Digital social research has highlighted socioeconomic and cultural gaps that affect the perception of Telemedicine in the University Community. In particular, gender, age, educational, and professional levels influence medical choices and behaviors during Covid-19. There is often an unconscious involvement in Telemedicine (people use it but don't know it is Telemedicine), and an optimistic perception grows with age, education, professional, and income levels; equally important are the comprehension of digital texts and the effective use of Telemedicine. Limited penetration of technological advances must be addressed primarily by overcoming sociocultural and economic barriers and developing knowledge and understanding of digital environments. The key findings of this study could help direct public and educational policies to reduce existing gaps and promote Telemedicine in Calabria.

KEYWORDS

Telemedicine, digital social research, COVID-19, inequalities, Calabria

1. Introduction

The pandemic highlighted how new technologies made it possible to solve problems that would have otherwise remained unsolved. Digital social research, applied in an interdisciplinary project, proved an indispensable tool for carrying out research when it would not have been possible to apply any other techniques and obtain important findings to develop Telemedicine in the territorial area of Calabria. The following will frame the object

and the context of research, the role of digital research methods in identifying inequalities, and finally, the developed project.

1.1. E-Health and Telemedicine in Italy and Calabria

E-Health is defined as the application of information and communication technologies to health and care (World Health Organization, 2023). As in other areas (e-business, e-learning, e-commerce, etc.), the prefix “e” stands for the application of “electronic” technologies, in this case specifically applied to health care. It is a relatively recent term, arising around 1999 in industry and marketing before academia (Eysenbach, 2001).

In 2005, the World Health Assembly defined e-health as «the cost-effective and secure use of information and communications technology (ICT) in support of health and health-related fields, including healthcare services, health surveillance, health literature, and health education, knowledge, and research» embracing a variety of application forms. Indeed, several branches of medicine incorporate ICT over time, each at different rates and proportions (Reichert, 2006). Still, most importantly, its technical development comes with a change of perspective, which improves medical science in its local, regional, and global applications (Eysenbach, 2001).

E-Health opens unlimited possibilities for interaction between the health service provider and user (World Health Organization, 2016), between one health institution and another, and between users themselves in a peer-to-peer scenario (Eysenbach, 2001); in this sense, clearly defining its use is still an open challenge in the context of medical-scientific progress (Souza Filho and Monteiro, 2022).

The research project presented in this paper focuses on a specific branch of e-Health, namely Telemedicine. Telemedicine aims to provide proper remote health services (Sood et al., 2007) and has become prominent with the COVID-19 crisis (Yasmeen et al., 2021).

As defined by the (Italian Ministry of Health, 2012, p. 10): «Telemedicine is a way of delivery of health care services, through the use of innovative technologies, in particular Information and Communication Technologies (ICT), in situations where the health professional and the patient (or two professionals) are not in the same location». It must ensure «the secure transmission of medical information and data in the form of text, sound, images or other forms necessary for the prevention, diagnosis, treatment and subsequent monitoring of patients» (Italian Ministry of Health, 2012, p. 10). It is specified that it does not replace traditional medicine. Still, it aims to “improve efficacy, efficiency and appropriateness” of health care delivery by focusing on the citizen. Therefore, Telemedicine’s objectives can be secondary prevention, diagnosis, treatment, rehabilitation, or monitoring. It can be divided into three main macro-areas: specialized Telemedicine (declined in televisita, teleconsultation, or health telecooperation), tele-health (mainly dedicated to chronic

diseases), tele-assistance (reserved for the elderly, frail, or people with disabilities).

In connection with various national and international studies on the topic (see the collection made by Sood et al., 2007), the chief advantages of Telemedicine are the ability to address territorial inhomogeneity and the lack of infrastructure or social healthcare providers (Sood et al., 2007) all issues that closely affect the Italian context (Giarelli and Giovannetti, 2019; Benvenga, 2021).

In Italy, the National Guidelines on Telemedicine approved in 2012 aim to provide a unified and organic framework (Italian Ministry of Health, 2012). The report highlights how Telemedicine experiences in Italy are experimental, limited, and fragmented. It proposes models for its integration into the Italian National Health Service (NHS), considering technical and ethical aspects.

In 2019, the Italian government built a national map of active Telemedicine instances, identifying 282 initiatives mainly concentrated in a few regions in Northern and Central Italy. In Calabria, one of the most disadvantaged regions in the South, the report identified only three instances specifically concerning the remote control of Pacemakers, Defibrillators, Loop Recorders, as well as radiological and cardiological tele-referral (Italian Ministry of Health, 2012).

As Omboni (2020) points out, despite these valid foundations, Italy showed in COVID-19 a severe lag in digital support to medical care, and interest in Telemedicine only increased exponentially when an urgent need emerged.

Today, the willingness to continue along this path is evident in Mission 6—Health—of the Recovery and Resilience Plan, whose «objective is to bridge the gap between territorial disparities and offer greater integration between regional health services and national platforms, through innovative solutions. »It is stressed that «the development of Telemedicine is among the interventions to make the *Home* the first place of care» (Italian Ministry of Health, 2022).

The focus on domiciliary care was a defining feature of the pandemic period; it was only with the crisis triggered by the emergency that some of the structural problems of our National Health Service became evident (Giarelli, 2021). In particular, the gradual defunding, corporatization, and regionalization of the NHS in recent decades (Giarelli, 2017) has not put local healthcare providers in a position to effectively limit the spread of COVID-19 (Giarelli and Vicarelli, 2020).

In addition to structural issues, another obstacle to the development of technological innovations is Italy’s low digitalization index (20th out of 27 EU countries) (European Commission, 2022, p. 3). The Digitization of Economy and Society 2021 Index (DESI) shows that, although Italian public services have recently invested in digital innovation, they remain below the European average. The same document also highlights the lack of digital skills among the Italian population and slow and not widespread internet connections, «although Italy has made progress in terms of both coverage and deployment of connectivity networks. The pace of fiber deployment has slowed between 2019 and 2020, and further efforts are needed to increase the coverage of ultra-high-capacity and 5G networks and encourage their deployment» (European Commission, 2022, p. 3).

A 2013 Di Carlo and Santarelli study highlighted how digital medicine development follows the country's infrastructural, technological, and economic development, confirming the gap between Northern Italy and the rest of the country. In particular, Calabria and Campania had the lowest innovation levels (Di Carlo and Santarelli, 2013).

The University of Calabria is, however, an excellence hub (Bianchi, 2011; Aiello et al., 2012), where it is possible to develop interdisciplinary projects, useful to manage the current emergency and to clear the way for social and health innovation.

1.2. Contributions of digital social research: identification of inequalities

The University of Calabria is an excellent place (Aiello et al., 2012) to develop an interdisciplinary project in which medicine, technology, and social science interact. The University of Calabria has a highly qualified University Health Center and Center of Information and Communication Technology, and highly qualified Departments of (1) Pharmacy, Health, and Nutrition Sciences, (2) Computer, Modeling, Electronic, and Systems Engineering, and (3) Political and Social Sciences.

Social sciences, in this case, must individuate a method that can be integrated with Telemedicine and can be used in the pandemic period, avoiding physical contact. Of course, all digital methods have these characteristics. Still, considering the sample population, it is also necessary to choose a technique able to detect a large amount of data on a large population, allowing us to make good descriptions and inferences about the university community (Langbecker et al., 2017).

Digital social research «tends to be used to refer to conducting “e-research” using digitalized data sets [...]. The focus, therefore, is on the collection and use of data and the tools to analyze these data» (Lupton, 2012, p. 7), as we will see (par. 2.1), our technological solution can collect and give a first description of data.

Digital social research increased in the last 10 years (Veltri, 2021). It includes multiple quantitative and qualitative methods (Lupton, 2018, p. 42). Some come from social research tradition and are applied to the digital (e.g., content analysis, ethnography, surveys), while others are natively digital methods. Also, the kind of data that they analyze is different. Mainly we divide it into digitized and natively digital data (Rogers, 2016, p. 40): the former are analogic objects transformed into digital data, and the latter are data created directly in digital form. Another important distinction is between unobtrusive data collection methods (web scraping, social media mining) and obtrusive methods (qualitative methods, web surveys, experiments), which raise different questions, limitations, and reflections (Veltri, 2021).

This paper focuses on web and app survey, a traditional obtrusive method transformed into a digital one. In this case, we use it to reach a population potentially unattainable at the time of COVID-19, to reduce costs, and to speed up detection (Veltri, 2021, pp. 72–73), also considering the broader framework in which the

research was developed (see par. 1.3. The project). In particular, we offered a Telemedicine service, so it was necessary to flank a social research method well integrated with it. It could potentially arrive at all populations investigated (Veltri, 2021, p. 85–89).

Many studies underline the advantages of Telemedicine (Finkelstein et al., 2006; Coulter, 2012; Weinstein et al., 2014). However, some studies demonstrate that some initiatives fail (Elwyn et al., 2012; Zanaboni and Wootton, 2012; Armfield et al., 2014). Lupton and Masley (2017), in their recent review, underline how «the social contexts and ethical implications are often not fully considered» and how «researchers have rarely addressed these issues in great depth in their evaluations of Telemedicine». In a context like the South of Italy, as we have already seen, it will be essential to take into consideration sociological variables to develop Telemedicine. But why?

As reported in the Glossary of Health Inequalities (Kawachi et al., 2002, p. 647): «*Health inequality* is the generic term used to designate differences, variations, and disparities in the health achievements of individuals and groups. [...] Health inequality is a descriptive term that need not imply moral judgment», it is a condition that does not depend on individuals. In our definition, it leads with opportunities and not with outcomes (Scambler, 2011).

The health inequalities that have received more attention are gender, ethnic and spatial relations (Graham, 2009; Annendale, 2010; Bradby and Nazroo, 2010), but also the social position (Link and Phelan, 1995), behavior (Bartley, 2003), material (Gray, 1982) and psychosocial factors (Wilkinson, 1996).

At the origin, Telemedicine was presented as a way to overcome inequalities (Williams, 2003), but it cannot be made if there remain inequalities in access to technology (Cotton and Gupta, 2004; DiMaggio et al., 2004). Recent research (Heponiemi et al., 2020) underlines how access to online services, ICT skills, and extent of use is associated with the perception of Telemedicine benefits and the importance of having good relationships in everyday life.

Overall, in Telemedicine, medical choices and behaviors must be analyzed taking in consideration not only socio-anagrafic characteristics but also access, skills, and use of ICT.

We talk about perception because the idea we have of Telemedicine is a mix between observation and the mental image that built our awareness. We know that the results of Telemedicine can depend on the relationship that the specific user has with the proposed information system (Dünnebeil et al., 2012), and we want to analyze which factors affect this “image”. If, as Davis (1989) argues, the actual use of a system is influenced by perceived ease and usefulness (cited in Sezgin and Yildirim, 2014), questioning these aspects becomes crucial to support the increase of Telemedicine in Calabria. Furthermore, if success in the use of health services depends on the adoption and acceptance of the service by users (Walter and Lopez, 2008; Holden and Karsh, 2010) it is fundamental to identify these impeding causes.

The scientific purpose of this study is to identify digital, socioeconomic, and cultural inequalities in the access to Telemedicine among University community members during COVID-19, analyzing how digital, socioeconomic, and cultural characteristics affect the perception of Telemedicine, with the final aim to promote Telemedicine in Calabria in post-COVID-19.

To fulfill this study's aims, one main question and five subquestions have guided this study.

Main question: "To what extent do socio-anagraphic characteristics of the University Community members influence their access, skills, and use of ICT; and to what extent does that influence their choices, behaviors, and perception of Telemedicine?"

Sub-questions:

1. To what extent do socio-anagraphic characteristics of the University Community members influence their medical choices and behaviors during COVID-19?
2. To what extent do socio-anagraphic characteristics of the University Community members influence their access, skills, and use of ICT?
3. To what extent do socio-anagraphic characteristics of the University Community members influence their perception of Telemedicine?
4. To what extent do the access, skills, and use of ICT influence the University Community members' medical choices and behaviors during COVID-19?
5. To what extent do the access, skills, and use of ICT influence the University Community members' perception of Telemedicine?

Considering previous theoretical assumptions we define socio-anagraphic characteristics as gender, age, spatial collocation, educational and professional levels, income, family composition, health condition, political and cultural participation, and social life; medical choices and behaviors during COVID-19, as timeliness and how to recognize COVID-19, communication, and treatment of any symptoms (in this case, we are not talking about the use of Telemedicine itself but the medical choices and the medical behaviors that every subject made also offline); perception of Telemedicine as the optimistic or pessimistic impression detected on a pre-tested Likert Scale.

Following, we will describe the project and its aims. We will then describe the material and methods used, focusing on our digital social research that provides web and app surveys with particular technological solutions. Next, we will define the research design, the population, sampling, data collection, and types of data analysis. Further, the main results will be presented and discussed with relevant literature. Finally, we will propose a direction to develop Telemedicine in Calabria and provide an indication for future research.

1.3. The project

The project, "Medical Listening and Intervention Unical Online", aims to address the pandemic emergency by offering an immediate medical listening and consultation channel, as well as surveying and analyzing data related to vaccine prophylaxis and linking them to social variables, such as users' characteristics, choices, and behaviors in the context of health care and Telemedicine. The project stems from the integration of the Life Science and Social Science and Humanities areas and is funded

by the Special Supplementary Fund for Research (Italian Ministry University and Research).

The project is developed thanks to the University Health Center of the University of Calabria, in close collaboration with the University Center of Information and Communication Technology and the Departments of (1) Pharmacy, Health, and Nutrition Sciences, (2) Computer, Modeling, Electronic, and Systems Engineering, (3) Political and Social Sciences.

This pilot project is the starting point for a larger project, aiming to develop the service over the entire region. From a long-term perspective, the system may accommodate general biomedical diagnostic services, extending and/or changing the scope of applications beyond COVID-19 contagion.

The project is developed through different objectives, and in this paper, we will discuss only the sociological objective, which is to identify socioeconomic, digital, and cultural inequalities that can affect the development of Telemedicine in Calabria.

2. Material and methods: using institutional web and mobile app for web survey

At a time of physical distancing, the research project is developed through remote contact, and, only in some cases, actual in-person medical intervention.

With the advent of the pandemic, the University of Calabria had already swiftly equipped itself with a platform available in web-app and mobile app versions for monitoring access to classrooms and facilities and for contact tracing, useful for managing the flow of attendance and containing COVID-19 contagions. Such platform, called *SmartCampus*, is ideal to develop this Telemedicine project because: (a) it was already used massively by all students, professors, and technical-administrative staff, (b) it could be integrated with additional features, (c) it was designed with a user-friendly interface.

Moreover, a significant advantage was that the platform was available on mobile. In recent years the use of smartphones (even for the simplest everyday tasks) has grown exponentially. From a Telemedicine perspective, there was the rise of so-called m-health (Istepanian et al., 2010; Hampton, 2012), a subsector dedicated to the exclusive use of mobile platforms to offer medical services. Hand in hand with the growth in the use of smartphones (Petty and van der Meulen, 2012), the use of Telemedicine applications through mobile apps growing (Tachakra et al., 2003). Although some studies highlight that the use of mobile technologies carries the risk of reducing the quality of health care service (Visvanathan et al., 2011), it is also true that the results of a health care service delivered through mobile technologies depend a great deal on the relationship that the specific user has with the proposed information system (Dünnebeil et al., 2012).

In our specific case, where most of the population is made up of students, the use of a mobile application can certainly be considered a relevant methodological choice, overall considering the possibility to use it as a web application. In the following part, we will briefly cover the different stages of designing web and app survey, starting with the technological solution proposed by the IT team.

2.1. A technological solution for data collection

The project develops in two main phases: (1) design of software and questionnaires, and (2) data collection and analysis.

The first phase (4 months) was the design, development, and implementation of a software module called “Compass”, as well as the design and pretest questionnaires for two different surveys.

The design of the module included the following:

- The definition of the data representation model to support the storage and subsequent analysis of the data collected by questionnaires.
- The definition of the flowcharts of the questionnaires.
- The design of the specific component for the teleconsultation service.
- The definition of the interfaces of the software components to be integrated under the architecture of the existing application (*SmartCampus*).

The subsequent development phase led to the prototype implementation of the designed software components, their validation, and integration into the *SmartCampus* APP. The software module “Compass” was integrated into the *SmartCampus* APP of the UNICAL, available in a web app and mobile app version for Android and iOS operating systems to the whole University community (students and staff).

The team members tested the prototype version of “Compass” and identified potential improvements to increase usability and ease of use. The feedback received at this stage was implemented, obtaining the final sign-off. The module was then made publicly available within a new version of the *SmartCampus* app released in the app stores.

It is composed of a set of questions that directs the patient to the most useful medical solution (Q1—the effective Telemedicine service), an epidemiological questionnaire (Q2), and a social research questionnaire (Q3). In this article, we will focus on Q3.

Q3 was structured to collect sociological data. On the web app, all the responses to the questionnaire were recorded and reports in a multidimensional format were generated. This allowed us to follow the evolution of data collection in real time.

2.2. Web survey design

The model of investigation represented in Figure 1 will drive the research.

In terms of content, the survey model involved the intersection of the different areas present in Figure 1, assuming a direct influence of socio-anagraphic characteristics and the digital skills of the subjects on the individual choices and behaviors, and the perception of Telemedicine (positive vs. negative). Finally, we explore how the set of these characteristics might affect the surrounding environment. However, this last part of the project is not presented in this paper.

Considering the research set forth and reflecting on group investigation, we have integrated different elements to identify inequalities in the Calabria University context.

We have taken into consideration variables traditionally related to health inequalities (gender, age, spatial collocation, educational and professional levels, income, family composition, health condition) and variables that emerge as relevant in recent research (political and cultural participation, social life) or the specific approach to Telemedicine (access, skills and use of ICT), but also health choices and behaviors during COVID-19 (times and ways to take care of one’s health) that can influence the adoption of Telemedicine (Chandra et al., 2011; Oster, 2018; Khairat et al., 2019).

We depart from these main hypotheses:

H1. The socio-anagraphic characteristics affect individuals’ medical choices and behaviors during COVID-19. In particular: H1.1 Older people are more concerned¹ than younger individuals and are better informed; H1.2 Individuals with higher educational and professional levels are better informed than people with lower educational and professional levels; H1.3 Those who live farther from a primary place of care are more concerned than people leaving close to a primary place of care; H1.4 Individuals with worse health conditions are more concerned and are better informed than individuals with overall better health.

H2. The individuals’ socio-anagraphic characteristics affect access, skills, and use of ICT. In particular: H2.1 Younger people have more access, better skills, and make more use of ICT; H2.2 The higher educational and professional levels, the best is the access, skills, and use of ICT; H2.3 High-income earners have more access, better skills, and make more use of ICT than people with lower income; H2.4 Individuals with an active political and cultural participation, or a satisfactory social life, have more access, better skills, and make more use of ICT.

H3. The individuals’ socio-anagraphic characteristics affect their perception of Telemedicine. In particular: H3.1 As age increases, so does the optimistic perception of Telemedicine. H3.2 As educational and professional levels increase, so does a favorable perception of Telemedicine. H3.3 As income boosts so grows the optimistic perception of Telemedicine. H3.4 Families with “fragile members” will have a more optimistic perception of Telemedicine than families without “fragile members”; H3.5, Individuals with poor health conditions, will have a more optimistic perception of Telemedicine; H3.6 Individuals with active political and cultural participation or a satisfactory social life, will have a higher favorable perception of Telemedicine than people not meeting these criteria.

H4. Access, skills, and use of ICT affect individuals’ medical choices and behavior during COVID-19.

H5. Access, skills, and use of ICT affect the perception of Telemedicine. In particular: H5.1 The higher the access to ICT,

¹ It means that they worry before if they have symptoms that could be traced to COVID-19 (question 16) and that they will contact someone immediately (question 18).

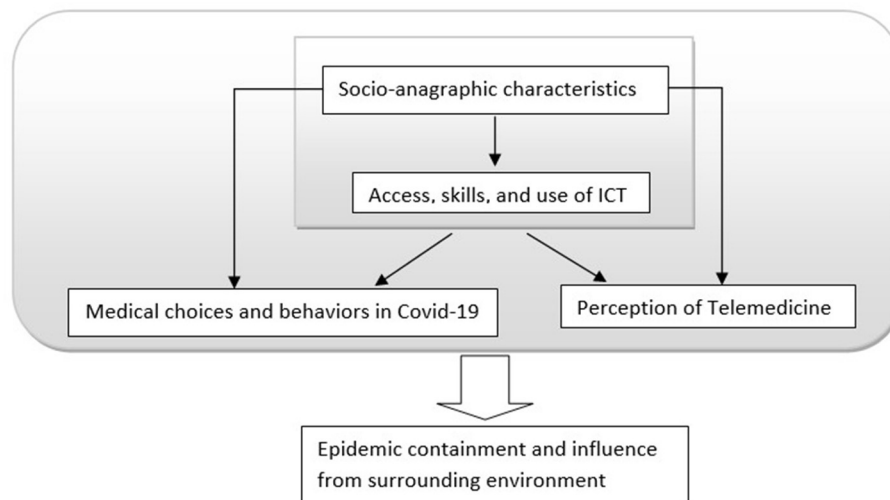


FIGURE 1
Model of investigation.

the more positive the perception of Telemedicine is; H5.2 Digital skills increase positive perception of Telemedicine.

H6. As increase the use and knowledge of Telemedicine, optimistic perception increases.

This study is partly explicative and partly exploratory. It is explicative as we have derived some concepts from previous literature. Nevertheless, the specificity of this study context (University of Calabria) also required an exploratory lens. In this framework, considering the research questions and the feasibility of the study in terms of time and resources, a questionnaire has been chosen as the primary research method (Brian, 2008).

The design of the social research questionnaire (Q3) takes into account the advantages and disadvantages imposed by the web and app administration (Bethlehem and Biffignandi, 2012). It is highly recommended to use short questionnaires with clear and simple questions and answers. Also, using an app imposes special attention on graphics and display problems that may arise from a mobile compilation (Veltri, 2021). Further, given the project's broader scope and the relatively limited space for sociological research, researchers had to prioritize the most relevant sociological variables, as highlighted in the Telemedicine literature.

The following data have been collected:

- Socio-anagraphic characteristics: age, gender, role in the institution (UNICAL), educational qualification, level of income (self-assessment), area of residence (urban-semi-urban-rural; proximity/reachability place of care), household composition (presence/absence of elderly, children, disabled, individuals with acute, chronic diseases, post-acute situations), personal health conditions (self-assessment), social life (family and friendship relationships, political-social engagement).
- Medical choices and behaviors during COVID-19: timeliness and how to recognize COVID-19, communication, and treatment of any symptoms.

- ICT: access, skills, and use in general and social-health settings (self-assessment).
- Telemedicine: knowledge and evaluation (perception).

In particular, the architecture of Compass allows not to directly ask for gender and age, automatically detected at the moment of access. The questions are attached (Questionnaire_design).

The questions concerning other members of the family are detected in a proxy. This allowed us to explore the digital skills of the family members, furthest from digital environments.

Specifically, in the case of ICT skills, self-assessment of personal and household members' skills was surveyed through a self-anchoring scale with scores from 1=no skills to 10=extremely good skills. This is a simplification necessary for the type of study and the limitation in the number of questions that allow us to detect a piece of information, usually more complex, in a single question.

In the case of Telemedicine, given the complexity and lack of knowledge of the topic, it was provided with a battery with a series of dichotomous responses regarding the services used before analyzing perception. 13 services were considered, and only eight were related to Telemedicine. Not specifically Telemedicine: booking appointments, prescriptions charges, services availability search, comparison of services quality, and prescriptions renewal. Specifically, Telemedicine: entering data for self-assessment of my health, receiving results of tests performed, seeking advice from social-health personnel, receiving post-therapeutic care, providing medical data to health care personnel, receiving information about medical treatments to follow, performing clinical monitoring, and checking the outcome of therapy with the competent physician.

To understand the perception of Telemedicine it was given a selected 4-point anchored Likert scaling technique. These constructed items were useful to stimulate reasoned responses on the topic and provide anchors for memory and knowledge. The points range from 1 = completely disagree to 4 = completely agree, adding an off-scale point dedicated to those who did not know the proposed item. Those who had little or no knowledge about the

topic were then excluded from part of the analysis. Referring to the literature and previous research on the topic, we limited the items to 12, all related to the potential advantages and disadvantages that this type of service can offer. To obtain the Telemedicine Perception Index, we calculated the sum of the respondents' scores on each item to correlate it with the other available variables.

The scale, but also the entire questionnaire, was pretested first by social health personnel from different medical areas and then by subjects from the same survey target group. Health personnel helped to construct better items and advised on setting up polarities, students, in particular, helped to clarify some questions, like those on digital skills.

Considering the new instrument (Taherdoost, 2016) and the need to administrate in a limited context (University of Calabria) we assess face (Oluwatayo, 2012) and content validity (Straub et al., 2004), including essential items/questions and eliminating undesirable (Lewis et al., 1995; Boudreau et al., 2001). We follow the following steps:

- An exhaustive literature review to extract the related items.
- The group of social researchers evaluates the appearance of the questionnaire in terms of feasibility, readability, consistency of style and formatting, and clarity of the language used.
- The survey was sent to experts in Telemedicine, social science, and other medical areas.
- Items that are not significant are eliminated.
- Proposal of new items/questions.
- The survey was sent to students, professors, and administrative staff.
- Items that are not understandable are eliminated.
- Proposal of new items/questions.
- For each change repeat the procedure.

2.2.1. Population and sampling

The research was conducted at the University of Calabria (UNICAL) and included students, professors, and technical-administrative staff with access to *SmartCampus* APP. It should be emphasized that the possibility of access to medical services comprises not only those directly involved but also their families.

The population investigated is composed by:

23416 students (registered in the academic year 2021/2022).

854 professors and researchers (on 31/12/2022).

588 directors and technical-administrative staff (on 31/12/2022).

Considering the population and the technological solution adopted, we have opted for self-selection sampling, which is a type of non-probability sampling technique. On the one hand, it is more rapid, and it is adequate for units that are committed to taking part in the study, overall, for using Telemedicine services. There is a risk in terms of self-selection bias (e.g., students who think to have advantages responding desirably) and representativity (e.g., students overrepresented because they have more time or interest).

Self-selection sampling is helpful in this case because it gives the possibility to each *SmartCampus*-users (each member of the studied community) to participate in the investigation and enables them to choose to take part in research on their own accord,

volunteer, only because they have a specific interest in Telemedicine or simply in their organization (UNICAL).

To create the self-selection sample, we involve three steps:

- We determine a minimum sample size to pursue representativity.
- We publicize the project and that we need units in different contexts and ways (for Q1, Q2, and Q3).
- We check the relevance of units (only for our questionnaire, Q3).

To determine the sample size, we used this formula:

$$sample\ size = \frac{z^2 \times p(1-p)/e^2}{1 + (z^2 \times p(1-p)/e^2) N}$$

where:

N = numerosity of the population = 24858

z = Z-score = 1.96 (for 95% confidence level)

e = margin of error = 0.05 (5%)

p = standard deviation = 0.5 (50%)

Determining a sample size of 378 cases.

2.2.2. Data collection

Between February and March 2022, questionnaires were delivered *via* the web or app to the members of the community on an anonymous basis. To promote the initiative, we use:

- Online channels: notices on institutional portals, sharing *via* email, and sharing *via* social networks, both individuals and groups.
- several presentations were held in university classrooms.
- administrative offices were contacted *via* email.
- Directors of the departments were contacted *via* email asking for collaboration.

The university community's attitude toward the initiative was generally positive and proactive. Students made clear their interest in the expansion of UNICAL Telemedicine services, emphasizing that the privacy that comes with remote health services can increase requests for assistance, especially when more sensitive topics are concerned (e.g., gynecological, psychological, chronic problems, etc.).

These meetings and presentations also enabled the researchers to answer any questions the respondents might have in real-time and solve any technical problems that might have arisen (e.g., connection, configuration, updating, etc.). No incentives were used, also if it could be a good idea to do it.

Finally, we collected 489 completed questionnaires related to social research. We check the relevance of units departing from the sample size and role in the institution. The number of units self-selected was enough to continue the analysis, 111 more of the sample size previously calculated. Students constituted the 91% of the respondents, followed by faculty staff (7%), and administrative staff (2%).

2.2.3. Data analysis

The data analysis techniques used involve univariate, bivariate, and multivariate analysis. In particular, we departed from an exploratory analysis to arrive at an inferential analysis. Exploratory Data Analysis (EDA) consented to investigate unexpected relations in a context never analyzed. Inferential analysis consented to verify the hypothesis still exposed. The model of investigation represented in [Figure 1](#) shows how we identified dependent and independent variables and helped to understand the development of our statistical analysis.

Practically we followed three steps:

- Univariate analysis: to derive the data, define and summarize it, and analyze the pattern present in it. We explored each variable separately, distinguishing categorical and numerical ones. Here we reported only non-graphical data for the first frequency distribution in percentages and the numerical mean and standard deviation.
- Bivariate analysis: to find the cause and the relationship between the two variables. In this case, we used graphical data to represent the main results. Scatter plot for relationship numerical-numerical variables, but also non-graphical data like Linear Correlation (r) to represent the strength of a linear relationship between two numerical variables. For association categorical-categorical variables, we selected only the one in which chi-square test results are significant and reported both probabilities of dependency between two categorical variables and bar charts that represent frequency distributions.
- Multivariate analysis: we did not report it because we found no significant results.

3. Results: detecting socioeconomic, digital, and cultural inequalities

3.1. Socioeconomic conditions

Considering the total number of respondents, 60.3% state that they belong to middle-income households. The remainder declares mainly (33.3%) a low income, while only 6.4% of the sample belong to affluent households. In 37.2 percent of cases, respondents also state that they have experienced economic difficulties in the past 12 months.

The respondents mainly reside in urban (43.4%) or semi-urban (43.8%) areas and still show difficulty in reaching both their primary care medical doctor's office and the nearest emergency room, which can be reached exclusively by private transportation in 69.1 and 62% of cases, respectively.

Even in terms of travel time, reaching the medical facilities that should be of closest proximity does not prove particularly convenient. The questions dedicated to travel time were two: one asks "How long does it take you to get to your primary care physician? (Indicate in terms of hours: minutes) __: __", the second "How long does it take to arrive at a first aid health center? (Indicate in terms of hours: minutes) __: __".

On average, the primary care physician is about 20 min away from the respondents' home (with a standard deviation of 35 min),

and it takes an average of more than 28 min (with a standard deviation of more than 34 min) to reach a first aid center.

Most households are large (4 people on average) including the elderly (20% of households), children (10.6%), or people with disabilities (9.2%), but above all, 35 percent of the subjects surveyed also include people with acute, chronic diseases or post-acute situations.

3.2. Behaviors

Although the sample of respondents mainly includes students, declaring, as expected, excellent or good health (67.5%) and stating to conduct an active social life (56.6%), as many as 47.2 percent of them say they would be concerned immediately if they had symptoms potentially attributable to COVID-19. Obvious symptoms would also trigger initial contact aimed at treatment in 89.6 percent of cases, and only 10.4 percent of subjects would wait for their health condition to worsen.

It is also important to note that 70.3% of respondents would contact their primary care physician and, to a lesser extent, deal with COVID-19 infection by contacting friends or relatives (24.9%), consulting websites (3.9%) or going directly to the emergency room (0.8%).

Some of the variables emerging from the study were also significant ($p < 0.05$) concerning the subjects' health behaviors. At the onset of the first symptoms, for example, women ([Chart 1](#)) and older age groups ([Chart 2](#)), in particular, declare to have an immediate concern.

As age ([Chart 3](#)) and educational qualifications ([Chart 4](#)) increase², so do the shares of those who go directly to their primary care physician rather than consulting websites or relatives and friends, a behavioral difference that is confirmed between students and faculty or technical-administrative staff ([Chart 5](#)).

3.3. Digital and cultural divide

From a technological and digital point of view, the research shows a particularly active population, which constantly uses digital means of communication in 57.7% of cases, and 40.1% of cases claim to use them often anyway.

The university population has both the right tools (smartphones in 98.8% of cases, PCs or tablets in 98.6% of cases) and a good connection to the Internet (smartphones always connected in 93.9% of cases and PCs or tablets in 61.6% of cases, as well as a stable home connection in 79.3% of cases).

However, a digital skills gap is evident between the respondents and their families³: while the

2 Educational levels were 4 but became 3 because in "1) elementary/middle school diploma" there are no cases. It remains a high school diploma, bachelor's or master's degree, or postgraduate (e.g., doctorate, specialization).

3 The digital skills of families have been surveyed by a proxy question, necessary for the cost/benefit tradeoffs despite the conscious risk incurred (Cobb, 2018).

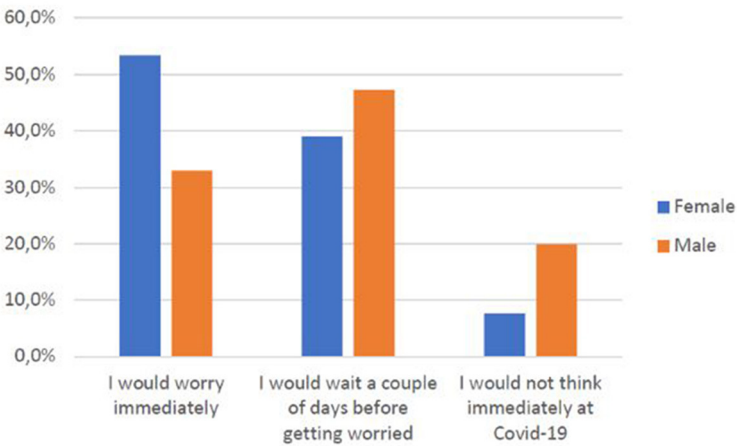


CHART 1
Gender vs. concern related to COVID-19.

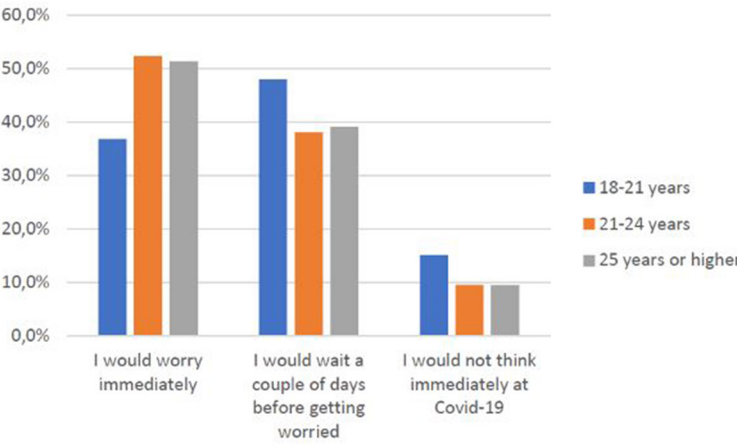


CHART 2
Age group vs. concern related to COVID-19.

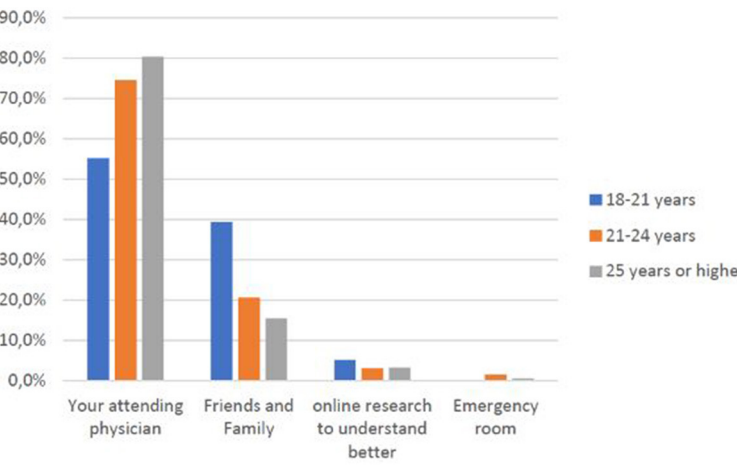


CHART 3
Age groups vs. preferred source of medical help/information.

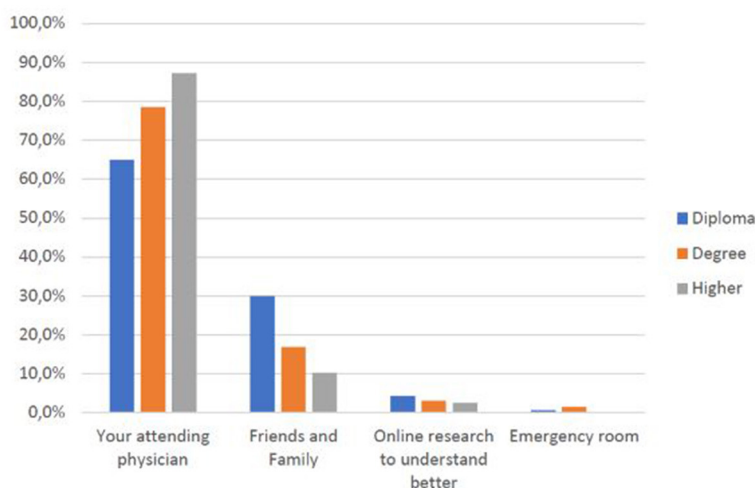


CHART 4
Education level vs. subject preferred source of care.

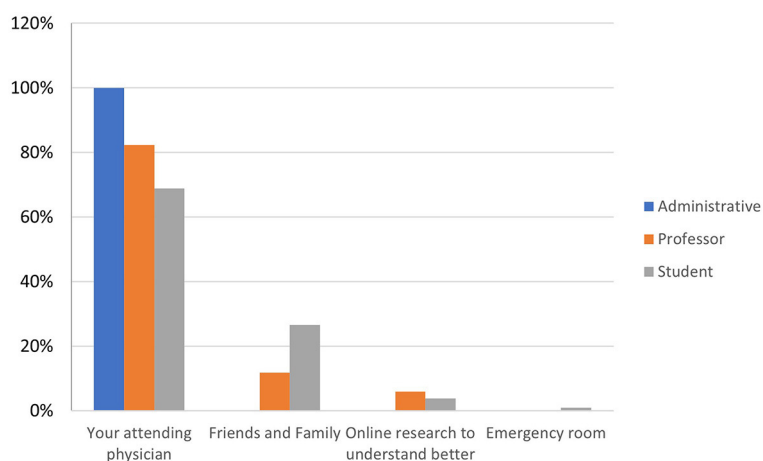


CHART 5
The role played by the subject within the University vs. source of care.

university community describes themselves as having good digital skills, assigning themselves an average score of 7.73 out of 10, they state that the digital skills of their family members are much poorer, averaging 5.9.

Another particularly significant finding also points out that despite their frequency and ability to use digital media, nearly half of those surveyed (48%) sometimes do not understand the information provided through sites and applications (Chart 6). These are joined by 6% of subjects who often do not understand what is conveyed to them and 1.2% who say they never understand the information provided. In such a context of difficulty, more than half of the respondents (53.1%) also complain that they do not often or always find help to better understand the meanings conveyed by digital media (Chart 7).

3.4. Use, knowledge, and perception of Telemedicine

Going into the specifics of Telemedicine, 70.3% of respondents state that they never used it. However, analyzing the subsequent responses shows that, albeit unknowingly, many have used it previously.

Specifically, through ICT, 16.4% received aftercare, 18.4% did clinical monitoring, 34.6% checked the outcome of their treatment, 37.6% entered personal health data for self-assessment of their health, 39.9% received health counseling, 46.6% provided their data to health care personnel, 54.2% received information on treatments to follow, and 79.3% at least received the results of their tests.

As illustrated in Table 1 however, the highest percentages concern online services that cannot be configured as Telemedicine, despite using digital means.

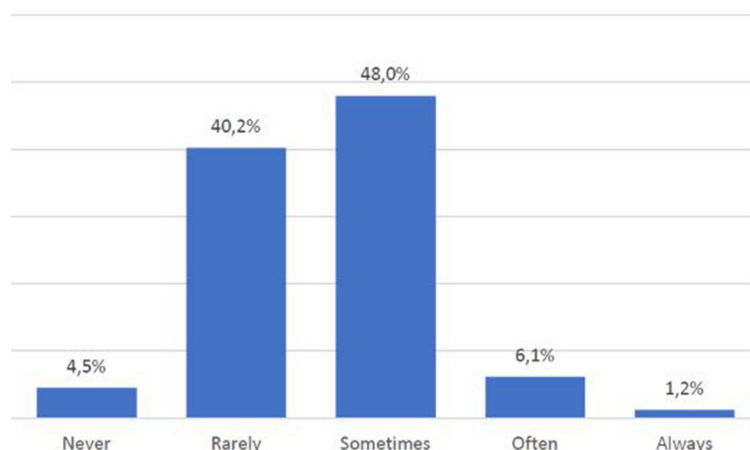


CHART 6
Lack of skills in comprehending online texts.

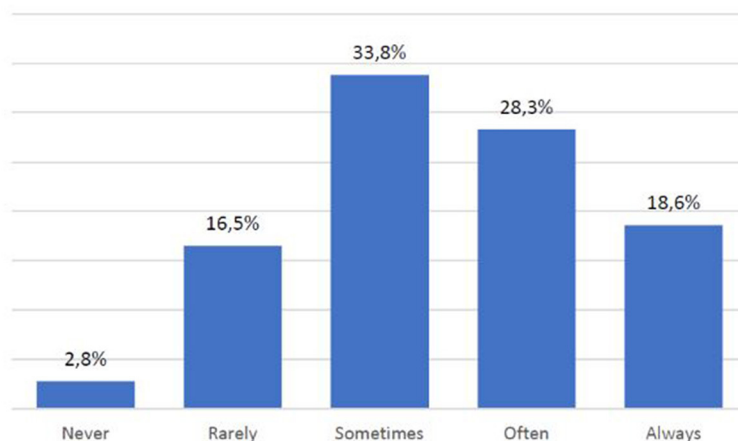


CHART 7
Availability of help to comprehend online texts.

Focusing on the analysis of the respondents' perceptions of Telemedicine, a generally positive view emerges, although, precisely because of the lack of knowledge on the subject, there is a high (55.6) percentage of those who fail to express an opinion on the different features that characterize it.

Most respondents agree that Telemedicine is a valuable option to empower citizens (78%) and to reach even those who live in peripheral areas (67.7%), guaranteeing constant clinical monitoring (62%); more than half of the respondents, moreover, say they are not afraid of possible problems regarding the protection of personal data (54.9%).

3.5. The award

Analyzing the sub-sample (44.4%) of those who have a clear opinion about Telemedicine, it becomes evident that as age increases, there is also a slight increase of an optimistic perception toward Telemedicine ($r = 0.22$) (Chart 8), and the

same happens when educational qualification increases ($p < 0.05$) (Chart 9).

Within the university community, the faculty is most optimistic (60% versus 30.9% of students and 16.7% of technical-administrative staff) (Chart 10), a trend that also emerges in those who report a higher income (60% versus 30% of those with low incomes and 31.8% of those who report a medium income) (Chart 11). Thus, the positive view of this type of innovative medical service is also related to socioeconomic level.

A positive perception of Telemedicine also emerges among those whose household includes elderly people or children; on the contrary, it does not emerge from households in which there are people with disabilities or illnesses.

The positive perception of Telemedicine is also found to be significantly associated with the possession of a stable home connection and the daily use of technological and digital means ($p < 0.05$), while there is no evidence of substantial differences in terms of skills possessed by respondents or their families.

TABLE 1 Percentage of Telemedicine and other online services users.

Telemedicine services	% subjects using Telemedicine	Online services not identifiable as Telemedicine	% subjects using services not identifiable as Telemedicine
Entering data for self-assessment of my health	37.6	Booking appointments	75.5
Receiving results of tests performed	79.3	Prescription charges	68.3
Seeking advice from social health personnel	39.9	Services availability search	90.8
Receiving post-therapeutic care	16.4	Comparison of services quality	63.6
Providing medical data to healthcare personnel	46.8	Prescriptions renewal	36.2
Receiving information about medical treatments to follow	54.2		
Performing clinical monitoring	18.4		
Checking the outcome of therapy with the competent physicians	34.6		

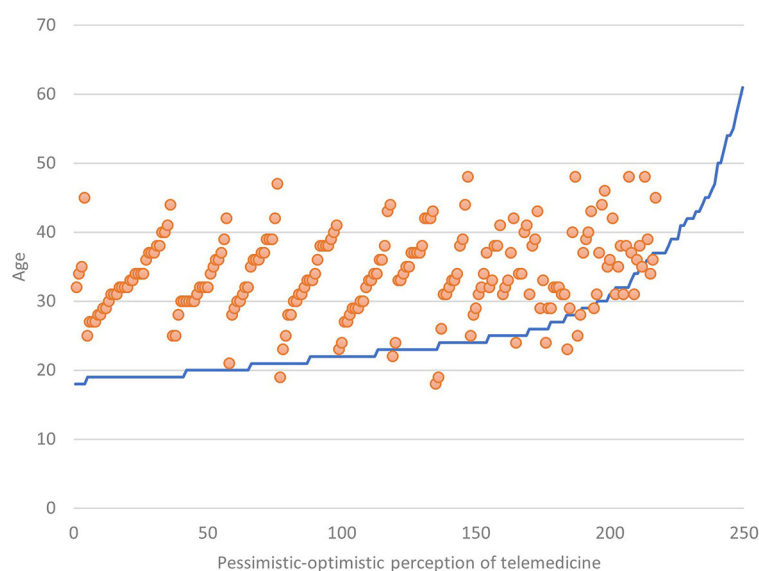


CHART 8
Perception of Telemedicine vs. age.

On the other hand, the relationship between difficulty in understanding ICT means and the degree of optimism toward Telemedicine is also found to be significant: those who can understand the tools almost always turn out to have a more positive view of Telemedicine (Chart 12).

Those who say they have already used Telemedicine services are also the most optimistic (Chart 13).

4. Conclusion: driving medical innovation process in Calabria after COVID-19

Digital social research identifies digital, socioeconomic, and cultural inequalities to access Telemedicine among the university community during COVID-19. We have analyzed how digital, socioeconomic, and cultural characteristics

affect the use, knowledge, and perception of Telemedicine, with the final aim to promote Telemedicine in Calabria in post-COVID-19.

The research results show that digital, socioeconomic, and cultural characteristics of the sample influence perception of Telemedicine, but how?

Below, we present our conclusions based on our collected findings. We do so accordingly to our investigation model (Figure 1) and questions:

- (1) *To what extent do socio-anagraphic characteristics of the University Community members influence their medical choices and behaviors during COVID-19?*

Hypothesis 1 “The socio-anagraphic characteristics affect individuals’ medical choices and behaviors during COVID-19” is verified only in part.

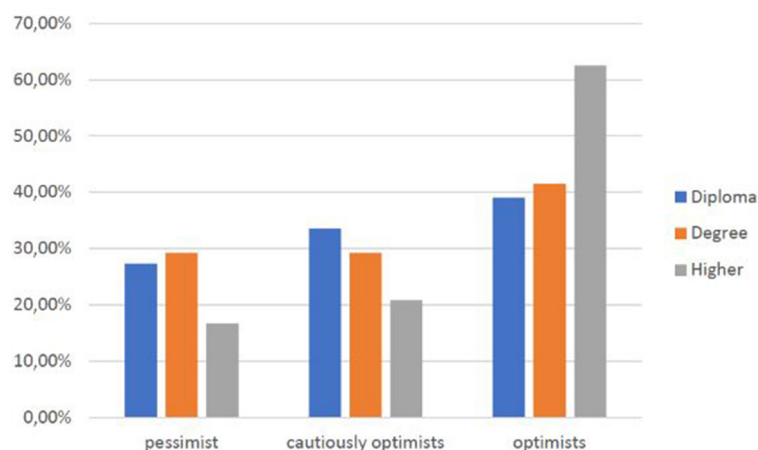


CHART 9
Perception of Telemedicine vs. education level.

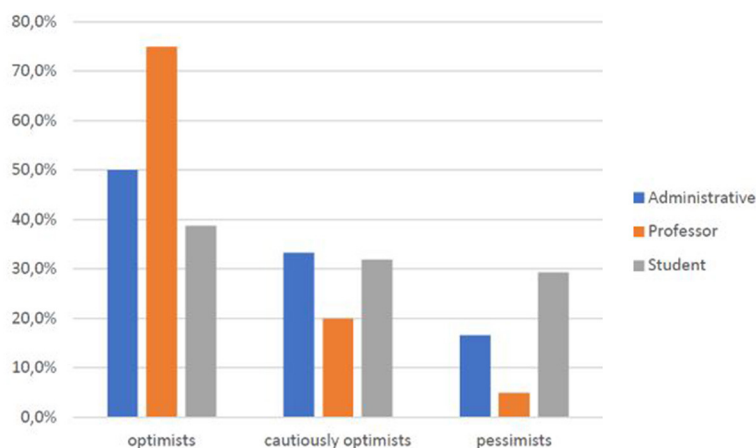


CHART 10
Perception of Telemedicine vs. role at UNICAL.

As [Chart 1](#) shows, female is more concerned about COVID-19, but we don't find a significant relationship between the rapidity of asking for help and the mean of information used.

As [Chart 2](#) shows, older people are more concerned related to COVID-19 and good medical behavior (going directly to their primary care physician), but there is no evidence of the rapidity they take care of. This confirms specific hypothesis H1.1.

As [Charts 4, 5](#) show, higher educational and professional levels have good medical behavior (go directly to their primary care physician), but there is no evidence of the rapidity they take care of or of the concern related to COVID-19. This confirms specific hypothesis H1.2.

Finally, we have not found a significant association between residence in urban or not urban areas or with means of transportation and time to arrive at the first medical help center, so H1.3 is not confirmed. There is no evidence of the relationship

between medical choices and behaviors with income levels or families' dimensions and health conditions, so hypothesis 1.4 is not confirmed. Also, political, cultural, or social life is not related to medical choices and behaviors.

- (2) *To what extent do socio-anagraphic characteristics of the University Community members influence their access, skills, and use of ICT?*

Hypothesis 2 "The individuals' socio-anagraphic characteristics affect access, skills, and use of ICT" is not verified. There are no evident inequalities related to these dimensions.

We cannot find evidence that access, skills, and use of ICT are related to gender, age, spatial collocation, educational and professional levels, income, family composition, health condition, political and cultural participation, and social life, so H2.1, H2.2, H2.3, H2.4 are not confirmed. In particular, the hypothesis that active political and cultural

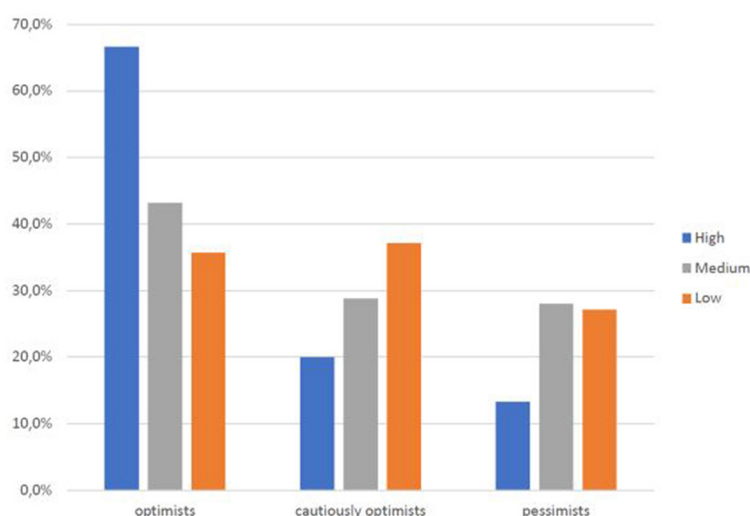


CHART 11
Perception of Telemedicine vs. income level.

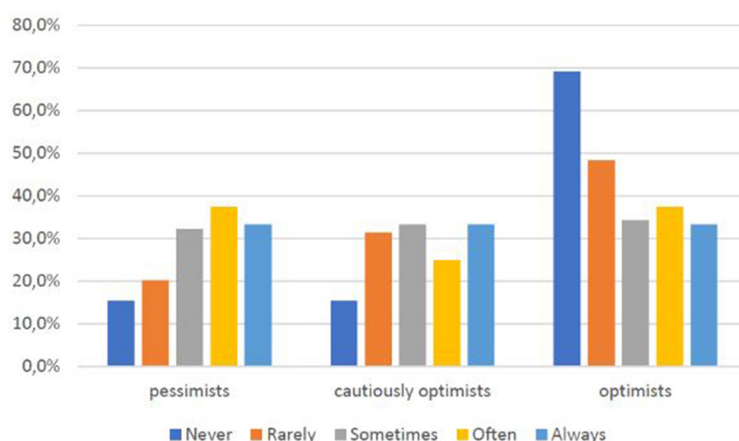


CHART 12
Perception of Telemedicine vs. lack of online text comprehension.

participation or a satisfactory social life influences access, skills, and use of ICT is in contrast with Heponiemi's (2020) research results.

Never less, the exploration of the data consent to detect interesting results.

Also, if the majority of the sample has optimal access (over 98% possession of digital tools, 93.9% internet mobile access, 79.3% home connection) and use (57.7% constant use sum to 40.1% often use) of ICT, a digital skill gap emerges between respondents and families: on our scale respondent assess themselves 7.73/10 while family members are evaluated 5.9/10.

Also, the influence of cultural characteristics emerges not from socio-anagraphic variables but from the comprehension of texts: 55.2% of the sample does not understand digital content (sometimes, often, or never). The worst evidence is that, in such a context of difficulty, 53.1% of them find

no help (often or always). So, we can say that cultural characteristics (in this case, in terms of competence) influence skills and use of ICT because people admit to not understanding digital content and, subsequently, they cannot use it well.

- (3) *To what extent do socio-anagraphic characteristics of the University Community members influence their perception of Telemedicine?*

Hypothesis 3. "The individuals' socio-anagraphic characteristics affect their perception of Telemedicine" is partly verified.

Only 29.7% of the sample declare to have used Telemedicine, also if 79.3% have used at least one Telemedicine service. Unfortunately, because of the lack of knowledge on the subject,

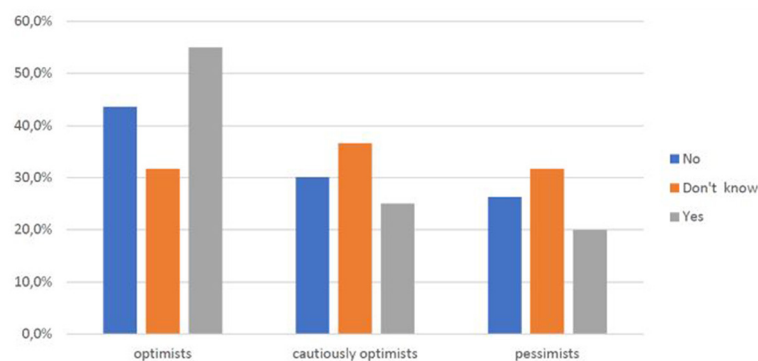


CHART 13
Perception of Telemedicine for Telemedicine use.

there is a high (55.6) percentage of those who fail to express an opinion on the different features that characterize Telemedicine. Still, we can make inferences departing from people who declare to know it.

As age (Chart 8), educational level (Chart 9), professional level (Chart 10), and income (Chart 11) increase, it also increases an optimistic perception toward Telemedicine. So H3.1, H3.2, and H3.3 are confirmed.

H3.4 is partly verified because a positive perception of Telemedicine emerges among households, including older adults or children, but not disabilities or illnesses. H3.5 and H3.6 instead are not confirmed, the last one in contrast with Heponiemi et al. (2020) research results.

- (4) *To what extent do the access, skills, and use of ICT influence the University Community members' medical choices and behaviors during COVID-19?*

Hypothesis 4. "Access, skills, and use of ICT affect individuals' medical choices and behavior during COVID-19" is not verified.

There is no evidence of the influence of ICT on medical choices and behavior.

- (5) *To what extent do the access, skills, and use of ICT influence the University Community members' perception of Telemedicine?*

Hypothesis 5. "Access, skills, and use of ICT affect the perception of Telemedicine" is partly verified.

A stable connection and frequent use of ICT are associated with a positive perception of Telemedicine, but there is no evidence of skills. H5.1 is verified; contrary H5.2 is not.

As Chart 12 shows, another interesting result that emerged from the exploration of data is that comprehension of digital content is associated with an optimistic perception of Telemedicine.

Hypothesis 6. "As increase the use and knowledge of Telemedicine, optimistic perception increases" is verified. As Chart 13 shows, those who say they have already used

Telemedicine services are also the most optimistic, highlighting how knowledge of the tool helps redefine perceptions of it.

The multivariate analysis doesn't underline significant results that can help us to detect latent factors or natural groups that are more or less inclined to use Telemedicine.

In conclusion, we verified that socio-anagraphic characteristics affect individuals' medical choices and behaviors during COVID-19, underlining gender and age influences, but also the influence of education and employment levels. On the contrary, there are no differences in Calabria University Community related to the area of residence, the health conditions of the households, or the social habits of individuals.

The individuals' socio-anagraphic characteristics don't affect access, skills, and use of ICT, also if there is a digital skill gap between respondents and their families. The worst evidence is the lack of comprehension of digital content and the lack of help in understanding it.

Results underline that individuals' socio-anagraphic characteristics affect the perception of Telemedicine: as age, educational level, professional level, and income increase, it increases an optimistic perception toward Telemedicine. Additionally, households with older adults or children have a more positive perception of Telemedicine.

Access, skills, and use of ICT don't affect individuals' medical choices and behavior during COVID-19, but affect the perception of Telemedicine, optimistic if there is a stable connection and a frequent use of ICT. Overall, as increase comprehension of digital content, optimistic perception increases.

Finally, as increase the use and knowledge of Telemedicine, optimistic perception increases, and this is an important finding to develop Telemedicine in Calabria.

5. Discussion

Telemedicine can overcome inequalities (Williams, 2003), but it cannot be made if there remain inequalities in access to technology

(Cotton and Gupta, 2004; DiMaggio et al., 2004). Therefore, an environment ready to accommodate digital innovation is the essential foundation to foster medical innovation in Calabria after the COVID-19 pandemic.

The pandemic highlighted how new technologies can solve problems that would have otherwise remained unsolved (e.g., Cipolla et al., 2021). The risk incurred in other epidemics that preclude physical contact and the need to reduce the time and distances related to medical (as well as psychological or social) intervention should prompt us to question how to overcome the limitations imposed by the physical environment. Digital social research and digital medicine services are the means for us to do so.

As highlighted by this paper, the “Medical listening and intervention Unical online” project is not just an excellent achievement for the Telemedicine services provided in Calabria. Still, it is outstanding for coupling this offering with digital social research. Furthermore, the interdisciplinary approach—to which IT experts substantially contributed—enabled us to respond to an immediate, multidimensional, and complex need, in which topics related to subjects’ behaviors, choices, and experiences did not remain unnoticed.

The results show that the Calabrian university community is composed of middle-income households, but during COVID-19, 37.2% experienced economic difficulties (Gray, 1982; Link and Phelan, 1995). Calabria, for subjects, is a complex context in which most people have difficulty reaching their primary care medical doctor’s office and the nearest emergency room, and the travel time to reach them is always too high (Seidel et al., 2006). The lack of healthcare providers in the South of Italy can be a problem (Brems et al., 2006; Wilson et al., 2009). Also, suppose most of the sample live in urban or semi-urban areas in this context. In that case, Telemedicine could offer great advantages economically, logistically, and concerning time management, benefits that address territorial inhomogeneity and the lack of infrastructure or social healthcare providers (Sood et al., 2007) that we can observe in Italy and overall, in South and Calabria in particular (Giarelli and Giovannetti, 2019).

The sample is also composed of large households, including elderly, children, and people with disabilities or acute, chronic diseases or post-acute situations (Wang and Liu, 2006), for whom the services offered by the project would provide additional benefits (Italian Ministry of Health, 2012), also if results underline that they have no awareness of this. This is a significant result.

The sample mainly comprises students with good health and an active social life. The concern related to COVID-19 is 47.2%, but in 89.6% of cases, apparent symptoms trigger initial contact aimed at treatment, and the first person contacted would be their primary care physician. This evidence shows concerned, careful, and responsible young people, alert to the onset of COVID-19 symptoms, contrary to what media and common-sense underline during COVID-19.

As still detected in other research (Barber and Kim, 2021; Datta and Eiland, 2022) females and older have more concerns related to COVID-19. As age, education, and professional level increase, good information addresses personal physicians. Age is an ascribed variable, but we can reflect on the importance to

strengthen education (Luo et al., 2021) and a labor market that permits—also in Calabria—to achieve a high professional goal and better medical choices and behavior (Paige et al., 2018).

In general, the results indicate trust in the National Health System and awareness of both the ineffectiveness of self-medication and the need to prevent the overloading of first aid stations. In this context, Telemedicine would reduce the burden on primary care physicians (Battineni et al., 2021) who, during the pandemic, had difficulties dealing with their workload (Gagnon et al., 2006). Telemedicine offers easier, more immediate, and direct contact and avoids physical contact, thus preventing the spread of some diseases (Sood et al., 2007). This tool is not only a proper means of medical consultation and intervention but also reassures the patient, who no longer finds himself in a prolonged state of uncertainty due to prolonged waiting times (Italian Ministry of Health, 2012).

So, in the first part of the analysis, we have demonstrated that “socio-anagraphic characteristics of University Community members influence their choices and behaviors” and we have identified the elements on which we can intervene.

Then we have seen that “socio-anagraphic characteristics do not influence access, skills, and use of ICT”. Maybe because most of the population has yet excellent access to ICT and uses it every day (Lechman, 2015), we cannot identify the association with socioeconomic and cultural characteristics (Tobishima, 2020). It is essential to underline that there is a relevant difference between the university community and their families. This result reflects on the specificity of the sample, who belongs to a favored context (University), and on the necessity to extend the research to different contexts.

On the other hand, contrary to what we can think, the analysis of the ICT dimension shows a population who have relevant problems in text comprehension (Beaunoyer et al., 2017) and also in finding someone helps. This can be a great challenge for the University of Calabria: it is not sufficient to have access, use, and have digital skills if we cannot comprehend digital content, and this is a problem for all educational institutions (HEIs) in the territorial area of Calabria. Action is needed both to increase basic digital skills in the general population (European Commission, 2022) and to strengthen autonomy in understanding written material and how informatic systems also work (Bagozzi et al., 1992).

Finally, “socio-anagraphic characteristics of the University Community members influence their perception of Telemedicine”, and this is why it is necessary to overcome inequalities. We have already seen that the use of Telemedicine depends on the usability of the information system (Dünnebeil et al., 2012), which is strictly connected to the perception we have of it (Altmann et al., 2022).

Results show that households that include elderly people or children have an optimistic perception of Telemedicine, but the same doesn’t happen for households in which there are people with disabilities or illnesses. It is really important to inform people about the advantages offered by Telemedicine, and overall, households can receive more benefits from it (Annaswamy et al., 2020).

The research shows an increase in optimistic perception of Telemedicine, increasing age, educational level, professional level, and income (Luo et al., 2021), confirming the importance of investing in educational and labor policies that permit facing

inequalities. On the contrary, the research doesn't confirm that an active social life influences the perception of the benefits of ICT (Heponiemi et al., 2020). Maybe because a context such as Calabria doesn't offer a "social life" comparable to the Finnish one.

It is not confirmed that "access, skills, and use of ICT influence the University Community members' choices and behaviors", but "access and use of ICT are associated with an optimistic perception of Telemedicine". Maybe we don't detect an association with skills because we have not deepened the different digital skills of the population (Pincirolì et al., 2011), but the main result is that comprehension of digital content is associated with an optimistic perception of Telemedicine. So, it is necessary to invest in digital education.

Finally, we find that using Telemedicine help to have a more optimistic perception, so people who use it and are aware of doing it, understand the great advantages it takes. If success in the use of health services depends on the adoption and acceptance of the service by users (Walter and Lopez, 2008; Holden and Karsh, 2010) it is indeed necessary to act on awareness of addiction to socioeconomic and cultural aspects.

The unawareness is the most important result detected. The unconscious involvement of users in Telemedicine can be a first lever to increase its use. It is important to raise awareness of its opportunities and advantages (Yellowlees, 2005). It is an issue that falls squarely within cultural inequalities, which do not even allow the recognition of Telemedicine as a tool used in daily life. Unawareness is the first challenge to solve, as—to take advantage of an opportunity—it is necessary to know its merits and drawbacks.

Exploring the last two areas (ICT and Telemedicine) has allowed us to have a greater awareness of a service that is still little known to users, especially in a region where the development of digital medicine is in progress. As Andreassen and Dyb (2010) underline «relation between IT and social inequalities in health is constraining as well as insufficient to explain the persistence of health inequalities in digitalized western societies».

This study suggests how limited penetration of technological advances in the population must be addressed primarily by overcoming sociocultural and economic barriers and developing knowledge and understanding of digital environments. This can be an important way to lay the foundations for an achievable process of digital medical innovation in Calabria.

The proposed technological solution ("Compass") would make Telemedicine a useful tool for the National Health Service, by improving its efficiency, reducing time and costs, and increasing flexibility. The long-term deployment of the app would also improve communication between physicians and patients and between different healthcare providers, facilitating specialist consultations and prescriptions. The versatility of the project is made evident by its long-term prospects and potential: in the future, the system developed for the current situation can easily be repurposed for general diagnostics, independently of COVID-19, and extend and/or modify the medical services field by transforming, in Calabria, the dialogue and exchange of information amongst physicians, specialists, pharmacies and patients.

In conclusion, we want to underline that, departing from these results, if National Health Service (NHS) and the regional government want to promote an achievable process

of digital medical innovation in Calabria, it is crucial to overcome inequalities through adequate public policies and to strengthen partnerships with higher education institutions (HEIs), to overcome socioeconomic, cultural, and digital gaps in Calabrian population.

Digital social research proved to be an indispensable tool, both for carrying out research in the COVID-19 period, and for obtaining necessary findings to develop Telemedicine in Calabria, identifying factors that may affect the service. The research showed that the progression of digital medicine in Calabria and the development of the Calabrian health network should not be driven by technological or infrastructural development but by socioeconomic and cultural development to reach a better understanding and use of digital resources. If the fruition of a digital service is closely linked to the user's relationship with the proposed information system (Dünnebeil et al., 2012), the ability and willingness of users to make use of an innovative service affect the actual realization of the possible medical-health innovation.

This pilot research presents certainly some limitations: it is a proof of content, and the questionnaire and the scale must be better tested and developed. In particular, we must keep all dimensions we have detected with few questions. It has been necessary because of the time and requests of the interdisciplinary group of research, considering the different aims that have the entire pilot project. It will be important to deepen concepts and to check new instruments in the territorial area of Calabria. It could be important also to develop multivariate analysis. Also, the population investigated must be expanded, both to limit sample bias and to foster the medical innovation process in the entire region.

Future research can take into consideration also attitudes of physicians, specialists, scholars, and facilities in the area, who are also closely involved in the use of digital platforms. It could be useful to deepen the research with other methods, both quantitative and qualitative. We are thinking about developing UX research (Barnum, 2019; Zheng et al., 2022) and cyberethnography (Ward, 1999), giving a more profound interpretation of the present results and suggesting new directions for research.

Data availability statement

The datasets presented in this article are not readily available because restrictions apply to the original data under the GDPR regulation. Requests to access the datasets should be directed to ltaddei@unisa.it.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

LT is the first author and the corresponding author. She has been responsible for the organization of the writing and the

design of the concept of the article. She has designed the social research questionnaire and she is responsible of the analysis and interpretation of the results. FM is the medical director with experience in conducting clinical-epidemiological studies, he dealt with the analysis of data hesitated by the Telemedicine service for suspected contagion from COVID-19 and for the side effects of the vaccine prophylaxis activity. EP is scientific manager of the social research, he constantly monitored the progress of the survey during data collection, planning, organizing and participating in periodic meetings with the team members involved. TG has followed the progress of the investigation by participating in periodic meetings with the research team. EP and TG supported LT in the design of the social research questionnaire and in the analysis and the interpretation of the results, contributing to the writing of the article. AM and RM helped conceive the project and provide technical and organizational support to write the article. All authors contributed to the article and approved the submitted version.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsoc.2023.1141750/full#supplementary-material>

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Measuring digital capital in Italy

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Introduction: This paper aims to theoretically and empirically investigate the concept of digital capital in the Italian context. Digital Capital can be conceived as independent individual capital whose lack within a population can be a cause of digital inequality. Our paper draws from recent works that have measured the Digital Capital as a combination of digital access and digital competences, and have tested this operational definition through an online survey on a UK sample. The results of such research proved the construct validity of the operational definition, thus showing that Digital Capital could be empirically measured. However, a measurement model needs to be tested and validated over time and in different socio-cultural contexts in order to be refined and strengthened, and eventually disseminated on a large scale.

Method: This is the reason why this paper will show the results of a funded research project (named DigiCapItaly) carried out to test the validity of the Digital Capital measure in a different country, i.e., Italy. The data were collected with an online survey using a representative sample (by age, gender and geographical area) of individuals living in Italy aged 18 years or more. The creation of a composite index to measure Digital Capital followed a two-stage Principal Component Analysis approach.

Results: First, the paper provides a methodological framework for facing challenges and pitfalls in operationalizing and assessing a complex concept in social research. Secondly, results show that Digital Capital operational definition works in Italy as well as in the UK, thus legitimizing its recognition as an independent capital.

KEYWORDS

digital capital, Italy, digital divide, validation, composite index

1. Introduction

The growing use of digital solutions in everyday life offers multiple questions and food for thoughts. Unfortunately, the spread of technology is still not the same in every country, due to the digital divide. Following Hilbert (2015, 2016), Van Deursen and Van Dijk (2015, 2019), digital divide is meant as inequality in access to and use of new digital technologies. In these studies, online and offline inequalities are highly linked and influence each other: inequalities seem to extend also to many other aspects of individuals' offline lives and vice versa (Wei et al., 2011; Ragnedda, 2017). Indeed, digital inequalities are not a strictly geographical concept, only linked to the evolution of broadband infrastructure (Warf, 2001; Crang et al., 2006; Riddlesden and Singleton, 2016). Instead, digital inequalities seem to be linked to other aspects, such as age (Neves et al., 2018), working position (Van Deursen and Van Dijk, 2019), income (Martin and Robinson, 2007; Jung et al., 2010), belonging to specific social groups such as the disabled, racial minority groups (Clark and Gorski, 2001, 2002; Wilson et al., 2003), and many others.

Most of the research in this area have shown strong links between social exclusion and digital engagement, which tend to influence each other: those with fewer economic resources, lower social position, and less cultural capital are also affected by this type of inequality.

However, previous studies on digital divide are very far from analyzing all the implications of the phenomenon. Initial definitions of the concept have focused on purely informational aspects (Hamelink, 2000) or technical and IT aspects (Rojas et al., 2004) and circumscribed it to the possession of technologies (Katz and Aspden, 1997; Hoffman and Novak, 1999; DiMaggio et al., 2001). Despite the limited scope of these studies, they deserve the credit of having underlined how the unequal distribution of resources among the population underpins digital inequalities (Helsper et al., 2015). It is with the extension of the concept of digital divide to the use of digital devices (Hargittai, 2002; Peter and Valkenburg, 2006; Van Dijk, 2006), that the importance of users' knowledge and technological skills begins to be acknowledged. These research streams consider also the set of skills and competencies developed through engagement with IT as a constituent of the digital divide (Hamelink, 2000; Prieur and Savage, 2013). Within this perspective, digital divide has a dual nature based on digital competencies and digital resources.

Thus, digital inequalities are conceived as the consequence of the different accumulation and availability of digital resources, both material (such as technological devices and digital infrastructure) and immaterial (digital skills, problem-solving capability, content-creation capacities, etc.).

From this point of view, they can be understood as another form of capital—the Digital Capital—which is the object of this paper. The paper leverages on the recent work by Ragnedda et al. (2019), who have operationalized the concept of Digital Capital and measured it through an online survey based on a representative sample of UK citizens. The results proved the construct validity of the operational definition, thus showing that Digital Capital could be empirically measured.

By leveraging on these conceptual and empirical definitions of Digital Capital, the paper supports the empirical aim to explore and test the validity of the Digital Capital and measure it for the first time in Italy. Specifically, it aims to validate the operational definition of digital capital used in the UK in Italy and to explore how it is correlated with the socio-economic and socio-demographic variables in such a context.

The paper is organized as below. The next sections (The concept of digital capital-The research context) provide a theoretical overview of the concept of digital capital and the rationale for choosing Italy as research context. Sections Research design, research method, sample and data collection, Operational definition and measures, and Results deal with the research design, the operationalization procedures and the statistical results. Finally, in the last section findings are discussed and conclusions are drawn.

2. The concept of digital capital

We can distinguish three stages in the research on digital inequalities. The first one focuses merely on the differences in

users' access to the internet (Hoffman and Novak, 1999; DiMaggio et al., 2001), on purely informational aspects (Hamelink, 2000) or technical and IT aspects (Rojas et al., 2004). In the second stage, some studies go beyond mere accessibility by recognizing differences in the uses of the Internet according to digital skills and competencies (Peter and Valkenburg, 2006; Van Dijk, 2006). The third stage is well summarized by Ragnedda (2017, 2018), who linked the concept to the tangible and intangible outcomes and the benefits of using technological devices, that is exploitation of the advantages of the Internet and the changes in people's life that could improve their living conditions.

Thus, digital inequalities may be conceived as the consequence of the different availability and accumulation of digital resources, both material (such as technological devices and digital infrastructure) and immaterial (digital skills, problem solving, content-creation, etc.), and the different distribution of benefits that users are able to achieve.

This recognition of the possibility that digital assets—in their technological and capability aspects—are socially valuable and can improve life chances makes it possible to conceptualize them as a distinct form of capital, referred to as digital capital (Ragnedda, 2018). The concept of capital here is meant in Bourdieu's (1983) terms as transcending economic aspects and involving internalized and externalized resources able to produce benefits in other arenas. Although independent, digital capital is strongly intertwined with other types of capital (e.g., economic, social, cultural, etc.) (Ragnedda, 2018). This reinforces the idea of a dual process (offline → online → offline) in which offline inequalities produce digital inequalities, which in turn could reinforce inequalities present in offline contexts (social, political, economic, personal) (Ragnedda, 2017, 2018; Ragnedda et al., 2022a).

In this sense Ragnedda (2018) defines Digital Capital as “a set of internalized abilities and aptitudes” (known also as “digital competencies”) as well as “externalized resources” (also called “digital technology”) “that can be historically accumulated and transferred from one arena to another.” Within this perspective, digital capital contributes to life opportunities enhancement by creating a bridge between online and offline realms. Online activities produce *social benefits* such as opportunities for socialization, for creating weak ties and reinforcing strong ties; *economic benefits* such as opportunities in finding employment and better jobs, in accessing online services, in online shopping; *political benefits* in reinforcing citizenship and participation in deliberative democracy; *personal benefits* contributing to entertainment, fitness and health; *cultural benefits* in enhancing cultural engagement and cultural activities (Ragnedda et al., 2022b).

There are previous attempts to define the concept of Digital Capital (Morgan, 2010; Seale, 2012). For example, Seale (2012) defines it as the technological know-how, the informal time invested in enhancing technological skills, the formal time spent in ICT education, the online social network. She is interested in how and whether digital capital promotes the inclusion of disabled students. Morgan (2010) conceptualizes it as a new literacy for today's students unconnected with print-based literacies. In the majority of cases, the concept of digital capital is used at a firm level to indicate the set of resources of the

digital economy (Tapscott et al., 2000; Roberts and Townsend, 2015).

However, these studies are theoretical at heart. On the contrary, Ragnedda (2018) aims to measure digital capital as a specific and independent form of capital and to construct and validate it with sociodemographic and socioeconomic variables. Our work leverages precisely on the operational definition provided and validated by Ragnedda et al. (2019) which articulates the concept of digital capital into two components: digital access and digital competence.

Digital access includes the *digital equipment* (devices used to access the Internet), *connectivity* (quality of access to the internet), the *time spent online* and the *support and training* in using the Internet.

Digital competence follows the competences framework defined in the European Digital Competence Framework for Citizens (Carretero et al., 2017), so including the individual abilities ranging from the capability in browsing, searching, filtering and verifying information to the capability of creating online content and protect privacy: *information and data literacy, communication and collaboration, digital content creation, safety and problem-solving* (see Figure 1).

There are already several studies in the literature that demonstrate how sociodemographic and socioeconomic features are intertwined with online dynamics such as how the Internet is accessed, how well it is managed, the level of engagement in ICT and the breath of online activities (DiMaggio et al., 2004; Zillien and Hargittai, 2009; Robinson et al., 2015). The relationship between sociodemographic and socioeconomic preconditions and online life cannot be considered linear and unidirectional. Instead, it is an interactive and continuously evolving cause-and-effect relationship (Park, 2017). This circular process allows socio-demographic and socioeconomic preconditions to compromise every aspect of online life, starting from online access (Tsatsou, 2011), to digital skills (Jones-Kavalier and Flannigan, 2008) and online activities (Hargittai and Hinnant, 2008; Zickuhr and Smith, 2012).

According to the literature, there are five socio-demographic and socio-economic variables related to Digital Capital:

- Income: As shown in several previous studies (Witte and Mannon, 2010; Talukdar and Gauri, 2011; Mardis, 2013; Ragnedda and Muschert, 2013, 2015; Van Deursen et al., 2017), income is supposed to affect various aspects of online life, in particular the possession of technological devices. For this reason, it should positively affect the level of Digital Capital;
- Age: many studies have found a negative association between age and digital skills, engagement and activities (Lenhart et al., 2008; Lee et al., 2011; Dutton et al., 2013; Blank and Groselj, 2014), so it is assumed that digital capital is negatively related to age;
- Gender: Although in many developed countries with a high Internet penetration, gender digital divide has been reduced or even bridged (Blank and Groselj, 2015;), there are many other developing countries where we can still find a gender gap in terms of frequency, intensity and type of internet use (Wasserman and Richmond-Abbott, 2005; Hargittai, 2010;

Haight et al., 2014; Hargittai and Shaw, 2015). Thus, men are supposed to be more likely to have a higher level of Digital Capital;

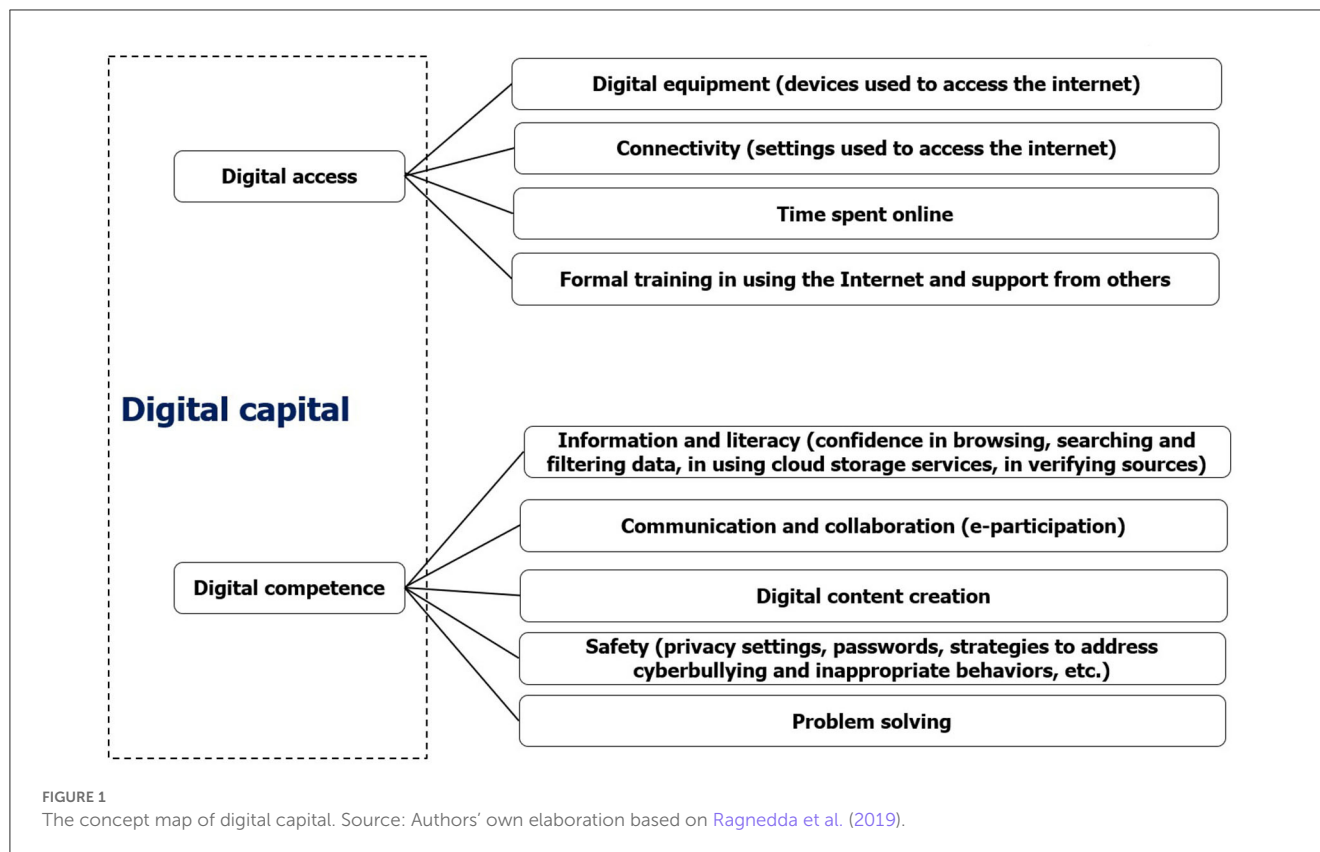
- Education: Previous studies have shown that the educational level positively influences the level of Digital Capital (Attewell, 2001; Clark and Gorski, 2001, 2002; Mossberger et al., 2007; Shelley, 2009), establishing a positive relationship: users with higher education are more successful in online activities and have better management skills (Van Deursen and Van Dijk, 2013; White and Selwyn, 2013; Blank and Groselj, 2014).
- Place: The literature shows that urbanization influences the level of digital capital. In central areas the presence of infrastructures allows for a greater internet penetration than in rural areas (Crang et al., 2006; Mardis, 2013; Townsend et al., 2013; Ashmore et al., 2015; Philip et al., 2017). This would make geographical differences significant: people from the city (more exposed to technology), are assumed to have a higher level of Digital Capital than those living in peripheral areas.

3. The research context

The rationale of a study on Digital Capital in Italy is consequence of the low level of digital skills and knowledge, as testified by the Digital Economy and Society Index (DESI)¹ developed by the European Commission on an annual basis from 2014. The DESI describes the digital performance and tracks the progress of each member states, with the aim to help them to improve their own weaknesses. The results show significant gaps in both basic and advanced digital skills, in terms of the four dimensions of the DESI Index: *Connectivity* (fixed and mobile broadband coverage), *Human capital* (Internet user skills and advanced skills), *Integration of digital technology* (business digitization and e-commerce), *Digital public services* (e-government).

The DESI 2022 report, based on 2021 data, shows Italy among the poorest performers. Italy ranks 18th out of 27 Member States, with a score of 49.3 out of 80. What seems to be relevant is that only the 46% of the 16–74 years old have at least basic digital skills (54% in the EU) and only 23% have more than basic digital skills (26% in the EU). Generally, the area where greater progress is required is the *Human Capital* dimension, “Internet user skills” and “advanced skills.” In this area Italy tend to be near the bottom of the ranking (Italy is ranked 25th out of 27 European countries). This shows that digital inequalities are much more complex and refer to not only the possession of devices, but also the possibility of developing skills in order to benefit from them. The third dimension of the DESI index, *Digital public services*, also shows major challenges: while most Europeans engage in a wide range of online activities, Italy is ranked 18th out of 27. This shows that once again the Italian position is below the European average (58.5 Italian vs. 67.3 European out of 80). Italy demonstrates to perform better in the *Integration of digital technology* showing a score above the

¹ For information and details refer to <https://ec.europa.eu/digital-single-market/en/desi>.



European average (40.7 vs. 36.1 for the European average) and placing 8th out of 27 countries. Among the most interesting results, Italy is in a good position regarding SMEs with at least a basic level of digital intensity (60%, well above the EU average of 55%), and the use of electronic invoicing by enterprises (95% of Italian companies compared to 32% of the European average). However, the use of big data is still low (with an Italian average of 9% compared to 14% at the European level). These mostly positive results are probably related to policy aimed at the digital growth of Italian businesses. Whereby, the growth cannot be considered entirely natural but it is mainly an induced process. Indeed, such policy is included in a more comprehensive five-year plan called “Italia 2025” by the Minister for Technological Innovation and Digitization aimed at a digital transformation of the country. Moreover, one of the most encouraging news about the *Connectivity* dimension is that Italy is one of the most advantaged countries in the 4G replacement project, in accordance with the 5G Action Plan for Europe. On the other hand, the Italian position regarding mobile connectivity is quite controversial: while mobile connectivity coverage is still one of the worst in Europe, Italy is one of the leader countries in mobile only access (with 23% of households compared to 11% in Europe). Results on *Digital public services* also seems controversial: although below the European average (67 vs. 72%), Italy performs well in terms of offering digital and open data services. The low score seems due to the poor interaction both between users and online services and between users and public authorities that should encourage the use of public data and digital services. Once again, there is evidence that the digital culture in Italy is weak in terms of the availability of services and infrastructures.

However, despite the low growth of digitalization progress in the last 5 years, in 2022 Italy has climbed a few places in the European ranking (moving from a DESI index score of 45.5 to 49.3). This small comeback gives hope that the level of digitization in Italy will improve over time, also thanks to scientific and academic research that could draw attention to digital issues.

4. Research design, research method, sample and data collection

The main objective of our study is to measure digital capital following the research approach developed by Ragnedda et al. (2019) and implemented in the United Kingdom, with the necessary adaptations for the Italian context. Thus, the paper aims to answer the following research questions.

RQ1: Is it possible to implement and validate the operational definition used in the UK to measure Digital Capital, conceived as a distinct and independent capital, in the Italian context?

RQ2: Does Digital Capital measured in Italy behave in the same way as in the UK? In other words, through a construct validation procedure, has the Digital Capital in Italy similar statistical relationship with the socio-economic and the relevant socio-demographic variables (age, gender, level of education, income, area of residence)?

Our research questions required different statistical techniques to be properly addressed. More specifically, RQ1 was addressed by conducting Exploratory Factor Analysis (EFA) with a two-stage Principal Component Analysis approach (Di Franco and Marradi,

2013), in order to build and validate the Digital Capital Index (DCI). To answer RQ2 and construct validate the DCI, bivariate analysis was carried out using five sociodemographic variables: gender; age; education; income and occupation. Data analysis was carried out using the statistical analysis software, IBM SPSS Statistics 25[®].

The data were collected on December 2021 through a web survey involving Italian people aged 18 and over. As with the UK study, the research team opted for online-only administration of the questionnaires, as this meets the gnoseological need to include only those who (whether for age reasons or not) have a minimum level of technical competence and access. The questionnaire is composed by four sections with a total of fifty questions. The first

section collects sociographic information about the interviewee (such as gender, age, educational qualification, etc.); the second section focuses on information about Internet use (e.g., which devices one usually uses, from which places one generally connects to the Internet, whether one has enrolled in online courses, etc.); the third section delves into the sociocultural and socioeconomic background of the respondent, with a set of questions about different life domains (economic, social, political, cultural, and personal) (e.g., the respondent's the degree of political interest and participation; leisure time occupation; sociocultural status of birth family; types of activities carried out online, etc.); finally, the fourth section deals with life satisfaction (with a focus on economic conditions). The average time required to complete the questionnaire was 25 min. The survey was pre-tested on 20 Internet users in two rounds. Based on the feedback, changes were made.

The sample was built by extracting respondents from an online panel provided by Toluna, a professional organization for market research. The web survey collected 1,100 full responses with a response rate of approximately 8% of contacted people. The sample has been built to be representative of the Italian population with reference to gender, age, and geographical area (as shown in Table 1). The sample size was calculated with a 2.95% margin of error at 95% confidence level.

TABLE 1 Sample-population comparison.

		Sample		Population
		Count	%	%
Gender	Male	534	48.5	48.3
	Female	566	51.5	51.7
Age	18–29	159	14.4	14.2
	30–44	258	23.5	21.1
	45–65	400	36.4	38.0
	Over 65	283	25.7	26.7
Geographical area	North-West	295	26.8	26.8
	North-East	229	20.8	19.6
	Center	207	18.9	19.9
	South	262	23.8	22.9
	Islands	107	9.7	10.9

Source for comparison: ISTAT (2021).

5. Operational definition and measures

Following Ragnedda et al. (2019), the construction of DCI was carried out in three steps: First, a univariate analysis was used to check for the data quality and provide an overview of the results; then, a multivariate analysis was conducted to create the DCI; and finally, a bivariate analysis was conducted to test the validation of the DCI.

The analysis was performed as described in detail below.

TABLE 2 Digital access: operational definition.

Sub-component	Description	Items or modalities	Collection	Measure
Digital equipment	Devices used to access the Internet	-Mobile phone or smartphone -Laptop or netbook -Tablet computer -Desktop Computer -Media or game players -Smart Tv -Other devises (e.g., e-book reader, Smartwatch)	Multiple response	Nominal
Connectivity	Quality and Place of access	In which of the following settings do you most frequently access the Internet?	Multiple response	Nominal
Time spent online	First time using the Internet	How old were you when you used the Internet for the very first time?	Open question	Scale
Support and Training	Request for help, formal training received, and help offered	Have you ever had any formal training in using Internet?	Multiple response	Nominal
		If you needed help, would there be someone who could help you with using the Internet?	Closed question	Nominal
		Have you looked or asked for help to use the Internet in the past 3 months?		
		Have you helped someone use the Internet in the past 3 months?		

TABLE 3 Digital competences: operational definition.

Sub-component	Description	Items or modalities	Collection	Measure
Information and data literacy	Browsing, searching, filtering data, information and digital content	I am confident in browsing, searching and filtering data, information and digital content	Likert Scale -Not at all true of me-Not very true of me-Neither true nor-untrue-Mostly true of me-Very true of me	Scale
	Evaluating data, information and digital content	I regularly verify the sources of the information I find		
	Managing data, information and digital content	I regularly use cloud information storage services or external hard drives to save or store files or content		
Communication and collaboration	Interacting through digital technologies	I actively use a wide range of communication tools (e-mail, chat, SMS, instant messaging, blogs, micro-blogs, social networks) for online communication	Likert Scale -Not at all true of me-Not very true of me-Neither true nor-untrue-Mostly true of me-Very true of me	Scale
	Sharing through digital technologies	I know when and which information I should and should not share online		
	Engaging in citizenship through digital technologies	I actively participate in online spaces and use several online services (e.g., public services, e-banking, online shopping)		
	Managing digital identity	I have developed strategies to address cyberbullying and to identify inappropriate behaviors		
Digital content creation	Developing digital content	I can produce complex digital content in different formats (e.g., images, audio files, text, tables)	Likert Scale -Not at all true of me-Not very true of me-Neither true nor-untrue-Mostly true of me-Very true of me	Scale
	Integrating and re-elaborating digital content	I can apply advanced formatting functions of different tools (e.g., mail merge, merging documents of different formats) to the content I or others have produced		
	Copyright and licenses	I respect copyright and licenses rules and I know how to apply them to digital information and content		
	Programming	I am able to apply advanced settings to some software and programs		
Safety	Protecting devices	I periodically check my privacy setting and update my security programs (e.g., antivirus, firewall) on the device(s) that I use to access the Internet	Likert Scale -Not at all true of me-Not very true of me-Neither true nor-untrue-Mostly true of me-Very true of me	Scale
	Protecting personal data and privacy	I use different passwords to access equipment, devices and digital services		
	Protecting health and wellbeing	I am able to select safe and suitable digital media, which are efficient and cost-effective in comparison to others		
Problem-solving	Solving technical problems	I am able to solve a technical problem or decide what to do when technology does not work	Likert Scale -Not at all true of me-Not very true of me-Neither true nor-untrue-Mostly true of me-Very true of me	Scale
	Identifying needs and technological responses	I can use digital technologies (devices, applications, software or services) to solve (non-technical) problems		
	Creatively using digital technologies	I am able to use varied media to express myself creatively (text, images, audio and video)		
	Identifying digital competence gaps	I frequently update my knowledge on the availability of digital tools		

To create the DCI, we first built the two sub-indices of Digital Access (by combining the set of digital access' questions shown in Table 2) and Digital Competences (by considering the sub-components shown in Table 3). A two-stage Principal Component Analysis approach was run to develop a Digital Capital Index from Digital Access and Digital Competences indices, able to synthesize a high number of items and to simplify the interpretation of the results (Di Franco and Marradi, 2013). After the first extraction, each factor (and the loading variables) was independently analyzed to remove those variables that were not strictly connected to the concepts under analysis.

TABLE 4 Factor loadings of the variables used for the digital access index.

	Digital access index
Digital equipment	0.746
Connectivity	0.756
Time spent online	0.606
Support and training	0.646

Kaiser–Meyer–Olkin (KMO) test = 0.701; Bartlett's test, Sig. < 0.000.

TABLE 5 Factor loadings of the digital competence items.

	Factors		
	Problem solving	Content creation	Safety
I am confident in browsing, searching and filtering data, information and digital content			
I regularly use cloud information storage services or external hard drives to save or store files or content		0.553	
I regularly verify the sources of the information I find			
I actively use a wide range of communication tools (e-mail, chat, SMS, instant messaging, blogs, micro-blogs, social networks) for online communication		0.698	
I know when and which information I should and should not share online		0.601	
I actively participate in online spaces and use several online services (e.g., public services, e-banking, online shopping)		0.678	
I have developed strategies to address cyberbullying and to identify inappropriate behaviors		0.501	
I can produce complex digital content in different formats (e.g., images, audio files, text, tables)	0.706		
I can apply advanced formatting functions of different tools (e.g., mail merge, merging documents of different formats) to the content I or others have produced	0.764		
I respect copyright and licenses rules and I know how to apply them to digital information and content			0.632
I am able to apply advanced settings to some software and programs	0.828		
I periodically check my privacy setting and update my security programs (e.g., antivirus, firewall) on the device(s) that I use to access the Internet			0.626
I use different passwords to access equipment, devices and digital services			0.757
I am able to select safe and suitable digital media, which are efficient and cost-effective in comparison to others	0.519		
I am able to solve a technical problem or decide what to do when technology does not work	0.775		
I can use digital technologies (devices, applications, software or services) to solve (non-technical) problems	0.761		
I am able to use varied media to express myself creatively (text, images, audio and video)	0.651		
I frequently update my knowledge on the availability of digital tools	0.712		

Kaiser–Meyer–Olkin (KMO) test = 0.946; Bartlett's test, Sig. < 0.000.

Considering the Kaiser (1960) criterion of retaining only those factors having eigenvalues of 1 or more, results showed that the extraction of one factor was appropriate to represent the factorial solution; moreover, the average size of the factor loadings (over ± 0.6) is good (Comrey and Lee, 1992), this suggests that all the selected variables contribute to define the factor.

In the final stage, we adjusted index score to a range from 0 to 100 to simplify its interpretation.

Indeed, to answer the RQ2, we carried out a bivariate analysis between the DCI and socio-demographic variables considered crucial (age, gender, level of education, income, place of residence) to test the validation of DCI. Specifically, we used one-way analysis of variance (ANOVA) to explore the relationships between Digital Capital and gender, income, educational level and place of residence. Meanwhile, we used a correlation analysis to test the statistical relationship between Digital Capital and age. Finally, the relationship between Digital Capital and gender was addressed by performing an independent samples *t*-test.

TABLE 6 Factor loadings of the variables used for the digital access index.

	Digital competences index
Problem solving	0.869
Content creation	0.822
Safety	0.866

Kaiser–Meyer–Olkin (KMO) test = 0.707; Bartlett's test, Sig. < 0.000.

6. Results

6.1. RQ1

As mentioned above, the first stage of analysis focused on the building of the Digital Capital Index by combining the Digital Access Index and the Digital Competences Index.

In order to create the Digital Access Index the multiple responses related to each sub-component of Digital Access were conceived as dummy variables and summarized into single variables. The four variables were included in the EFA to test the operational definition and develop the Digital Access Index (see Table 4). The factor scores were saved using the regression method.

Indeed, the Digital Competence Index was built by directly applying the EFA to the set of items shown in Table 5. The first step of the factor analysis provided a three-factor solution that explained the 58% variance and are named after “Problem-solving,” “Content creation” and “Safety” competencies.

By implementing the two-step factor analysis approach (Di Franco and Marradi, 2013), the three factors were converted into variables by considering only those items with high factor loadings on each component. Then, we performed a second EFA on the three variables, representing “Problem-solving,” “Content creation” and “Safety,” in order to extract a single factor representing Digital Competences (see Table 6). This double step improved the interpretation of the latent dimension by “refining” the results and isolating those features that strongly contribute to the factors.

The last step of our process was to combine the Digital Access Index and the Digital Competence Index through a further extraction of a single factor representing the DCI (as shown in Table 7). The factor analysis provided a one-factor solution that explained the 72.8% variance and shows that the two components have the same weight in determining Digital Capital.

6.2. RQ2

The second research question addressed the validation of digital capital in a different social and cultural context, namely the Italian one. To achieve this, we applied a construct validation procedure in which we tested the DCI with the sociodemographic and socioeconomic variables considered in the literature by previous studies (see Section The concept of digital capital): Education, Age, Gender, Income, and Place of Residence.

Previous studies have shown that education has a positive impact on the digital experience, e.g., levels of access, usage, digital skills, etc. (Clark and Gorski, 2001, 2002; Shelley, 2009; Van Deursen and Van Dijk, 2013; Blank and Groselj, 2014; Ragnedda et al., 2019). Consistent with these findings, the one-way ANOVA

TABLE 7 Component matrix of the combination between digital access index and the digital competence index.

	Component 1
Digital access	0.853
Digital competences	0.853

TABLE 8 Relationship between qualification and DCI.

Qualification	Mean	Standard dev.
Some high school, no diploma	43.0	16.9
High school graduate	50.7	14.6
Some college credit, no degree	51.2	13.5
Bachelor's degree	51.9	14.9
Master's degree	60.6	14.7
Postgraduate qualification	62.5	9.5

$F = 13.692$; Sig. < 0.000.

TABLE 9 Correlation analysis between age and DCI.

	Digital capital index
Age	−0.404**

**Correlation is significant at the 0.000 level (two-tailed).

shows a positive and statistically significant impact of education on digital capital (see Table 8).

The literature shows that younger people have a higher level of access and use (in terms of digital skills, types of online activities, engagement, etc.) than the older ones (Lee et al., 2011; Dutton and Blank, 2013; Blank and Groselj, 2014; Ragnedda et al., 2019). In this regard, we performed a correlation analysis between age and Digital Capital (shown in Table 9). The correlation coefficient shows a statistically significant negative relationship (-0.404 , $p < 0.000$).

Digital divide literature has shown differences between men and women about digital experience and digital knowledge: several studies show that men are more likely to use digital devices and to develop better digital skills (Ono and Zavodny, 2007; Blank and Groselj, 2014). However, in Ragnedda et al. (2019) this evidence is not supported. Digital gender inequalities are very likely to decrease over the years, especially in more developed societies, as shown by Blank and Groselj (2014). In our analysis, a small gender difference emerged from the one-way ANOVA, with men being slightly better than women, with a positive deviation of 3.6 are. However, the t -test (shown in Table 10) returned coefficients about a non-statistically significant relationship (with $F = 0.025$).

Similarly, several scholars (Witte and Mannon, 2010; Talukdar and Gauri, 2011; Ragnedda and Muschert, 2013) have suggested that the level of economic resources can have a major impact on the ability to access digital devices and/or develop specific skills in this regard. In other words, recent literature shows that those who have more resources are also more likely to have access, skills, and engagement related to technology. The results of the one-way ANOVA shown in Table 11 shows a positive relationship between income and DCI, highlighting a 6.3 gap between those with high

TABLE 10 Relationship between gender and DCI.

[illegible]

TABLE 11 Relationship between income and DCI.

Income	Mean	Standard dev.
<10.000€	48.9	14.3
10.000–20.000€	50.6	14.5
21.000–30.000€	50.9	15.9
31.000–50.000€	52.0	15.1
More than 50.000€	55.2	13.4

F = 2.995; Sig. < 0.018.

TABLE 12 Relationship between area of residence and DCI.

Area of residence	Mean	Standard dev.
Urban areas	55.1	15.3
Small towns	51.0	14.3
Rural areas	47.8	15.3

F = 18.919; Sig. < 0.000.

income and those with low income. However, not only is the difference smaller than expected, but the results are not statistically significant ($F = 2.995$).

This result may shed light on the democratization of technology, due primarily to broader access and use of technology by all segments of the population, but also to the low cost of owning certain digital devices or services that bring technology closer to people.

Geographic location of residence is another important aspect in understanding how access to and use of technology may differ across people. In fact, several works (Ashmore et al., 2015; Philip et al., 2017) show that living in an urban area may have a positive impact on technology experience compared to living in more rural areas. One of the most important aspects in this context is the availability of infrastructure for connectivity, such as network signals, broadband connections, etc. The study by Ragnedda et al. (2019) also contains some scientific evidence along these lines. In this regard, our results can be considered consistent with this research, as Table 12 highlights the relationship between place of residence and DCI, showing a difference of 7.3 between those who live in the center and those who live in rural areas. The results are also statistically significant (with $F = 18.919$ and $\text{Sig.} < 0.000$).

7. Discussion and conclusion

The aim of this paper was to derive further evidence about the theoretical and empirical validity of the concept of Digital Capital as originally defined and measured in the UK by [Ragnedda et al. \(2019\)](#). As a first step, the operational definition of the concept was adapted to the Italian context. Subsequently, Digital Capital was measured and then tested by comparing it with specific socio-demographic and socio-economic variables.

Actually, the relevant literature shows that digital experience, in terms of access, use, engagement and skills, is closely linked to specific socio-economic factors, such as Education, Age, Gender, Income, and Place of Residence. In other words, Digital Capital, like all other types of capital (economic, political, social, cultural, etc.),

is intertwined with and influenced by factors external and internal to individuals and the specific societies in which they live.

In fact, addressing RQ2 enabled us to test the DCI from this point of view; despite its limitations, the bivariate analysis, allowed us to assess the presence and intensity (where possible) of the association between Digital Capital and the socio-demographic and socio-economic variables.

The data analysis provided satisfactory results in line with the reference literature. Among other results, the bivariate analysis showed significant relationships between:

- Qualification and DCI, with a spread of 19.5 between those without an educational qualification and those with a postgraduate qualification, in favor of the latter;
- Age and DCI, showing that young people have a higher level of Digital Capital than older one. This could be justified by the fact that younger people have a better quality of digital experience together with the amount of time spent online than previous generations;
- Area of residence and DCI: unlike the English context, Italy cannot be considered a high internet penetration country due to lack of geographical distributed infrastructures which makes people living in cities more technological advantaged.

However, the bivariate analysis produced not statistically significant in Italy related to:

- Gender and DCI, with a 3.6 non-significant difference between men and women. However, this result is in line with the latest findings in the literature, which show a reduction in the gender technological gap. This is because, especially in more emancipated societies, women like men are exposed to technology on a daily basis;
- Income and DCI. A key to understanding the non-significance of this relationship could be related to the widespread use of digital technologies in the Italian population, beyond the socio-economic class they belong to.

This study demonstrated how Digital Capital is intertwined with the “traditional axes” of social inequalities (particularly education).

Italy presents similarities with UK (they are both countries belonging to Western Europe) but also differences (see section The research context) particularly with reference to internet penetration. It cannot be considered a high internet penetration country as the UK due to territorial imbalances in the broadband accessibility. This consideration help us understanding the main difference between Italian and UK samples: the average of digital capital's score is higher in UK (72.8) than in Italy (51.1). This makes the results particularly meaningful, because we have proved the validity of digital capital measure in two different contexts, thus supporting its operational definition given in previous studies and legitimizes its recognition as a specific and independent form of capital.

However, it would be important and equally interesting to test this tool in other contexts, both in Western Europe and in other parts of the world, both in developed and developing countries.

Therefore, cross-national studies are needed to examine the level of digital capital and related outcomes. Such studies also seem highly relevant for understanding and addressing inequalities at the policy level. Indeed, digital capital can be viewed as bridging capital, as it is influenced by pre-existing offline capital (helping to improve individuals' digital skills, capabilities, and access) and influences offline capital by producing different types of benefits (translating Internet experiences into new life opportunities). Because of the close linkages between digital capital and other types of capital (e.g., economic, social, and cultural capital), inequalities in access to and use of the Internet may exacerbate inequalities in other important areas. Conversely, then, by improving the level of individuals' digital capital, it would also be possible to reduce inequalities in tangible outcomes. From this perspective, the introduction of a digital capital index could be an important policy-making and monitoring tool. Looking at so many indicators simultaneously can be challenging when it comes to providing guidance for action. Combining indicators into indices at different levels and into a single composite measure helps to achieve a comprehensive assessment of digital capital, provide a methodology for monitoring over the years, able to indicate the areas at risk of digital divide, the success and failure of national policy initiatives and measures, etc.

However, this research is not without limitations. The use of bivariate analysis provided basic results, which could be further investigated through more comprehensive multivariate analysis to better clarify the relationship between DCI and all the variables tested, also including other factors that might influence this link. In addition to this, this study may represent the basis to develop and validate new methodological instruments to assess extent and quality of digital capital based on the same constructs validated in this paper, such as a multi-item scale based mainly on individual's own descriptions. This will be a direction for further research.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

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Supplementary material

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Ethnography and the digital scenario: a typological scheme of differences and evolutionary trajectories

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The ethnographic method has been a feature of the social sciences since its inception, and for some disciplines, it is markedly characterized by a strong aptitude for physical field research over extended periods in circumscribed communities. However, with the advent of the digital age, this process has undergone further acceleration, upsetting and partly undermining the solid assumptions on which the ethnographic method had been formed, precisely because in the digital scenario, the assumptions of boundaries of contexts, the agency of scenario, and the need for a long-term field investigation change radically. This conceptual analysis aims at providing an overview of the trajectory of the evolution of ethnographic studies in social sciences by trying to trace the main pillars of change and the future direction of the method.

KEYWORDS

ethnography in social sciences, digital era, typological schema, ethnographic evolutionary trajectory, pillars of change, role of the researcher

1. Introduction. Ethnography to the evidence of a digital turn

The rise of the digital issue has been guaranteed in the last 20 years as a not insignificant frame for social science because of its power of identity building, information, and knowledge sharing in the architectures of relations and networks made by users via computer-mediated communication (CMC).

Beyond this, the standardization of Internet, blogs, social media, and other web-sphere use, is similar considering the offline ways to access information and what concerns the observation of social phenomena (Airoldi, 2017). In-person or web-mediated situations can in fact equally be considered “information systems” (Meyrowitz, 1985) that “affect the kind of knowledge we can produce as researchers/observers” (Airoldi, 2017, p. 9).

Starting from the idea of the innovation intended as a cultural object composed both as an instrumental repertoire and as well as a set of practices applied by the tools contained in this repertoire, “the various identities, practices, values, rituals, hierarchies, and other sources and structures of meaning that are influenced, created by, or expressed through technology consumption” (Kozinets, 2019, p. 621) have changed over time. Consequently, social research methods are also continuously challenged (and rightly so) with discussions and reflections about the changes related to current innovations tied to the social context in which we live.

In light of this, following Lupton (2018), we cannot agree with the idea that old-fashioned methods, such as ethnography, must be “left aside to give more space to those new methods that differently are featured by the current evolution of technologies” (p. 41). Sociologists

today should instead consider how different approaches can be adopted, what opportunities they open in terms of knowledge production, and what kind of data they produce in order to «open a fruitful debate concerning the own nature of our discipline and its future in the digital era» (*ivi*).

Quantitative and qualitative methods remain, in fact, so relevant in the current state of social research to investigate identities, daily life, institutions, the social gap, and so on, not to mention investigating whether the opposition of this classic dichotomy has also been overturned because of the implications that technologies carry out for research practices. It is enough to think of the online tools ethnographers today can use as digital recorders during the interviews or the use of software to analyze the new kind of digital data. *User-generated content* (UGC), users' activities on the web-sphere, e-commerce orders, and the whole big-data frame are some examples of new data that is possible to gather from sources not available before the digital turning point.

The emerging epistemological tasks and ethnography, one of the oldest and most consolidated methods in the social research sphere, is no exception in challenging social researchers to rethink their work. Innovations and new technologies bring the standard anxiety from which social researchers have not been excluded across the *digital turn* (Marres, 2017). Many scholars in recent years have been interested in high levels of the administration of social science research methods via the Internet. They were driven toward the idea of «new technologies presented both as an opportunity to be grasped and a threat to be countered» (Hine, 2000, p. 4). After stating that, it becomes helpful today to reassess the current opportunities and threats for researchers who move inside and outside online environments in light of the epistemological and methodological changes over the past few years. Starting from these assumptions, it becomes relevant to assess the role of technologies in research methods in order to understand the following:

- if that anxiety emotion by which nothing could be taken for granted has been eventually overturned thanks to the running-in of online and offline research methods;
- how the complementarity vocation of online and offline methods helped compensate for what can be lost during ethnographic sessions on physical and non-physical spaces.

Following the plentiful literature, ethnography is intended as a method based on direct observation (Spradley, 1980; Gobo and Marciniak, 2016) that usually involves “the researcher participating, [...], in people's daily lives for an extended period, watching what happens, listening to what is said, and/or asking questions through informal and formal interviews, collecting documents and artifacts” (Hammersley and Atkinson, 2007, p. 3).

The main disciplines that were historically suited to direct observation, anthropology, and sociology, are mainly related to the specific focus elected as the fundamental connotation of the ethnographic method: community, field, and the relationship between researcher and researched (Hammersley, 1990). Brunt (2007) retraced how the concept of community has evolved in recent years, first intended as the association between places and people sharing specific interests, feelings, behaviors, and objects (Warner and Lunt, 1941). It is based on the Fletcher formula (Fletcher, 1971) that connects family, work, and places, duly

expressed as a «group of households situated in the same locality and linked to each other by functional interdependencies which are closer than interdependencies of the same kind with other groups of people within the widest social fields to which a community belongs» (Elias, 1974, p. XIX).

Relating to the epistemological assumptions it becomes relevant to the reflection about the role of researchers in the way that «For a long time, no one thought much about how fieldwork was written up into descriptions of other cultures» (O'Reilly, 2007), neglecting the research outcomes from the researcher's written fieldwork and how the social construction of the reality depends on ethnographers' choices and their narrations. Several epistemological debates have been developed concerning the various ways to approach the ethnographic vocation (such as realism, interpretivism, relativism, etc.). The *reflexive turn* of 1980s and 1990s, was characterized, among others, by Atkinson (1992) and Clifford and Marcus (1986) and drove toward a brand new pragmatic vocation proposed by Hammersley (1998) by which «rather than attempting to reproduce reality in our ethnographic accounts we admit the best we can do is to make attempts to represent it» (O'Reilly, 2007, p. 184).

The emergence of critical ethnography (Thomas, 1993) explicated the role of social science in doing ethnography, extending the conventional application of the method through the ethnographer's choices. Focused particularly on political issues, the critical vision had already highlighted how the representational consequences of research cannot be considered neutral. On this assumption, postmodernist ethnographers (Burawoy et al., 2000) drove the debate toward the possibility of “evoking” reality rather than “representing” it. It led the contemporary discussion to the idea of an ethnography conducted by human beings who «make choices about what to research, interpret what they see and hear, decide what to write and how, and that they do all this in the context of their own personal biographies and often ensconced in scientific and disciplinary environments» (Spencer, 2001). This gave up the presumption of being objective and following the attempt to create ethnographies that reflect the complex nature of reality (Hammersley and Atkinson, 2007) and sustaining how the latter exists externally to our possibilities of experiencing it.

In light of this premise, O'Reilly (2007) redefined the assumptions about the ethnographic epistemology debate clarifying that the application of the method consists of «iterative-inductive research (that evolves in design through the study), drawing on a set of methods. It involves direct and sustained contact with human agents within the context of their daily lives (and cultures), watching what happens, listening to what is said, asking questions, and producing a richly written account that respects the irreducibility of human experience and that acknowledges the role of theory as well as the researcher's own role» (p. 52).

However, when the ethnographic method is tested in the digital environment, most of these assumptions undergo evolutions and revolutions. The initial function of the method framed on a specific object changes its configuration in terms of the place to carry out the ethnographic work due to the subsequent evolution of the instrumentation adapted to the changed scenario.

New methods offer a wide range of new investigation possibilities, but they also have their own limitations and

boundaries that social researchers need to experience to make the most of online as well as traditional research methods. Many scholars stated the strict connection between research objects and research questions to study certain phenomena through the most appropriate methods (Phillimore and Goodson, 2004). Following Addeo et al. (2021), a compelling statement that has been the core of social research practice since its beginning is still valid nowadays in the era featured by the so-called *digital turn*.

It is enough, for example, to think about the challenges in exploring new kinds of spaces no more related to physical fields of observation and those social phenomena first transposed, and then, in some cases, totally migrated online. In this way, the compresence of the researcher and research in the same kind of space is not required. At the same time, the compresence does not affect the ethnographical application. Following Schrooten (2016), in fact, «the everyday lives of many individuals often transcend the geographical locations in which classical fieldwork took place, challenging ethnographers to include these social spaces in the demarcation of their fieldwork sites» (p. 66). In this way, the vision of Hine (2006) concerns the anxiety about how far existing research methods are appropriate for technologically mediated interactions due to the willingness to incorporate the Internet as part of “the field”. It brings us to consider digital technologies and wonder how «the study of these sites has substantially increased the range of possible relationships involving fieldnotes» (Jackson, 2016, p. 51).

Following Paccagnella (1997) and Di Fraia (2007) digital tools can be intended as flexible objects that enable knowledge production and knowledge sharing. This attitude is still valid in the frame of social research and ethnographic application also by the «implementation of practices not provided by developers» (p. 23). Thus, we can intend the Web not as a «sum of sites but rather as a series of digital resources related to events, concepts or relevant topics» (Schneider and Foot, 2011, p. 2) in which «the use practices can follow some evolutionary paths» (Vittadini, 2018, p. 15).

Research actions and their relevant practices follow different paths in data gathering procedures, taking care of technologies and digital tools which can enable researchers to reach their purposes. As already assumed by Padricelli et al. (2021), multiple turning points mark differences and exceptions in every kind of application practiced. Among them, it is enough to think about the relevance of the field notes to collect regardless of the kind of data used (digital, digitalized, etc.) and the opportunity to build primary data or collect secondary data for primary use for social media analysis. On these bases, technologies and digital maps play different roles in doing ethnography. On the one hand, they play an exogenous role in traditional ethnographic applications in the way that, for example, the use of audiovisual recording tools during the observing or interrogating sessions can be useful to transform and re-adapt the method in order to enrich, complement or rearrange fieldnotes by different immersive research experiences.

On the other hand, technology plays an endogenous role in a netnographic way. In this vision, technologies take part of a whole digital context that becomes an additional and integrated social participatory environment where the researchers take into account as well the role they play in relation to technologies and web affordances: researchers that use some data collection

tools to access digital fields that are not limited to study the online cultures, but rather that can aim at detecting cultural changes and social conditions through technologies. In this way, following Tummons (2020), the boundaries of the non-traditional applications in ethnography «are discursively constructed rather than bounded within geographic spaces» (Liu, 2022, p. 3) in the way that «digital platforms are both tools and fields to study social relationships that differ from those occurring at traditional sites such as schools, firms, and classrooms. While the research subject may be the same, how researchers “gaze upon” them differently, depending on how technology mediates or highlights a particular dimension of social interactions» (ivi).

Based on these factors, the time has come to retrace the evolutionary trajectory of the ethnographic practice to provide (young) researchers with a systematization of recent ethnography development so as to know better, threats, limits, and opportunities in choosing the best research path and the method layout to achieve their goals.

Ascertained by this background, the following article aims to investigate the current developments in ethnographic practice to understand its evolutionary trajectory starting from the following research questions:

- How did the digital context change the canonical application of social science?
- How do researchers move inside and outside the online field availing (or not) of research innovations and related digital technologies?

Primarily, the topics presented will focus on the evolution of ethnographic practice in the digital age. Subsequently, the main dimensions of the intervening changes will be reviewed, and a proposed systematization of a typological scheme will be attempted. Finally, we will discuss the emerging pillars on which to focus, to adequately answer the questions that drive this study and its ultimate aim of understanding what happens to the epistemological and ontological essence of the ethnographic method.

2. The role of technologies and the trajectories of ethnography

The Internet has developed drastically and has influenced our daily routines, way of life, how we express ourselves, our culture and shared beliefs, knowledge, and ideas. Consequently, the Internet revolution has profoundly impacted ethnography (Garcia et al., 2009) and more generally all methods of investigating cultural and social phenomena. The Internet has made it possible for any researcher to simultaneously access online information, actions, interactions, communities, and cultures located in different places, and then to designate several variations in the application of the method characterized by new advantages and limits concerning the relationship between the field and the researcher, the levels of intrusion, the research actions, and the techniques used (Padricelli et al., 2021).

The turning point for ethnography in light of Internet studies coincides with the new centrality assumed by the concept of cyberspace, beginning in 1990 (Woolgar, 1996) and intended as a

place to store large amounts of helpful information to discover how much social culture is online. Cyberspace can also be understood «as computer-mediated contexts intrinsically related to supposed-to-be “real” places. From this point of view, the ethnography of online groups is not just the ethnography of the groups online (or the online ethnography of groups). However, it is both the ethnography of online and related off-line situations, the ethnography of humans and non-human actors in these related fields» (Teli et al., 2007). This attempt at linking what is on the Internet and what is moving in the world, outside the Internet, concerns the Web not only as a cultural context, but also as a cultural artifact, a flexible, dynamic, and pervasive object. On this requirement, Hine's vision (2000) concerns how research methods need to be continually adapted to the social context, social phenomena, and their characteristics. In this way, the ethnographic method adapted its traditional vocation to the well-known version called “netnography”. Following Hobbs (2006), it consists of a repertoire of practices needed to understand a particular culture. Traditional research methods move to the web environment where real communities become web-communities to preserve, or create, substantive networks and relationships in cyberspace. Based on these assumptions, netnography, upon its inception, was defined as the online transposition of classic techniques: in the same way, as the survey becomes a *web-survey*, the interview becomes a *web-interview*, and so on. Observation is elected as the main research method, complemented by a series of research actions that produce ancillary sources of information such as passive listening, querying, and reading, by which the researcher is not forced to be involved in web-based activities. However, it can instead select a specific level of participation. The assumption related to the observation is also valid for netnography, even if it differs for any feedback effects related to the different observing scenarios addressed online. Netnography can deal with a non-intrusive level: a setup that indeed entails further reflections about the ethical ways of doing research.

On the other hand, for in-person ethnography, the observation concerns an interactive relation between the ethnographer and observed subjects in any case. In this way, we must always speak of intrusion level as well as in case of covert observing sessions by which the observed subjects are unaware of the researcher's identity and purposes (Amaturo, 2012). Beyond all of this, as demonstrated, netnography is not only characterized by a technical emphasis related to comprehending new socialities through online fieldwork. Recently, new definitions have helped to better understand the elaborate epistemological concerns of netnography, intended by Kozinets (2020) as a “set of general instructions relating to a specific way to conduct qualitative social media research using a combination of different research practices” (p. 7).

These practices bring to attention the first dimension of differences it must consider, that is, those that distinguish traditional ethnography and its applications from the netnographic practice based on data-gathering procedures. This dimension of difference immediately recalls the interconnected opposition between immersive and investigative practices in implementing ethnographic research. In detail, *immersion* “references the netnographer's self-reflective and introspective collection of research observations and experiences” (Kozinets, 2022, p. 107).

This means that User generated contents (UGCs) available on the web represent real traces to be used as a basis for observation and reflection as well as the continuing relevance of field notes, diaries, or memos, produced by the researchers during the observation of a participatory and co-construct reality. The freely available and directly accessible information from UGCs becomes data that allows for economic savings and faster elaborations. More specifically, the processes of entry, storage, and management of such data are simplified (Acampa et al., 2022). The rise of *user-generated data* is one of the most useful examples of the progressive and rapid evolution of the Internet background. Research methods have not been unaware of its evolution, in fact, in the last few years, social researchers have begun to wonder if and how traditional methods, and their applications in overcoming simple digital transposition, were exposed to moderate gains in terms of costs and efficiency, as well to threats in terms of the quality of data, loss of representativeness, absence of feedback, and validation of the results. The empirical opportunity related to UGCs opens up a second practical declination in netnography defined as *investigation* which refers to the “disciplined collection of already existing data—also called online traces—which, in most netnography to date, has come from the archives of social media platforms, blogs, and forums” (Kozinets, 2022, p. 107).

This vision matches with a transversal dimension of differences that deals with the definition of context and its progressive change which sees the Web go from a communication and information medium to an environment for mediated interactions among individuals; between researchers and individuals, in-depth interviews or other “interpersonal data collection methods such as digital diaries or mobile ethnography” (*ivi*); between researchers and non-human social actors. This environment comprises its ontological artifacts that Patel (2013, p. 411) defined as a “*read-write web*”, “*people-centric web*”, and “*participative web*”. The Web becomes a scenario, currently recalled with the digital location *scenario*. As with every scenario, it is governed by rules, contains within itself the means that make action conceivable, and defines the spaces within which action is possible, pursuable, and takes on meaning. Following the idea of the Internet intended as an innovation composed of two elements that mutually evolve (an instrumental repertoire as well as a set of practices needed to use the devices), the scenario concept helps to renew the interpretation of the Internet as a space. It needs to consider the double composition of the Internet as a combination made by technical infrastructures and the set of contents it carries, better known as the Web (Gallino, 2003; Grimaldi, 2005). The digital scenario described in this way draws paths that overcome the reduction of the Internet to merely a medium for communicating and spreading information. The mediation process allows opportunities for users to *be* media. It has passed the mediatization process by which it is possible for users, as well as for social researchers, to become media (Boccia Artieri, 2012) through the interiorization of proper codes, aesthetics, and expressive forms which can generate a sense which was not identifiable before the advent of the *digital turn*. This means that it is only possible to study what happens inside the scenario, especially if it is digital, if the researcher takes on the perspective of those inside the scenario. Therefore, it is only possible to produce knowledge on what happens on the Internet if it becomes both

an object of study and a methodological tool to investigate it. The ethnographic method better known as *digital ethnography* (Murthy, 2008) follows these assumptions as an approach that makes it possible to recreate a new Internet story from the inside of the device and its own agency «linking the researcher directly to the spaces within the studied subjects move and analyzing every relation cluster not concerning the subjects in a place as the virtual world» (Consolazio, 2017, p. 81). These points have challenged the solid assumptions on which the classical ethnographic method has been supported. The digital environment with its prerogatives places at the center another dimension of difference that is expressed in overturning the concept of community, making borders more and more fluid, and creating temporary associations and cooperations among strangers with mutual agendas which disappear after a few hours of intense shared experience (Arvidsson and Caliandro, 2016). This assumption of the circumscribability of social actors challenges the need for the researcher to have prolonged exposure to a digitally transposed field: a field configured as something in which everything persists from the moment it is released onward. The mediation function of the technologies is not the only one related to ethnographic approaches. Baulieu (2012) has already identified multiple functions that technologies can assume for research exploration purposes. They transcend the mediatic concerns and twist with the interaction assumptions, taking care of the researcher's position and her/his intrusive or unobtrusive opportunities along the «participant/observer continuum technology make possible» (p. 149). The unobtrusive one in fact enables one to «gather the material at the ethnographic level (at the level of specific interactions) without the intrusiveness of the tape recorder or the disturbing physical presence of the observer» (Baulieu, 2012, p. 146), while the former, taking care of the socio-technical spaces already defined by Wakeford (1996)—information, communication, and interaction spaces—relate to the human and non-human subject (users, as well as search engines; blogs, website, etc.) (Baulieu, 2012, p. 149).

Following the paradigmatic assumption related to the current mixed-method vocation, today's ethnographers can benefit from the opportunities emerging from physical and digital scenarios related to traditional ethnography and netnographic orientations. The immersive movement inside and outside the digital scenario is a «current essential need for researchers to comprehend social phenomena» (Punziano, 2022, p. 290) that allows integrating different insights coming from the observation in a (non) digital environment. It is featured by different ways to access and take positions inside the field(s) and by the kind of data used. A recent example of research by Addeo et al. (2021) makes it clear how netnography and traditional ethnography applications can no longer be considered the extremes of a *continuum*. Instead, they must be rethought as methodological practices that enable gradual and intermediate choices based on the research objectives and expected results. They first aim to discover the exclusive or coexisting methods in hybrid ethnographic practices. In this way, current social conditions have been an appropriate opportunity for researchers to test the research question because of the restrictions and limitations related to the COVID-19 pandemic which inhibited mobility and the usual ways of accessing physical places where

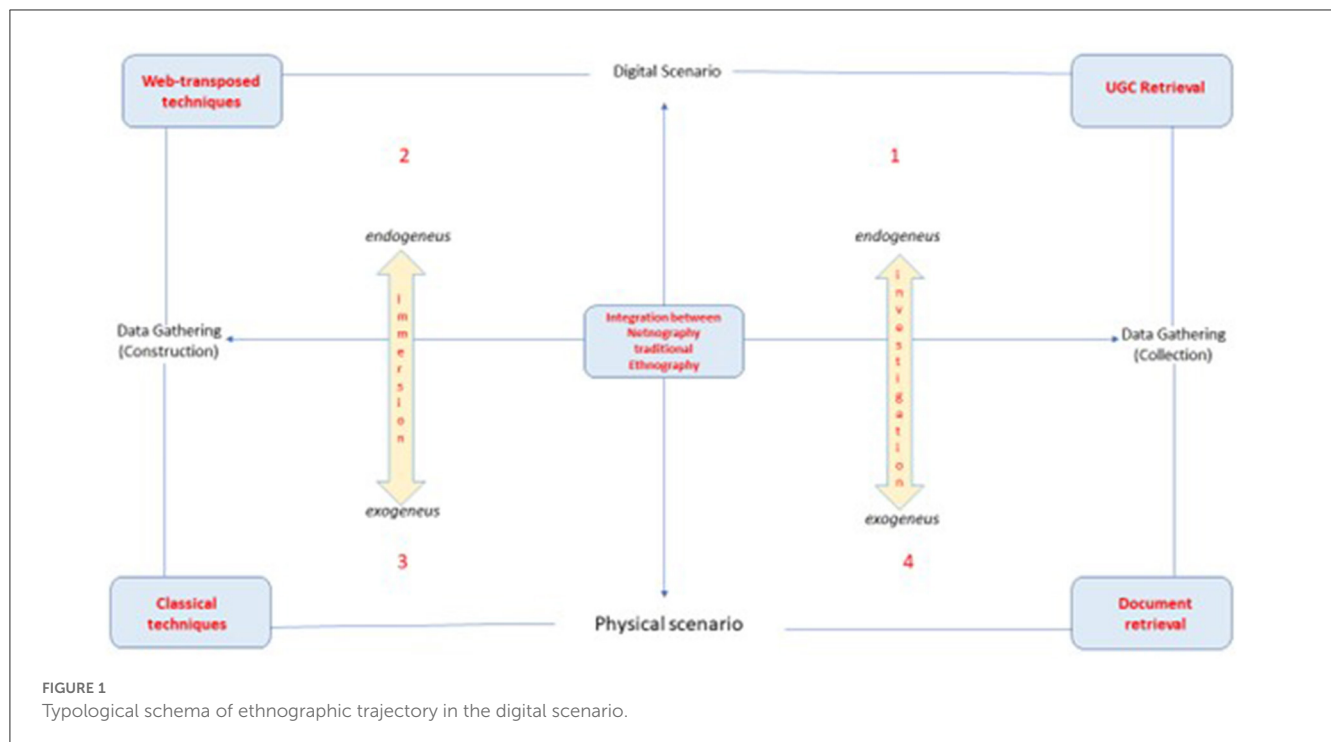
social phenomena happen. Their study aims to understand the motivation behind visiting *places of suffering* for *dark tourism*.

According to Quarantelli (2000), and the classification of the pandemic as a disaster, researchers have investigated how *dark tourists* can fulfill their tourism desires when they are unable to physically visit *places of suffering*. In February 2020, COVID-19 reached Europe, in northern Italy. In <24 h two small cities close to Lodi (Codogno and Vo' Euganeo) became *off-limits* areas patrolled by police. Over the same 2 days, on social media, many *non-local people* in different Italian regions joined Facebook groups originally created by Codogno and Vo' Euganeo citizens to share and promote their local activities. Their research consisted of a 3-month non-intrusive observation of non-local interactions. At the end of the observation period, the data collected consisted of 47 posts made by 25 of the 111 non-local users identified. These contents mainly promoted support and charity providing protective equipment and preventative supplies such as masks or sanitizing lotions. The other 86 profiles had yet to interact with local people, positioning themselves as hiding the real reasons for their presence in those Facebook groups. By using an exclusive single-netnographical practice, the researchers could not achieve the expected results and could not comprehend the real motivations of these users to transpose their *dark tourism* experience online.

The integration of the results obtained through the phases of immersion and investigation made inside and outside the (non) digital fields has been quite showed reasonable demonstrated as well as by a recent study made by Padricelli (2023) related to the longitudinal framing reconstruction of the Italian social movement *No Tav*. In this case, a proper netnographic application oriented to the study of digital self-constructions was made by the collective actors on social media during the last 10 years, and the researcher got more interesting results due to an ethnographic exploration by the interviews of activists. The first results concerned how *No Tav* used social media to spread and inform about diagnostic and prognostic reasons for their claims. These have been later integrated into collecting field notes concerning the direct experiences of activists in direct actions led on *the field of civic action* as well as on *strategic action fields* (Postill, 2017). This shows how the mixed method vocation inside and outside the digital field could return expanded results not retraceable by a single online application.

A typological scheme is proposed to better systematize the reflection that emerged from previous examples and, at the same time, have a proper useful instrument to systematize the next correlated ethnographical explorations.

The latter is built, taking care of the main epistemological dimensions previously approached. As shown in Figure 1, the first axis, the horizontal one, underlines the theoretical *continuum* that places the observing scenarios on opposite sides next to the online-offline fields that lie in our first dimension of difference, opposing *physical scenario* and *digital scenario*. The second axis, the vertical one, opposes the different ways of gathering data: on the one hand, data obtained through the construction practices in direct interactions with the research subject, and on the other hand, data obtained by collection procedures taking into account the endogenous or exogenous roles of technologies.



3. Imagining a typological scheme: the researcher's movement toward the integration of practices

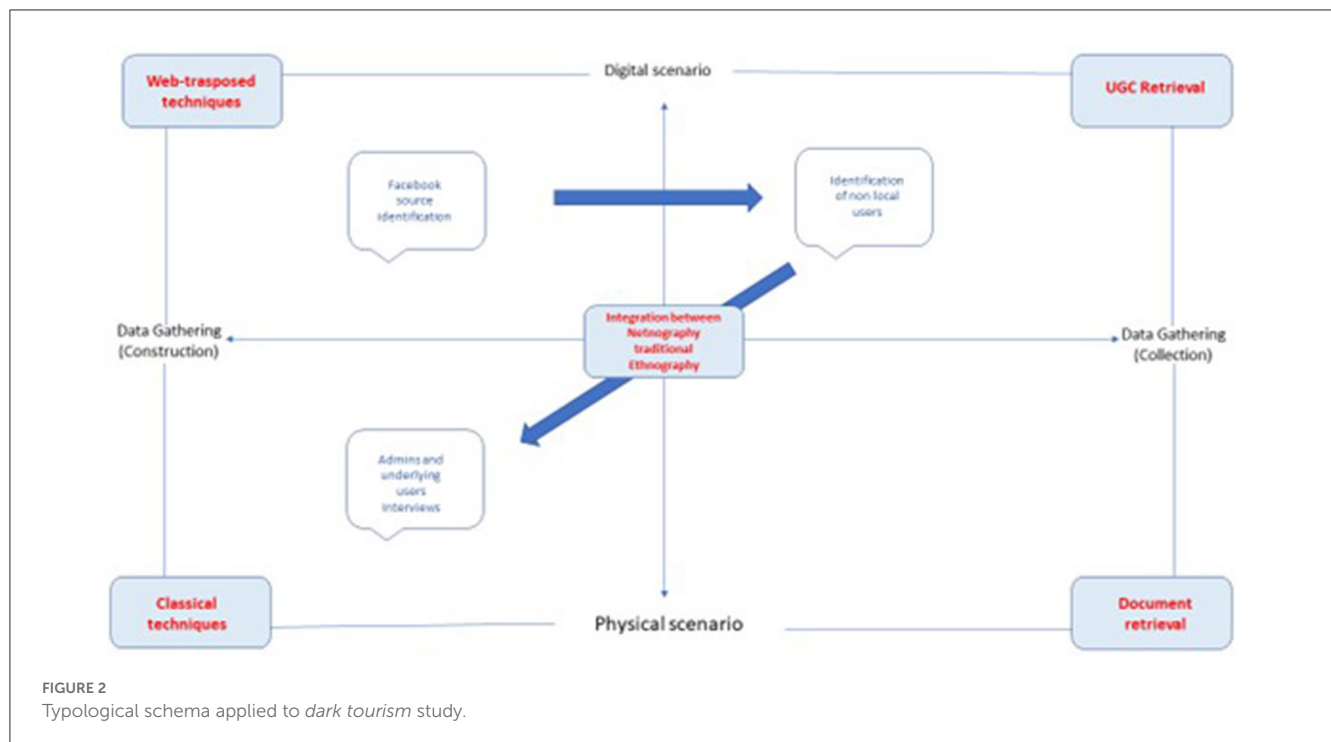
Looking at the graphic, the second quadrant crosses digital scenarios and data-gathering construction practices. When the researcher takes position here, they can gather information via web-transposed techniques. The latter concerns all those applications of the method featured by observing and interactive action held online because of the presence of researched objects in non-physical backgrounds, such as social media. In this way, as already described in [Addeo et al.'s \(2021\)](#) study, the non-comprehension of the researcher and focused subjects is not a condition that affects the success of the research. It can instead raise obstacles in terms of gained results, as the underlying behavior of non-local users in the experimental Facebook groups.

Shifting down to the third quadrant, which crosses data gathering construction practices and physical scenarios, the condition for ethnographers' position in the fields concerns their comprehension in the same place as what they observe, despite what concerns the immersive practice featured by netnographic application. In this way, classical techniques related to the application of traditional ethnography (interviews, direct observation, focus groups, etc.) are used for an additional research phase of the research design. It pushes the researcher to join the proper integration in the immersive hybrid scheme. It aims at going into detail and adds more helpful information not traceable by the only single application of netnography. This could be a follow-up of the mentioned study on *dark tourism* ([Figure 2](#)). Due to the sensitive topic approached by [Addeo et al.](#), formal direct interviews of underlying users, Facebook groups admins,

or any citizens located in *Codogno* or *Vo' Euganeo* can turn back interesting, deepened results related to the push factors of digital *dark tourism* experiences they made. In light of this, as shown in [Figure 2](#) by the double direction of the arrow across the second and third quadrants, it is stated that the integration of both techniques can be used starting from the digital scenario and the physical one.

Moving on the right side of the plan, the fourth quadrant concerns the data collection procedures researchers can follow by reading documents and any traces left by the observed subjects. When the researcher takes position in this quadrant featured by the traditional application of the method in the physical scenario, we must consider all the physical documents they can collect or receive directly from the intercepted subjects. Due to the study of documents retrieved, the researcher here positioned can find help to comprehend how social actors are placed in the social context to which they belong. This often occurs through analytical procedures such as content analysis. Moving up in the first quadrant which crosses data gathering via collection procedures in a digital scenario, the researcher here positioned can follow the same investigative assumptions as in the third quadrant, but not being in comprehension in the same place as the observed subjects and taking care of the UGCs that can help them to plan framing analysis. They can arrange the study of observed subjects' narratives or discourses on the web-sphere as blogs or social media.

The integration among the multiple combinations of practices concerning either exogenous or endogenous features of technologies is turned into the best research plan to apply due to the main object of the study and its related research questions. It is the case of the abovementioned study by [Padricelli \(2023\)](#) on the *No Tav* Movement. In this case, as shown in [Figure 3](#), the researcher who had the purpose of reconstructing the digital expression of a social movement by the longitudinal reconstruction of their relationship with the digital scenario was supported by



the research question oriented to understand how the narration of activists changed over time due to the evolution of technical opportunities and, on the other hand, to comprehend the adoption of digital media in the daily life of activists. Considering this purpose, the researcher took the first position in the first quadrant, collecting all the cultural products posted in the main digital portions attended by *No Tav* Movement: Blogs and social media public pages. Although, the only result concerning the different use of blogs and social media for the movement claim was not enough to understand how activists adopted digital media because of the movement mobilization and organizational purposes. This is what emerged based on the results of a proper content analysis aimed at enlightening the main topics and narratives in the last 10 years.

For this reason, as shown in Figure 3, the researcher took the latter position in the third quadrant, meeting the activists on the physical field, and asking them about the opportunities and threats in the digital shift of their collective action in the last years. During this phase, the researcher asked at the same time for any documents valid to enrich the investigation, receiving some institutional documents, original communications, pamphlets, and pictures activists produced over the years. At the end of the integrated immersive-investigative experience, the obtained results gave the researcher exciting answers to the abovementioned research questions. These enlightened the progressive transformation of the role of digital media from a facilitating instrument to share information and diagnostic features concerning their claims, to an enabling way for mobilization aims and emancipating practices of communication (Milan, 2013) oriented to enlarge the movement network.

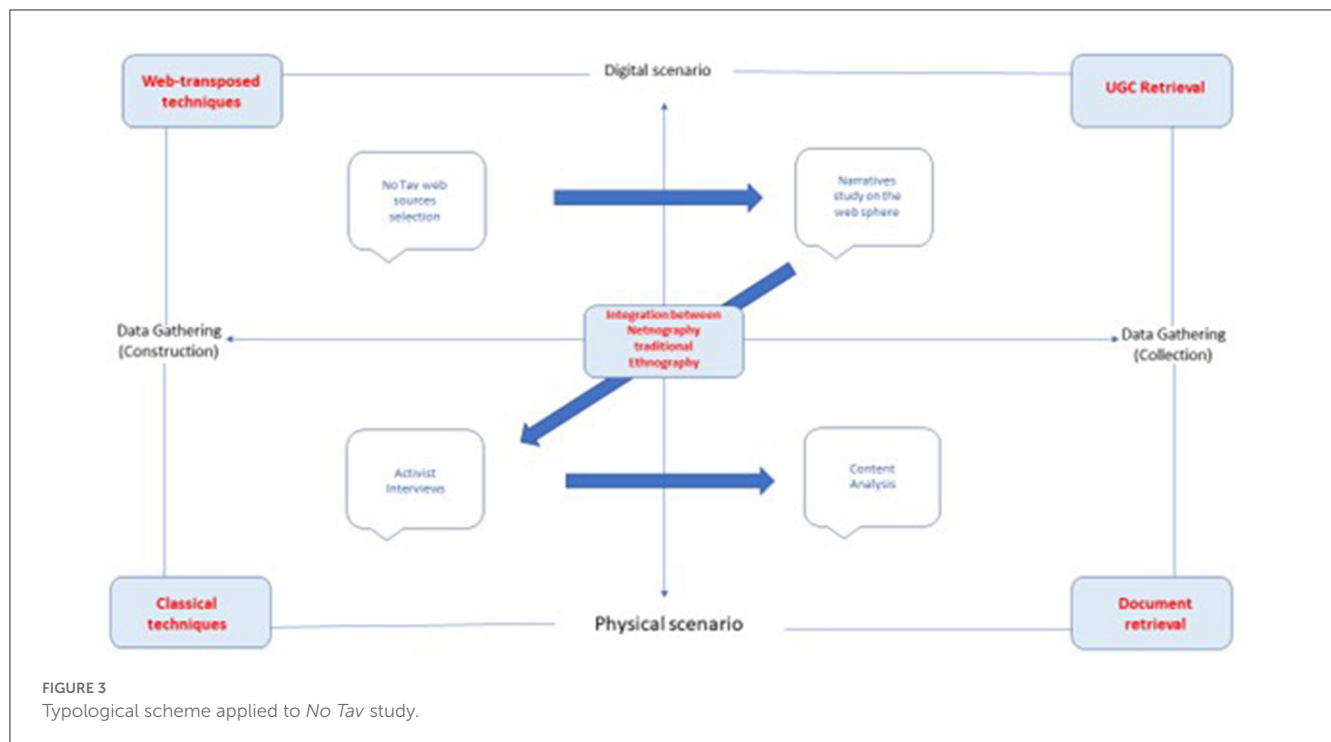
However, these connotations still leave one last point of interest in the shadows that it is important to recall. This point relates to the overall purpose of ethnographic study when elements

connote different practices, methods, and ethnographic ways that the researcher applies in the field. Following the hybrid vocation of ethnographers who move inside and outside the digital scenario, the ways they access the field, take the position, and assemble data (Liu, 2022) allow researchers to practice a *reinforcement* of their immersive or investigative actions, combining different strategies of data gathering. This strategy can be pursued to emphasize the results of one method with those obtained by the other, clarify and shed light on particular results, or even expand visions and spans of action sequentially using different collection strategies. On the other hand, there is a different strategy, equally pursuable, which aims at a different goal, that of *integration of applications* supporting investigative or immersive practice inside and outside the digital environment, in order to overturn limits and fill the empirical disadvantages of the single application of the method.

4. Discussion and conclusion

4.1. The epistemic challenge

The increase of research based on ethnography over the years (as shown, among others, by Bartl et al., 2016; Heinonen and Medberg, 2018) connotes how the method has never diminished for social science and how ethnography continues to be the most popular way to observe and reflect on the daily social context. Regardless of the methodological context created by community, fieldwork, and role, the techniques' application shows how ethnography has duly transformed and adapted to the changes of the last few years. Relating to the case studies proposed, in which the authors have played a central role in doing research, the main discussion element underlined concerns a more complex move from the traditional application of ethnography to the netnographic



method. On the other hand, the reference to the above case study aimed at enlightening the relevance of re-centered ethnography and mixing the various application opportunities depending on research questions, research purposes, and tools available.

In the wake of the reflections just conducted and trying to systematize a recognition of the vision of the complementary vocation of the method, it implies recalling an underlying perspective that moves transversally to them. It is the contribution of the focus of the innovation that moves from the side of the *innovation of the context* to the side of the *innovation in the method*, clearly showing that all scenario evolutions have implications for how knowledge is produced in that scenario. This is done by first testing the method in its classical application against a new cognitive challenge. When debates around this cognitive challenge and the evolution of the object, the web, are settled, it leads to the evolution of the method itself, creating innovation in the methods of investigation. This leads us to revisit and discuss the four main pillars subjected to epistemic challenges due to social change and methodological advances that are identifiable in

- (1) the transformations of observable communities in terms of boundless scenarios (Kozinets, 2020; Nasciemnto et al., 2022);
- (2) the changes that have taken place in terms of fieldwork in terms of multi-sited and short-term fieldwork (Seligmann and Estes, 2020);
- (3) concerns innovations in the instruments and in the role of the researcher over time in terms of the hybridization of methods and disciplines (Seligmann and Estes, 2020);
- (4) the scenario conceived in terms of agency as a restructuring of the concept of platform agency (Nasciemnto et al., 2022).

The first pillar implies for the researcher the impossibility of compartmentalizing the environments and mechanisms of

influence, imposing more complex and profound interpretative logic, centered on and imbued with the digital. This assumption happens in the field elected as the context of ethnographic practice, the sometimes-uncontrollable fluidity that urges practices, objects, and subjects to be simultaneously inside and outside the digital scenario.

The second pillar follows the conception of changes that have taken place in terms of multisited and short-term fieldwork. Fieldwork can and should occur anywhere, even if that “site” stretches into multiple places. However, “doing good multisited fieldwork is challenging, especially if researchers seek to go beyond doing interviews to carry out a fine-grained participant observation. Researchers must follow unpredictable ‘chains’ and ‘networks’ and use their skills to persuade gatekeepers to provide access. It is hard enough to figure out the topography of power in one location, and multiple sites. This kind of research demands that researchers fully take advantage of contacts they have in order to persuade gatekeepers to permit them access” (Nasciemnto et al., 2022, p. 178–179). This particular perspective implies a total immersion in the values and meanings assigned to a subject in the different sites and requires time and broad, non-stereotypical, or researcher-centered knowledge. However, the demand for multi-situated interpretative and comprehension skills requires this onerous commitment of involvement, time, and interpretative skills. In that case, this is counterbalanced by the increasingly popular short-term fieldwork. This attitude in research practice has constantly developed on the digital scene, characterizing digital fieldwork in a very peculiar way. We have already mentioned that the classic field notes born from observation, field presence, and mediation of meaning through the researcher’s reflections, are supported by the possibility of having access to a wide range of pre-existing, persistent, and coexisting data as the object of continuous

interaction on the net, which are the digital traces. The wide availability of these materials helps to compress the long processes of ethnographic practice and challenges perhaps the most classic of the method's cornerstones.

The third pillar concerns innovations in the instruments and in the role of the researcher over time in terms of the hybridization of methods and disciplines (Seligmann and Estes, 2020). If the ethnographic method was characterized in its early days by being born in a precise disciplinary context of an anthropological nature, today, it turns out to be a method used by various disciplines, often referring to the need for interdisciplinary work in order to obtain the best possible result through this research practice. Disciplinary contaminations are reflected in the combination of different methods that give rise to innovative practices recognizable, for instance, in participatory field methods with collaborative ethnography, overshadowing the central role of the interpretive phase devoted to the ethnographer, or the use of interviews as ethnography, this time overshadowing the fact that interviews give a partial and reworked view of the subjects concerning the object of investigation, sacrificing that outsider's view of the ethnographer, now increasingly involved in digital scenarios. Nevertheless, what may appear to be limitations push toward what we have previously called reinforcing and integrating practices in the three turning points that Liu (2022) defined as access to the field, taking the position, and assembling data. However, if observation, interrogation, and reading, are classically conceived as the main actions with which the researchers can produce data on social phenomena, nowadays it is possible to observe a progressive transition from traditional techniques unrelated to the context in which they are applied to a unique hybrid with the same entire context overcoming the concept of space where cultures can be studied (Woolgar, 1996). Ethnographers moved to an all-encompassing environment, rediscussing the notion of community and fieldwork norms in a reshaping of the researchers' role. The digital scenario, therefore, shows how ethnography is today shaped in several directions drawn by footprints left behind on the various paths walked by users to express identities and values on the Internet and to build their relational networks to share knowledge. The current framework cannot be intended as a final frame, nor projected onto further changes or drastically detached by limitations or criticism. Today, the sociological debate must review its epistemological profile to comprehend not only how ethnographic methods can coexist or be isolated for specific applications in research but also prompt discussion of its ontological basis. On the one hand, it is possible to assume how the digital scenario and the evolution of non-intrusive observation techniques oriented to gather discourse and spontaneous traces left by users allow researchers to overcome the critical opposition between modernists and postmodernists to reflect on the neutral vocation of ethnographers. On the other hand, it became more and more evident that it is necessary to consider if and how the hybridization of techniques and social context is intended, still speaking, in methodological terms, of pure ethnography, or maybe assuming the digital scenario as a whole environment open to the entirety of research methods in social science involving ethnography and computational and data science.

The last pillar focuses on the scenario not as a passive context, a scene on which action, interaction, and reaction of objects and subjects take place, but rather, the scenario is conceived in terms of scenario agency as a restructuring of the concept of platform agency (Nascimnto et al., 2022). It opens another interesting opportunity for reflection and empirical opportunities to understand the assumptions related to the ethnographic practice that classically recognizes the agency of the individual by analyzing how the contexts and scenarios within which they move to shape and impact their identities, practices, and interactions. In this way, further studies must be addressed to comprehend how the digital scenario, the use of digital devices, and its characteristics can shape the possibilities of individual agency by creating an infrastructure that acts on the subjects and the possibilities of the individual's agency. Therefore, on this pillar: *how does the scenario change the mechanism of influence, determination, and co-construction?*

The idea that the current methodological shape in ethnography is open to other critical limitations is already highlighted by scholars (Addeo et al., 2021; Murphy et al., 2021). Reflections on research methods can be sure of the unquestionable assumption: *ethnography never stops but undoubtedly, today it can no longer be considered the same as in the pre-digital era*. Despite continuing interest in the method, there are undeniable evolutions. Rather than referring to fashions of the moment, they indicate a progressive growth of both the object of study and the method used to study it.

At first, the ethnographic method was used to approach the study of a series of phenomena that also assumed a digital form that neither remains unchanged nor slowly changes. However, instead, it undergoes different accelerations as society progresses. Therefore, the ethnographic method, which configures slow, prolonged, and in-depth research paths, must begin to follow the object more closely and modify itself in the function of a better adaptation to it. Moreover, here is where the reflection on the method in the classical disciplines returns to the stage, perceived as transposed to a new place. In this new place, evolutions continue to progress over time, from Web 1.0 to a concept of the Web that is increasingly relational, with Web 2.0, and interacts with all the subsequent evolutions. On the Internet, there is not only a new context or place to which the ethnographic method can be adapted, but also the transposition of society and social structures that encompass identities, values and, with time, also defined interests, leading the ethnographic method in the digital context to involve other disciplines and increasingly specific arguments.

Therefore, the evolution does not stop, and the innovative path moves among these joint changes that work toward the level of theory and approaches, the production of knowledge, and constant questioning of the future of ethnographic research. Especially now that the ethnographer is not only socialized but is also a real native of hybridized digital scenarios in which persistent traces are found, collectible and reworkable beyond the issues of opening up the field, sharing and seeking feedback, reflexivity, and subjectification of the research. This made the method recognizable in its early days and ensured that it retained its importance and relevance despite the changes occurring in the digital age.

Perhaps an obvious but necessary conclusion remains an attempt to show how, despite all the changes, hybridizations, and contaminations, the ethnographic method resists firmly in

its univocal soul under whose umbrella it manages to shape the different forms in which its applications and new directions present themselves.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

Although the manuscript is the result of joint work, section 2 and 3 are to be attributed to GMP, and section 1 and 4 to GP. All authors contributed to the article and approved the submitted version.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Mapping obesity and diabetes' representation on Twitter: the case of Italy

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One of the main functions of public health is to monitor population health to identify health problems and priorities. Social media is increasingly being used to promote it. This study aims to investigate the field of diabetes and obesity and related tweets in the context of health and disease. The database extracted using academic APIs (Application Programming Interfaces) allowed the study to be run with content analysis and sentiment analysis techniques. These two analysis techniques are some of the tools of choice for the intended objectives. Content analysis facilitated the representation of a concept and a connection between two or more concepts, such as diabetes and obesity, on a purely text-based social platform such as Twitter. Sentiment analysis therefore allowed us to explore the emotional aspect related to the collected data related to the representation of such concepts. The results show a variety of representations connected to the two concepts and their correlations. From them it was possible to produce some clusters of elementary contexts and structure narrative and representational dimensions of the investigated concepts. The use of sentiment analysis and content analysis and cluster output to represent complex contexts such as diabetes and obesity for a social media community could increase knowledge of how virtual platforms impact fragile categories, facilitating concrete spillovers into public health strategies.

KEYWORDS

health, diabetes, obesity, twitter, sentiment (SEN) analysis, content analysis, T-LAB linguistic software

1. Introduction

Health is identified and recognized as reflecting the state of wellbeing of an individual and a society. Since WHO's first definition in 1946, there have been several evolutions of the concept of health itself over time. In the new information age (Castells, 1996), the concept of digital health, understood as the use of information and communication technologies in medicine to manage disease and health risks and to promote wellbeing (Kostkova, 2015; Mathews et al., 2019; Rieke et al., 2020), is gaining momentum.

The web and social media have become very important venues for discussing health issues and for providing ways to seek out and interact with communities of patients with similar conditions or professionals, not only to gather information but also to discuss problems and feelings, ask for help, support others, and get support from others (Farmer et al., 2009; Hawn, 2009). Actors inhabiting the digital public sphere also contribute to the public discourse on health and wellbeing through the production of big data by means of different modalities. User-generated health data are naturally occurring digital traces (Peng et al., 2019) and can be generated by social networks (Ayers et al., 2016), wearable devices and health apps (Casselmann

et al., 2017), and search engines (Mavragani et al., 2018). The proliferation of user-generated content is an element that generates an impact on the production, circulation, and consumption of health-related news and ensures a vibrant public sphere on the topic (Hodgetts et al., 2008). Today, it is critical to identify how the new datasets produced in health terms can be used to assess Social Determinants of Health (SDH)¹ understood as nonmedical factors that influence health outcomes and include the conditions in which people were born, grow, work, live, and get older and include what shapes the conditions of daily life (WHO, 2021).²

In this scenario, health technology holds enormous promise for building digital health literacy skills and improving health outcomes for patients with chronic diseases. Contemporary societies have undergone an epidemiological transition (Omran, 1971) that has seen diseases with an infectious prevalence turn into chronic degenerative diseases over the years.

The growth of social media has provided a research opportunity to track public behavior, information, and opinions on common health problems. Today, social media can provide timely public health information, such as tracking or predicting the spread of COVID-19. Several studies show how data extracted from social networks have been used to study the evaluation of vaccination campaign sentiments or mental health problems during the COVID-19 pandemic. Several authors have applied machine learning models to monitor the level of stress, anxiety, and loneliness during the pandemic using Twitter data (Guntuku et al., 2020; Zhang et al., 2020).

Nowadays, health information from social networks' traditional sources has the potential to change patterns of health inequalities and access to healthcare (Griffiths et al., 2012) by providing a unique opportunity to understand users' opinions concerning common health problems (Mejova et al., 2015).

Therefore, it is critical to consider social media both as an effective way to engage the public and communicate key "public health" messages and as a valuable data source for detecting or predicting diseases or conditions. Data sources that, if harnessed appropriately, can provide local and timely information about diseases and related events, and are interpreted as the concept of digital epidemiology.

Digital epidemiology can be broadly defined as epidemiology that uses digital data that are not properly generated for the main purpose of epidemiological studies. It involves the treatment of digital methods from the collection stage to the analysis stage (Eckhoff and Tatem, 2015; Salathé, 2018). The goal of digital epidemiology is identical to that of traditional epidemiology, namely, the study of the various factors that influence the occurrence, distribution, prevention, and control of diseases, injuries, and other health-related events in a defined population. The goal of epidemiological studies is not simply to identify the causes of a disease but to apply the findings to prevention and health promotion (WHO, 2004).³ In particular, epidemiological studies such as sociological research—conducted

within health services—are efficient to synthesize the description of the temporal and geographic distribution of diseases in communities, the relationship between specialized knowledge (medical, psychological, psychiatric, and social), and the health status of the population, besides the evaluation of the therapeutic effectiveness produced in public and private healthcare.

Relevant literature indicates that ubiquitous access to social media can help promote healthier lifestyles (Jiang and Yang, 2017). Risk factors, such as drug abuse, smoking, poor diet and exercise, and associated diseases, are often clustered in the population. A better understanding of social media and related health data will help expand the utility of social media in public health.

2. Materials and methods

2.1. Research framework

The burden of disease in economic, political, social, and, above all, human terms is intolerably high in most of the world, specifically when considering the poorest areas, but even when considering the impact of toxic lifestyles and the environment that affect human beings without differentiating their socioeconomic conditions. The pandemic showed us that this fragile equilibrium cannot face an emergency like COVID-19 because it does not respond to an acceptable normality in terms of sanitary systems' capacity to face the degeneration of human health conditions. If we can live longer, it means that we are older and, consequently, more vulnerable than ever (Napier, 2014; Lenzi and Vaccaro, 2019).

Current epidemiological challenges include reducing the prevalence of communicable and non-communicable diseases (NCDs). Diabetes—in this case, with a specific focus on type 2 diabetes—and obesity are two diseases that are often interrelated.

According to the World Health Organization, global obesity has nearly tripled since 1975 (Vespasiani et al., 2005; Leitner et al., 2017; Lenzi and Filardi, 2022; Veit et al., 2022). In 2016, more than 1.9 billion adults were overweight; of these, more than 650 million were obese.

Overweight and obesity have a multiplicative and dangerous relationship: worldwide, obesity and type 2 diabetes are on the increase and are among the chronic degenerative diseases that most affect people's health. In Italy, according to ISTAT⁴ data, for the 4 years (2017–2020), the prevalence of diabetes is estimated at 5.9%, corresponding to more than 3.5 million people, with a slowly increasing trend in recent years. Today, for people at risk of obesity and type 2 diabetes, it is possible to talk about prevention, drastically reducing the chance of getting sick and avoiding risk factors such as unhealthy lifestyles, obesity, and sedentary lifestyles. In Italy, nearly 22 million people are overweight, 6 million people are obese, and 3.5 million people have diabetes.

1 Social Determinants of Health Report of a Regional Consultation Colombo, Sri Lanka, 2–4 October 2007.

2 Health topics social determinants of health. Available at: https://www.who.int/health-topics/social-determinants-of-health#tab=tab_1 – Last accessed on: Jan 10th, 2023.

3 Who, A Glossary Of Terms For Community Health Care And Services For Older Persons, 2004.

4 The Passi (Progressi delle Aziende Sanitarie per la Salute in Italia) surveillance is characterized as a public health surveillance that collects, continuously and through sample surveys, information from the Italian adult population, aged 18–69 years, on lifestyles and behavioral risk factors related to the onset of chronic noncommunicable diseases, the degree of knowledge and adherence to intervention programs that the country is implementing for their prevention.

Social media provides an open forum for communication among individuals, and Twitter, with its 280-character tweet, has become a popular platform for conversations about health conditions, diseases, and medications (Prieto et al., 2014) and is an effective information channel for practitioners to provide relevant information (Pulman, 2009).

2.2. Research object

Considering the perspective of studies between sociology and health, the objective of the present study was to explore the themes, debate, and sentiment of tweets mentioning “obesity” and “diabetes” to analyze the semantic content and conversations taking place on this topic. In this study, therefore, the characteristics of the relationship between diabetes and obesity-related non-symmetrical but supportive concepts of disease/health are identified. The research questions from which the research moves are as follows: What themes prevail, in salient terms, in the conversations produced on Twitter? What kind of narratives do diabetes and obesity have in common?

Content posted on social media has an impact on people and their decision-making. Knowing the sentiment toward diabetes and obesity is crucial to understand the impact such information might have on people with this health condition and their family members. For this purpose, we have selected the social platform Twitter as the context unit. The empirical basis is the extraction of tweets in the Italian language using API (Application Programming Interface) respecting the two queries “Obesity” and “Diabetes” connected to keywords such as “health” and “disease.” The data automatically extracted and collected in natively digital matrices (Rogers, 2013; Caliendo, 2018) cover an observation period of 4 years, from 1 January 2019 to 31 December 2022. The variables included are dates, full tweet corpus, but also likes and retweets (RT) (dichotomous YES/NO).

For this purpose, text data mining operations using automatic text analysis and content analysis techniques are needed (Losito, 1996; Bolasco, 1999; Amaturio and Punziano, 2013). It is precisely through content analysis that it is possible to identify the themes through which communication is organized and the analysis of which words co-occur in the text.

There are some pitfalls in social media mining. First, text data can be difficult to classify and interpret because the data collected may not provide enough information and meaning to facilitate automatic classification. In addition, while coding for geographic origins can resolve some limitations, not all profile accounts on social networking sites contain geographic information, and visible geographic information cannot be easily verified. To avoid the risk of missing relevant information, other strategies are used that better fit the exploratory nature of the objective. We have extracted all tweets with the keywords “diabetes and obesity” associated with keywords such as health or disease. Next, the relevance exclusion methodology includes the elimination of retweets without additional information (comments), returning a set of 22,354 tweets from the first extraction (Table 1).

2.3. A two-phase methodological architecture

The analysis architecture involves two phases. The first part of corpus processing involves an automatic phase carried out by T-Lab,

which performs normalization, polythene selection, vocabulary construction, and corpus segmentation according to punctuation usage, number of characters, and statistical criteria (Lancia, 2012). Finally, lemmatization is carried out, which will be further refined in the keyword selection phase. Following this automatic phase, some quantitative characteristics of the corpus are evaluated to determine whether it is possible to process the data statistically (Bolasco, 1999; Giuliano and La Rocca, 2010). The elementary context analysis examines common themes and topic patterns to understand the prevailing factors and allows the construction of a corpus content map according to the co-occurrence of the selected keywords. The T-Lab software enables the construction and exploration of a representation of corpus content through a few thematic clusters consisting of elementary contexts described by lexical units. The chosen analysis procedure is the unsupervised clustering method and involves grouping the lexical units in the keyword list under the same root and selecting the keywords according to some exclusion criteria by eliminating words such as:

1) the words that belong to the high-frequency rank (drop point), since they are taken for granted in the context of the treated topic (Bolasco, 1999);

2) words that belong to the low-frequency rank because, by going to specify, they make noise and do not allow us to see regularities.

This procedure involves the use of the cosine measure and clustering of context units using the bisecting K-means method, the construction of a table of lexical unit contingency by cluster, the chi-square test applied to all cluster and lexical unit crossings, and the analysis of lexical unit contingency table matches by cluster (Benzécri, 1984). Then in the second phase, we use natural language processing (NLP) techniques and qualitative sociolinguistic analysis by calculating the sentiment scores of tweets (Gabarron et al., 2019).

The segmentation of the text into elementary contexts is classified by fragments, i.e., elementary contexts of comparable length consisting of one or more utterances.

Among computational methods for analyzing tweets, computational linguistics is a well-known approach developed to obtain information about a population, track health issues, and discover new knowledge (Paul and Dredze, 2011; Harris et al., 2014).

The technique used evaluates and combines two types of algorithms to improve the quality of the results: the Bert-Italian-cased sentiment model and the Van ADER, an acronym for Valence Aware Dictionary and Sentiment Reasoner (Gilbert, 2016). In the second phase, some preprocessing steps are also performed using the natural language processing library to segment the entire corpus with a Bert model that follows a dictionary specific to the Italian language.

The Bert model uses the sentiment intensity analyzer (SIA) with a deep, unsupervised, and, therefore, pre-trained two-way linguistic representation model to analyze sentiment in text data. The

TABLE 1 Year for total tweet.

Year	Total tweet
2019	7,284
2020	4,567
2021	4,832
2022	5,671
TOTAL	22,354

unsupervised learning model suggests that the system receives a set of unlabeled data in the training phase that will be classified based on common features (Di Giovanni and Brambilla, 2021).

The first line of the code imports SIA and vader_lexicon (VADER) (a lexicon of words and their sentiment scores) creating an empty list to store sentiment scores, sentiment intensity, and neutrality percentage. The model loops over each case in the “tweet” column of the array, passing each text to the polarity_scores() method of SIA. VADER provides a Python library that can be integrated into any project, and in addition, the model can be fine-tuned to fit specific use cases, such as analyzing domain-specific texts, which in our case allows for more accurate results. This model produces sentiment scores ranging from -1 to 1 , where -1 is the most negative, 0 is neutral, and 1 is the most positive. The code then adds the composite score to the sentiment_score list, the neutral percentage to the neutral list, and the sentiment magnitude to the sentiment_magnitude list. The model returns the following three new variables: sentiment_score, neutral, and sentiment_magnitude by returning the compound score, neutral percentage, and sentiment magnitude for each case in the ‘tweet’ column (Jiang and Yang, 2017).

Positive sentiment: compound value >0.001 , assigned score = 1 .

Neutral sentiment: (compound value > -0.001) and (compound value <0.001), assigned score = 0 .

Negative sentiment: compound value < -0.001 , assigned score = -1 .

3. Results

The analyzed corpus appears to be rich from a lexicometric point of view, as the TTR ratio (0.065) is <0.1 and Hapax/Type (0.462) is <0.50 . The analysis procedure for partitioning produces four clusters that are organized within a factorial space of $n = 3$ factors (three latent dimensions that explain the maximum total variance of the data).

By applying this procedure to the groups of lemmas extracted for the polarities of each of the three extracted factors (automatically extracted as a result of the algorithm applied by the software), the latent meaning of the representations that emerge for each factor may be reconstructed. Therefore, we report the most significant lemmas extracted for each factor (Table 2).

The three factors are shifted reciprocally on the x-axis and y-axis to capture the different nuances that can be observed in “photographs” portraying the same object, taken, however, from different angles, according to the metaphor proposed by Lancia (2012) (Figure 1).

As the repetition of similar words observed by scrolling through the individual clusters allows the GAP index not to be overwritten but at the same time to follow a more symmetrical logic, four clusters are chosen. The words within each axis are interpreted to recognize the dimensions that identify the characterizing cultural space.

The number of elementary contexts classified is $22,354$ ($=96.9\%$; out of a total of $23,069$). Of interest for interpretation, it can be seen immediately that the clusters with the most weight are number 2 and number 3, with 31 and 28% of the elementary contexts classified, respectively, as shown in Table 3.

The clustering procedure involves the use of cosine measurement and context unit clustering using the k-means method, i.e., the construction of a contingency table per cluster. The clusters have also been represented on a factorial plan to show proximity or dispersion related to the elementary context in diabetes and obesity's representation and narrativity, as shown in Figure 2.

The clusters are the product of grouping lemmas that can refer to the same representative matrix, as shown in Figure 3.

T-Lab has allowed the disclosure of lemmas after their clustering. For example, Table 4 shows the first 15 characteristic lemmas for each of the four clusters: The lemmas are extrapolated with the Who square test, a statistical test designed to check whether the frequency values obtained by survey and recorded in some double-entry tables are significantly different from the “theoretical” (or expected) values (Corbetta, 2014).

Sentiment analysis of tweets can be useful in clinical settings as it increases our comprehension of user's engagement on social networks and can help to improve strategic public health management.

The combination of the Bert and VADER models produces 73.2% accuracy on the analyzed tweets for a total of $16,382$ tweets with the following two types of output: the former differentiates 3 sentiments (positive, negative, and neutral), while the latter subdivides four basic emotions (anger, fear, joy, and sadness). As shown in Figure 4, tweets about diabetes and obesity in the health and disease framework are identified as communicating negative feelings at 87.5% , approximately 8% for positive feelings, and 4% for neutral feelings.

4. Discussion

Starting with the interpretation of the words in the factor axes in Table 2, an attempt is made to capture the most general cultural aspects that emerge from this study to identify the characterizing dimensions within which the issues carried by the clusters are located. Along the first dimension (Factor 1 with 44.09%) of the factorial space, the issue related to *Research* is played out. In fact, in its positive polarity, it seems to gather terms such as “study,” “NRP,” and “telemedicine.” In the negative polarity, the words, and particularly the verbs (increase, understand, and neglect) in common with fat/diet/overweight, recall the consequences of the two diseases. We could then hypothesize that this axis distinguishes the narratives produced because of how the different actors involved in the narrative (from healthcare institutions or people) relate to the theme of seeking treatment by linking diabetes and obesity to the necessary issue of going decisively reducing obesity and overweight. The second factor with 30.49% inertia, renamed as *Pathology*, seems to suggest an *a priori*-defined dimension that identifies the connection between the two diseases and their psychological sphere about them. In this sense, if on the positive pole, we find specific terms related to diabetes and obesity such as “mellitus,” “hypertension,” “eating,” and “sugar,” the negative polarity seems to express a specific reading of the patient's psychological context. The third factor, renamed as *Prevention*, seems to decline the categorization of prevention and information as the main dimensions, which leads the Twitter audience to confront the need to relate to it. If committees and support associations are found on the positive pole, the negative polarity seems to highlight interest in different therapies and prevention. Within this cultural space, the representatives of four different perspectives of making sense of the function played by the network belong to the topics of diabetes and obesity.

From the clustering of the elementary contexts produced by the text fragments of the considered tweets, the narrative and representation of diabetes and obesity in CLUSTER 2 emerge as preponderant in the aspects of low focus on the research question and high characterization of the pathology. The cluster itself is renamed as *dangerous pathology* with reference to the society theory of risk and

TABLE 2 Factor summary (list of the top 15 lexical units sorted by absolute contribution and percentage of inertia explained by factors).

Factor 1–44.09% Research		Factor 2–30.49% Pathology		Factor 3–25.40% Prevention	
Pole (+)	Pole (–)	Pole (+)	Pole (–)	Pole (+)	Pole (–)
New	Rischio	Diet	Pathology	Type	Medicine
Type2	Problemi	Mangiare	Problemi	Day	Care
drug	Pear	Covid	Helping	World	New
telemedicine	Eat	Factor	Food	Italy	Prevention
worldwide	Pathology	Hypertension	Alimentary	Drug	PNRR
prevention	Overweight	Die	Agile	Patient	Studio
patients	Increase	Diabetes mellitus	Profession	Committee the invisible patients (Comitato i malati invisibili)	Health
Italy	Understand	Sugar	Psychoanalytic	Invisible patients	Insulin
screening	Factor	Comorbidities	Mediterranean	Committee	Healthcare
Study	Diet	Person	Psychotherapist	Milion	innovation
Healthcare	Grease	Age	Aimed at	Committee onlus	Therapy
Medicine	Disregard	Serious	Blood glucose	TG24	Congress
Therapy	Text	Cause	Psychiatrist	November	Research
PNRR	Flexible	Death	Blood	Sky	City
Care	Cardiovascular	Vaccinate	Reading	Diabetics	Cell

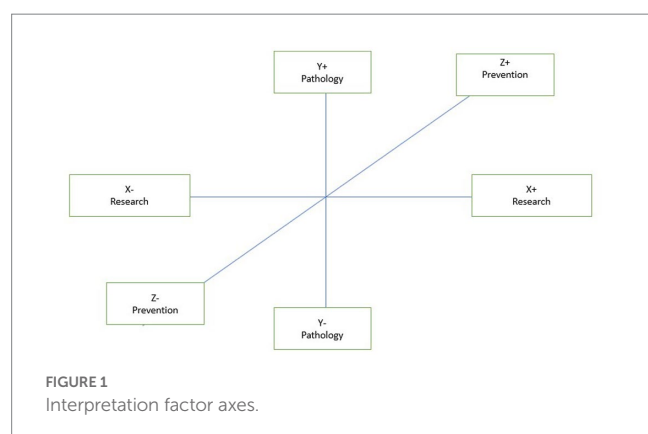


TABLE 3 Clusters by classified elementary contexts.

CLUSTER 1	4,231	18.93%
CLUSTER 2	6,998	31.31%
CLUSTER 3	6,400	28.63%
CLUSTER 4	4,725	21.14%

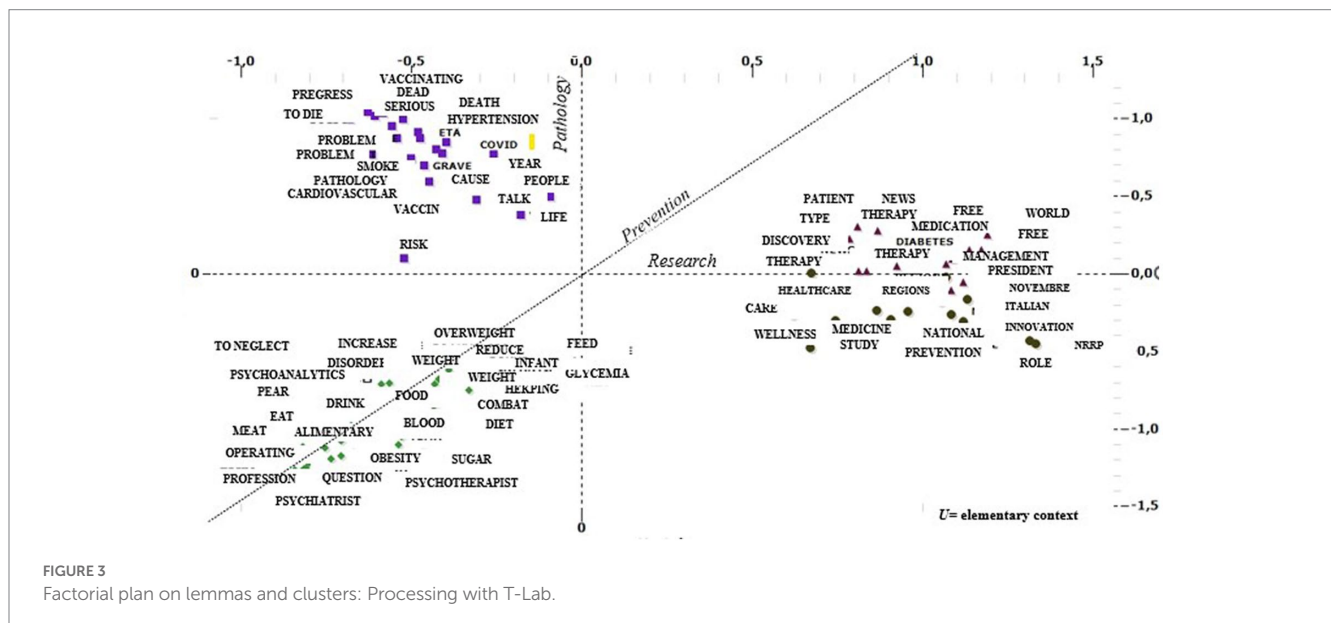
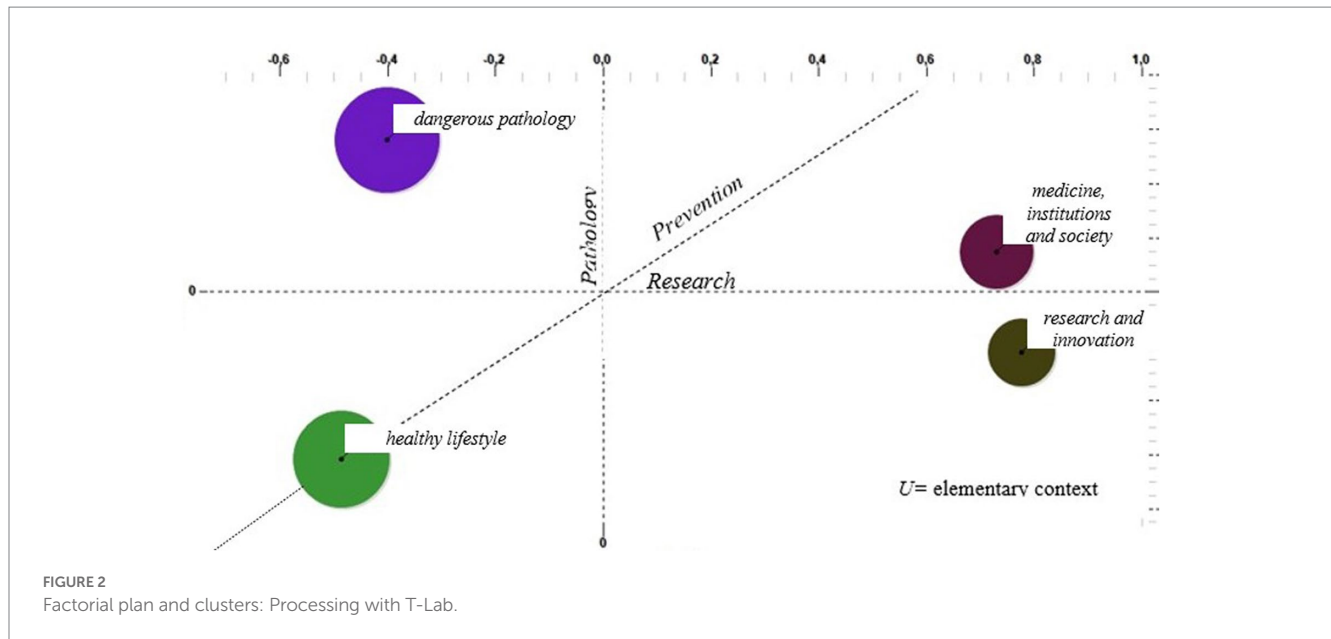
danger (Beck, 1992) and the distinction between danger, risk, and threats (Luhmann, 1993).

In this cluster, with greater weight in Factor 2, renamed as Pathology, the causes and complications of diabetes and obesity seem to be highlighted. Among the characterizing words, we find cardiovascular, severe, problems, and hypertension precisely highlighting the link between the two diseases with the increase and prevalence of cardiovascular disease. Interesting for interpretive purposes are the distributions of the keywords “death” and “dying” alongside “vaccinate” and “COVID,” ready to present what is an increased susceptibility to the development of infections for people

with altered immune systems. In CLUSTER 3, it follows a representation of diabetes and obesity that bypasses issues such as pathology and research, focusing rather on nutrition and lifestyle issues, which we have renamed as a *healthy lifestyle*. The plans show that there are few elementary contexts devoted to prevention in this cluster; however, it focuses on both proper nutrition and dimensions related to psychological and emotional wellbeing. The lexical patterns include a careful assessment of food discourse with words such as pear, meat, fruit, and food, and at the same time highlight the correlation with mental health status (with the presence of words such as psychotherapist, psychiatrist, and psychoanalytic). Much of the literature has explored emotions, mental health status, and the presence of psychiatric conditions in relation to the risk of diabetes and obesity. Some scientific studies have highlighted the correlation between depressive symptoms and poorer levels of diabetes self-management, a significant correlation, especially in children and adolescents (Gonzalez et al., 2008). The diseases examined involve profound changes in many aspects of daily life, from eating habits to social relationships. There is evidence that emotional wellbeing is the domain of functioning in which diabetes affects and interferes most negatively, second only to physical health status (Nicolucci et al., 2013).

In contrast, CLUSTER 4 demonstrates elementary contexts with a moderate pathology component but involving topics devoted to research, which we have renamed as *medicine, institutions, and society*, and is the one where more references to the prevention dimension emerge (in fact, it has a greater weight on Factor 1 Research and Factor 3 Prevention).

Table 4 shows the construction of the set of words highlighting 14 November as World Diabetes Day. Thus, the lexical patterns in this cluster show the central role being played by information launchers, and the set of characterizing lemmas confirms how online information has potential impacts on the health of people with diabetes and obesity. At the same time, the importance of associationism as a



contribution to the protection and improvement of health status is emphasized. A social commitment that should not be underestimated and that, as also demonstrated by the presence of the *Invisible Patients ONLUS Committee*, is also catapulted into the online world. Finally, CLUSTER 1 groups elementary contexts with a low pathology component but is also much more focused on the research dimension, coming very close to CLUSTER 4 even with reference to prevention. Renamed as *research and innovation*, the central element in CLUSTER 1 is the NRRP⁵ (National Recovery and Resilience Plan or Recovery Plan) along with words such as “region” and “innovation.”

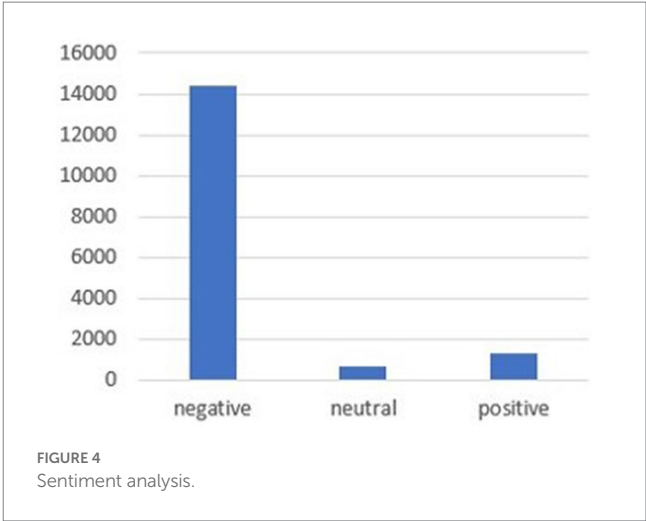
⁵ The National Recovery and Resilience Plan, or Recovery Plan (NRRP), is the plan approved in 2021 by Italy to revive its economy after the COVID-19 virus pandemic. It is part of the European Union's program known as Next Generation EU, a 750 billion euro European recovery fund.

The COVID-19 pandemic brings out the different weaknesses in the care and health system, with not a few differences between regions in northern, central, and southern Italy. The NRRP, with Mission 6 of the National Recovery and Resilience Plan, allocates 15.63 billion euros for reform to define a new institutional set-up for prevention in health, environment, and climate. All this also represents a political and cultural response that can propose a paradigm shift in the management of people with diabetes and obesity. This dimension can also describe a change of perspective so that access to the different regional territories in Italy is equitable and uniform. A perspective (framed by words such as innovation, wellness, and care) that provides for the renewal of measures to ensure a better capacity to deliver and monitor care through more effective and faster modalities can be added to this.

The results can also be commented on by observing sentiment analysis output. Several studies show that many tweets related to health and particularly to the many morbidity issues contain a

TABLE 4 The first 15 lemmas sorted by co-occurrences and CHI².

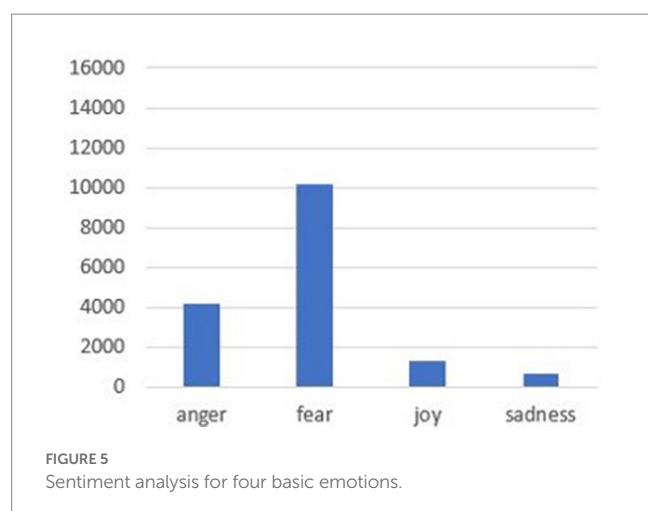
LEMMA-VARIABLES	Cluster 1				Cluster 2				Cluster 3				Cluster 4			
	IN CLU	IN TOT	CHI ²	LEMMA-VARIABLES	IN CLU	IN TOT	CHI ²	LEMMA-VARIABLES	IN CLU	IN TOT	CHI ²	LEMMA-VARIABLES	IN CLU	IN TOT	CHI ²	
New	736	1,098	1831,513	Pathology	1,049	1,282	1,316,782	Diet	869	1,131	1,258,387	Type2	1,284	1820	3,130,012	
Prevention	539	836	1,251,77	Problem	922	1,138	1,129,009	Eat	517	593	974,051	Day	625	669	2,388,974	
Medicine	382	501	1,174,216	Covid	851	1,148	829,756	Alimentary	383	417	798,578	World	576	605	2,264,734	
Study	512	893	959,77	Factor	627	751	823,734	Sugar	451	558	726,803	Italy	625	867	1,574,075	
Care	486	844	918,296	Die	418	458	671,596	Overweight	783	1,252	684,386	Drug	621	887	1,486,645	
PNRR	181	187	799,152	Hypertension	621	811	658,568	Agile	267	267	652,28	Patient	607	931	1,279,264	
Healthcare	347	552	769,363	Dead	386	423	619,874	Profession	267	268	647,856	Diabetes	4,309	15,528	800,685	
Health	342	559	722,1	Severe	367	420	535,065	Text	266	267	645,409	Invisible patients committee	98	98	413,504	
Innovation	140	148	597,684	Years	752	1,150	508,799	Psychoanalytic	264	264	644,941	Invisible patients	97	97	409,282	
Insulin	289	495	559,484	Cardiovascular	476	710	347,244	Operating	266	276	607,167	Comitatoimi	95	95	400,84	
Therapy	262	429	551,044	Causes	416	602	332,087	Reading	274	292	594,822	Anti-diabetes	86	91	333,531	
Research	218	397	375,07	Serious	324	435	318,831	To neglect	275	296	585,785	Daily	85	95	303,24	



message that can be perceived as negative (Yu et al., 2022). This can be found in the narrative of the ebola virus or mental disorders (Oyeyemi et al., 2014; Wynn et al., 2017) and is even more confirmed in the narrative of the relationship between diabetes and obesity. In some cases, the content of the negative sentiment can also be explained by improper use of the terms diabetes and obesity, for example, by its inclusion in a provocation that, while inappropriate, turns out to be “ironic” (since the model used fails to read irony) or in a political squabble (“the only question an obese diabetic with heart disease who survives COVID-19 as a vaccinated person should ask is if I had not been vaccinated, I would be here tweeting”). Thus, Figure 5 shows that negative feelings are most represented by fear at 62% (also often related to the possibility of COVID-19 infection), anger at 25.8%, and sadness at 4.2%. In contrast, the tweets with positive sentiment tend to be closer to topics concerning healthy lifestyles, in fact, in tweets such as “sports and health extraordinary pair to prevent and cure chronic diseases depression anxiety obesity diabetes,” “the possibility of doing sports is useful for wellness and to prevent diabetes and obesity in young people,” and “diabetes overweight obesity (...) main benefits with fructose rich breakfast.” The totality of positive sentiments is found in those of the sentiment “joy,” represented by 8% in Figure 5, which shows among the top results in the table tweets about research and innovation such as “Useful protein discovered that links obesity to diabetes risk” or “From adolescence to adulthood obesity may play a role in the onset of diabetes (...) Petrelli’s therapy.” So, in many of the tweets where the message tends to have a positive sentiment, and consequently with those tagged as “joy,” the association with encouraging healthy behaviors is proposed by providing examples of how one can improve the quality of life by following some tips on nutrition and physical activity.

5. Conclusion

Today’s society has been transformed by the digital revolution through new communication devices, the enormous amount of data, data storage, and many other advances that also follow major changes in the dynamics and distribution of health and disease. Today, health is identified and recognized as a mirror of the state of wellbeing of an individual and society. This recognition has matured



slowly over time, following particularly important stages. The definition of health itself is difficult to crystallize into a single sense that can be equally effective in different social, economic, and political contexts. In everyday life, people also attach quite different meanings to this word depending on personal characteristics (Blaxter, 1990). Thus, definitions of health and illness change over time in parallel with changes and advances in knowledge.

Social networks, such as Twitter, emerge as valuable resources for acquiring real-time data on a health topic or for leveraging platforms for scientific communication by experts. Today, there is a need to recognize the most discussed topics related to health and disease, as different discussions on social networks can influence patients' opinions and behaviors.

In this study, we have analyzed a dataset of more than 20,000 tweets and shown that the language used to simultaneously discuss diabetes and obesity is variable and complex. Specifically, systematic evaluation on Twitter exploring keywords suggests several dimensions read in a correlation of interpretations. The first one is close to research, innovation, and the future. The second one is close to pathology and side effects. The third one has a dimension that includes mental and physical wellbeing and aims to promote healthy lifestyles and behaviors. Finally, a trend that deserves further investigation is the scope of a social dimension perhaps closer to a demand for receiving social support.

In our study, then, there is no dominant conversation thread, but there are several. The Italian tweets show how talking about diabetes and obesity in the context of health and illness does not mean just referring to the only "health" conditions; delving deeper, we discover dimensions closely related to each other and with a multiplicity of influencing factors.

Even more emphasized in the concept of health, understood as "a state of complete physical, mental and social wellbeing and not merely consisting of an absence of disease or infirmity," is the emergence of both "individual factors" related to the body and psyche and "context factors," since health is determined as a condition from the social context in which the individual is placed and interacts, and even the narrative of diabetes and obesity on Twitter frames a state of wellbeing considered as a whole.

The limitations of this study can be found in the lack of extension of this dataset. Moreover, with a view to future in-depth studies, we focus on demographic data capable of representing specific

geographic locations in Italy in a way that differentiates the North, South, and Central regions.

However, the dimensions produced through the content analysis and the sentiment analysis allow not only represent the complexity of the representation of concepts such as diabetes and obesity for a social media community, but they are also useful to increase knowledge of how virtual platforms impact vulnerable populations. The presented study suggests the importance of implementing tools to rethink and better customize communication strategies for greater effectiveness of public health policies on complex pathologies such as the two considered.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical approval was not required for the study involving human data in accordance with the local legislation and institutional requirements. The social media data was accessed and analyzed using Twitter API.

Author contributions

FRL and FI contributed to the conceptualization, investigation and writing of the original draft. FRL contributed to conceptualization, investigation, data analysis and interpretation, to manuscript and literature review. FI contributed to methodology, formal analysis and data curation. All authors read and accepted the published version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Overcome the fragmentation in online propaganda literature: the role of cultural and cognitive sociology

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Evidence concerning the proliferation of propaganda on social media has renewed scientific interest in persuasive communication practices, resulting in a thriving yet quite disconnected scholarship. This fragmentation poses a significant challenge, as the absence of a structured and comprehensive organization of this extensive literature hampers the interpretation of findings, thus jeopardizing the understanding of online propaganda functioning. To address this fragmentation, I propose a systematization approach that involves utilizing Druckman's Generalizing Persuasion Framework as a unified interpretative tool to organize this scholarly work. By means of this approach, it is possible to systematically identify the various strands within the field, detect their respective shortcomings, and formulate new strategies to bridge these research strands and advance our knowledge of how online propaganda operates. I conclude by arguing that these strategies should involve the sociocultural perspectives offered by cognitive and cultural sociology, as these provide important insights and research tools to disentangle and evaluate the role played by supra-individual factors in the production, distribution, consumption, and evaluation of online propaganda.

KEYWORDS

online propaganda, social media, persuasion, information processing, culture, cognition

1. Introduction

The emergence of the Internet has revolutionized the way political information is created, disseminated, and consumed, particularly through Social Networking Platforms (SNPs), which have become a crucial arena for political communication. Given their centrality, the circulation on such platforms of political content that appears dubious in regard to its factuality, approval rates, and political motive has raised widespread concern. Numerous investigations have, indeed, uncovered the widespread presence of political content on SNPs that masquerades as reliable, neutral information—though it aims to discredit opposing viewpoints rather than serving an informative purpose (Tucker et al., 2018)—and it is frequently amplified through the systematic use of automated tools and impersonation of accounts (Woolley and Howard, 2018).

Such findings have urged scholars to extensively address this alarming phenomenon—which in this paper is referred to as online propaganda—leading to a thriving yet quite disconnected body of literature. This fragmentation can be attributed to the interdisciplinary nature of the research itself as well as to the complexity and multidimensionality of the phenomenon it addresses. In fact, scholars investigating online propaganda not only

employ various theoretical and methodological approaches, but they also focus on different dimensions of the phenomenon, contributing to the disconnected nature of the literature. This poses a significant challenge, as the absence of a structured and comprehensive organization of the extensive literature generated thus far hampers the interpretation and systematization of findings in relation to previous research within this field. As a result, the overall comprehension of the phenomenon is jeopardized.

To address this fragmentation, I propose a novel approach to analyze and structure the existing body of literature on online propaganda. This approach involves utilizing [Druckman's \(2022\)](#) Generalizing Persuasion (GP) Framework as a unified interpretative framework to organize this scholarly work. By adopting this approach, I argue that it is possible to systematically identify the various strands within this field of study and recognize their respective shortcomings. Additionally, employing such strategy enables the formulation of new strategies to bridge these research strands and advance our comprehension of how online propaganda operates.

Hence, this paper is organized as follows: firstly, it presents a theoretical definition of the phenomenon under investigation and introduces the GP Framework as a mean to consolidate the fragmented literature; secondly, it examines the different strands within the literature using this framework; finally, it addresses the limitations of each strand and suggests approaches to overcome them while also establishing connections between the various strands. In particular, arguments are made in favor of incorporating sociocultural perspectives in both the theoretical conceptualization and empirical evaluation of online propaganda functioning as an effective method to bridge the literature.

2. Defining online propaganda

Propaganda is still a much-debated term in the literature, which is often applied in very diverse contexts with different meanings and implications. The conceptual and, thus, terminological entropy characterizing the literature on propaganda is related to the multidimensional *nature of the phenomenon*—Do we intend propaganda as a communication practice, a public opinion issue, or a “more general” political phenomenon?—as well as its complex *relation with persuasion*—Is one a subcategory of the other or are there structural differences between the two?

Drawing from [Jowett and O'donnell \(2018\)](#), in this paper propaganda is intended as a specific *class of communication* that involves two actors—a sender and a receiver—who, through a process of symbolic interaction, use information in an attempt to share meaning. Although propaganda has important similarities with persuasion—highlighted by the presence of persuasive communication elements—it differs from the latter in one crucial aspect. While persuasive and propagandist communication share the same aim—i.e., influence a targeted audience into voluntarily adopting a point of view and/or a behavior favoring the sender's interest—the former is overt about its persuasive intentions, while the latter is not ([Jowett and O'donnell, 2018](#)). Indeed, propaganda wants to pass as informative communication—whose only purpose is to create mutual understanding of data, concepts, and ideas that are considered to be accurate and fact-based. Therefore, the

major difference between persuaders and propagandists lies in the fact that the former do not want to appear as informers, while the latter do ([Jowett and O'donnell, 2018](#)). Building on these considerations, propaganda can be therefore defined as a type of communication with a concealed persuasive aim, which is pursued in a systematic and organized way—i.e., with a clear and deliberate political strategy ([Jowett and O'donnell, 2018](#)).

To depict *online* propaganda, however, a further specification is required. Indeed, the Internet—and, in particular, SNPs—have profoundly altered “classical” top-down communication models, where sender-receiver roles were usually static and unidirectional ([Wanless and Berk, 2021](#)). In fact, these platforms have transformed their users into productive consumers—or *prosumers* ([Fuchs, 2014](#))—who, rather than being passively exposed to information, have an active role in its production and circulation. This aspect is of crucial importance for online propaganda, as it makes the traditional distinction between “propagandist” and “targeted audience” blurred, transforming social media users into potentially active campaigners ([Wanless and Berk, 2021](#)). This is why, compared to its traditional form, online propaganda is *participatory*, as it tries to co-opt its targeted audience to actively engage in the spread of its messages ([Wanless and Berk, 2021](#)).

This conception of online propaganda is far from being definitive. Nonetheless, it is particularly enlightening as it stresses a fundamental—and yet often overlooked—aspect of this phenomenon, namely the fact that, as a communication practice, online propaganda necessarily involves the interaction between two actors: a sender and a recipient.

Despite this relational aspect, studies addressing online propaganda often tend to focus on either one or the other actor, adopting different theoretical and empirical approaches that are rarely in dialogue with each other. This has produced a thriving yet quite disconnected scholarship, which makes its systematization particularly arduous. The lack of dialogue between such approaches—and their findings—hinders a coherent advancement of the literature, potentially jeopardizing a comprehensive understanding of the phenomenon. To overcome this issue, the following section proposes a systematization of the current scholarship under a common framework—the Generalizing Persuasion (GP) Framework by [Druckman \(2022\)](#). The intent is to evaluate different strands of literature on the same conceptual basis to clearly determine the contribution of each approach as well as its limitations, and later identify potential strategies to overcome existing shortcomings and bridge the two approaches.

3. Systematizing a disconnected literature under the GP Framework

The GP Framework ([Druckman, 2022](#)) was developed to offer a conceptual tool to systematize and draw generalization from the vast, but highly fragmented, scholarship on persuasion. It has been designed to highlight the sources of variations considered pivotal for the understanding of the phenomenon, in order to easily identify the connection between different studies addressing persuasion. Given the incorporation of elements of persuasive

communication into propagandistic communication and the—though covert—persuasive aim of the latter (Jowett and O'donnell, 2018), the deployment of the GP Framework is considered particularly suitable for the systematization task that has been set.

This framework identifies four core elements (or dimensions) in the study of persuasive communication: actors, treatments, outcomes, and settings. Each of them encompasses different components¹ that serve to better specify the aspects addressed by each dimension. Druckman makes clear that by no means does the GP Framework requires researchers to account for all the dimensions (and all their respective components) identified when investigating persuasive communication, but it rather urges them to be explicit about which elements they study and how, so that dialogue within the literature can emerge and potential contradictions can be overcome.

When assessing the literature on online propaganda by means of the GP Framework, it appears evident that the discontinuity previously mentioned is not only due to different theoretical and methodological traditions, but it is also related to different research goals, which are reflected in the dimensions addressed—and neglected—by the investigations. When accounting for these, two major strands of the literature emerge.

The first—which we could call “supply-side”—is mostly preoccupied with the question of how people get exposed to propaganda content on SNPs, thus focusing on the process and the motivations behind the production, supply, and availability of propaganda—including patterns of exposure to and engagement with such political material (Guess and Lyons, 2020). As such, investigations belonging to this strand tend to study a specific component of the “actors” dimension, namely the “speaker(s)”, completely neglecting the “receiver(s)” component and, consequently, the “outcome” dimension all together².

Conversely, the second—which can be labeled “demand-side”—engages with the study of the effects that exposure to online propaganda produces on its targeted audience, thus concentrating on the mechanisms underlying the persuasion process (Adam-Troian, 2022). Studies interested in this tend to focus on the “receiver(s)” component of the “actors” dimension, overlooking its counterpart (i.e., “speaker(s)”) but thoroughly addressing the “outcome” dimension instead.

In the following sections, these two approaches will be further examined by means of the GP Framework, with the aim of better positioning their contributions within the literature, addressing their limitations, and discussing how these—if not accounted

for—may represent important shortcomings for the sustainable development of the literature.

4. The supply-side approach: propagandist, their aims and their goals

Scholars adopting a supply-side approach to the study of online propaganda are usually preoccupied with the identification and classification of the political actors involved in this communication practice, the aims underlying their actions, and the strategies implemented to accomplish them—all while considering the specific features of the different political contexts in which such a phenomenon arise³. As such, these investigations mostly focus on three dimensions of the GP Framework, namely “actors”, “treatments”, and “settings”, though they do not address all the components these dimensions encompass.

Most notably, they devote most of the attention to the “speaker(s)” components of the “actors” dimension, concentrating research efforts on the identification of the “type(s)” of speakers involved in the production, distribution, and proliferation of propaganda on SNPs, as well as the “motivations” behind their actions. Indeed, this stand of the literature—whose research agenda has been largely stimulated by the Computational Propaganda Project at the Oxford Internet Institute (2023) and the Observatory on Social Media at the Indiana University (OSoMe, 2023)—is mostly preoccupied with uncovering the identity, the location, and the motives of online propagandists, as well as their organizational practices and methods of dissemination (Guess and Lyons, 2020). This work—often complemented by reports from non-academic sources, such as journalists, intelligence agencies, and SNPs themselves—has provided important insights on the characteristics of both online propagandists and the proliferation patterns of their messages.

Studies on the production and supply of online propaganda have uncovered how this is a widespread communication practice implemented by numerous actors around the Globe, who are very diverse in terms of identity, organizational structure, and motives (Woolley and Howard, 2017, 2018; Bradshaw and Howard, 2018). Ranging from state and intelligence agencies (Bastos and Farkas, 2019; Dawson and Innes, 2019) to teenage groups (Kirby, 2016) and political extremists (Marwick and Lewis, 2017), these “speakers” have very different aims for propagating their messages. Some are driven by economic reasons⁴, while others have political

¹ Here is an overview of all the components in relation to their respective dimensions: actors (speakers and receivers), treatments (topics, content and media), outcomes (attitudes, behaviors, emotions and identities) and settings (competition, space, time, process, and culture) (Druckman, 2022).

² As outlined in the following section, some authors belonging to the supply-side strand of the literature have discussed online propaganda “receivers” and “outcomes” (e.g., Woolley and Howard, 2018). However, they have done so in a descriptive way, by limiting their considerations to the accounts engaging the most with this kind of political content or by speculating on its effects without formulating empirically testable propositions. For these reasons, these components/dimensions are not considered to be the core focus of this approach.

³ It is important to note that studies exploring how the online media system and its ownership structure affect the production, circulation, and consumption of (political) information on SNPs (e.g., Fuchs, 2018; Marmura, 2020; Arayankalam and Krishnan, 2021) are not considered to be part of this specific body of literature. Inasmuch as they explore the reproduction of power structures in online environments and their impact on news media and communication at large, these contributions discuss online propaganda as a byproduct of such dynamics (like echo chambers, polarized conversations, etc.) rather than directly addressing its function and role as a political practice. For this reason, they are not addressed in this paper as they exceed the scope of this analysis.

aims encompassing social control—in the case of authoritarian states—issue-salience alterations and framing for electoral goals—in democratic regimes (Woolley and Howard, 2017). In terms of organizational structure, these actors also vary greatly, with investigations showing significant differences in terms of capacity, coordination, and resources (Bradshaw and Howard, 2018).

The supply-side literature on online propaganda has also provided important insights into the “treatments” and “settings” dimensions of the phenomenon, by exploring production and dissemination strategies employed by propagandists on SNPs. By mapping propaganda networks (e.g., Ferrara et al., 2016; Benkler et al., 2018; Vosoughi et al., 2018; Ahmed et al., 2020) as well as the type of messages circulating through them (e.g., Howard and Kollanyi, 2016; Rosińska, 2021), researchers have developed a detailed depiction of the online ecosystems where this kind of material proliferates, identifying diffusion patterns as well as techniques adopted for maximizing message propagation. On this latter, they have uncovered the widespread use of automation (often combined with human curation) to enhance the circulation of specific political stances, as documented in numerous studies on *political bots*⁵ (e.g., McKelvey and Dubois, 2017; Woolley and Howard, 2018; Ferrara, 2020). It is interesting to notice that automation, in addition to enhancing dissemination, also serves the purpose to maintain propagandists anonymous throughout the communication process—a crucial aspect in ensuring that also their intentions remain concealed.

Despite a preponderant focus on “speakers”, “settings”, and “treatments”, the supply-side strand also includes contributions that have tried to address the “outcome” dimension of the phenomenon (e.g., Forelle et al., 2015; Woolley and Howard, 2016; Bradshaw and Howard, 2018). However, these studies remain speculative in nature, as authors never empirically assess their postulations on online propaganda effects—which they identify as the “manipulation of public opinion” (Woolley and Howard, 2018). In fact, they do develop some theoretical considerations regarding the macro-processes through which the manipulative power of online propaganda unfolds⁶, but such considerations account only for the alteration of the political narratives on SNPs, failing to explain how the alteration translates into the manipulation of public opinion (Camargo and Simon, 2022). Authors do recognize this issue, attributing its causes to the difficulty of empirically establishing causal claims on effects that transcend the online realm⁷ (Woolley and Howard, 2018). However, I would argue that

the problem is first and foremost theoretical and that the empirical challenges identified by these authors are a consequence of it.

As a type of communication, online propaganda involves the *interaction* between two actors: “speakers” and “receivers”. It is in the unfolding of this interaction—and not in the actions of one or the other actor alone—that the mechanisms determining the persuasive result should be sought. It follows that, if “receivers” and their response to online propaganda are systematically neglected⁸ in the postulation of such mechanisms, the assessment of the persuasive outcome becomes virtually impossible.

Therefore, to go beyond postulations that seem to simply assume an automatic link (and not a testable mechanisms) between exposition to propaganda material and a voluntary change of attitudes and/or behavior, direct engagement with propaganda recipients must be envisaged when discussing online propaganda “outcomes”.

5. The demand-side approach: exploring online propaganda effects on its targets

Scholars adopting a “demand-side” approach to the study of online propaganda are interested in exploring the effects this communication practice generates in its targeted audience. As such, their investigations tend to focus on the persuasion process(es) triggered by these political messages, with the aim to identify the micro-mechanisms underpinning evaluations and behavior of those exposed to them. Given these research objectives, contributions belonging to this strand of the literature touch on all four dimensions of the GP Framework (i.e., “actors”, “treatments”, “outcomes”, and “settings”), albeit focusing on only some of the components that fall under these dimensions. Indeed, the demand-side scholarship is interested in assessing online propaganda “outcomes” by identifying factors that influence them—namely, “settings”, “treatments”, and characteristics of “receiver(s)” —and explaining their underlying mechanisms—i.e., the “process” through which information is assessed and decisions are formed.

Conversely from their supply-side colleagues, demand-side scholars are not interested in investigating how social media users end up getting exposed to online propaganda, but they are rather concerned with the cognitive mechanisms that are activated once exposure has occurred. It follows that their primary focus is “receivers” and the way they process and respond to online propaganda. Therefore, the “outcomes” they are interested

4 As in the famous case of the Macedonian teenagers who created and disseminated pro-Trump material for profit in 2016 (Subramanian, 2017).

5 Defined as “user account[s] that ha[ve] been equipped with the features or software to automate interaction with other user accounts about politics” (Howard et al., 2018, p. 85).

6 Building on the Agenda-Setting Theory (McCombs and Shaw, 1972; McCombs et al., 1997), these authors claim that the systematic use of computational tools allows political actors to bypass traditional gatekeepers of information and directly alter the salience of specific topics in the online public discourse. In this way, they drive media coverage toward political issues and narratives considered more advantageous for their faction, thereby shaping the political debate and influencing the electorate (Woolley and Howard, 2018).

7 Woolley and Howard (2018, p. 244) indeed maintain that “making a causal claim from social media use to citizen engagement, trust in institutions, or voter sophistication is proving difficult to do even in countries for which there are significant amounts of data”.

8 Some contributions belonging to the supply-side strand have provided interesting insights into the type of users who are more likely to be exposed to and engage with online propaganda on SNPs, by exploring the characteristics and the behavior of their social media accounts (Shao et al., 2017; Guess et al., 2019). However, such information is mostly descriptive, as it is based on online available data that, as such, does not explore the decision-making process underlying the displayed behavior.

in are those related specifically to these actors, that is, the observable voluntary changes in the “attitudes” and “behaviors” of the recipients.

As previously discussed, it is extremely complex to causally link exposure to online propaganda with offline behavior (e.g., voting, demonstrating, rioting), as “the effects [of online political persuasive content] on electoral outcomes or other behavior have yet to be reliably detected” (Guess and Lyons, 2020, p. 22). Therefore, the outcomes studied usually concern receivers’ evaluation of online propaganda material and the (online) response such material elicit. On the one hand, this means assessing users’ perceptions of information *credibility*⁹ (e.g., Castillo et al., 2011; Metzger and Flanagin, 2013; Braddock and Morrison, 2020; Wittenberg and Berinsky, 2020), *reliability*¹⁰ (e.g., Diviani et al., 2015), and *accuracy*¹¹ (e.g., Lucassen and Schraagen, 2011; Pennycook et al., 2018). On the other hand, it means investigating online engagement—which is usually operationalized as sharing behavior—prompted by propaganda content (Islam et al., 2020; Pennycook and Rand, 2021; Liang et al., 2022; Song et al., 2023).

To understand whether and how these evaluations and behaviors are altered by online propaganda, researchers have identified and investigated the influence exerted by three main factors: the design of online propaganda messages (i.e., the “treatments”), the features of the information environments in which these messages are circulated and processed (i.e., the “settings”), and the characteristics of those exposed to such messages (i.e., the “receivers”).

Studies addressing the first factor investigate how different message features that are commonly employed to evaluate information validity and salience—such as source (e.g., Ecker et al., 2022), endorsement (e.g., Metzger et al., 2010; Metzger and Flanagin, 2013), emotional salience (e.g., Ali and Zain-ul-abdin, 2021; Song et al., 2023), popularity (e.g., Haim et al., 2018), stereotypes (e.g., Lombardi Vallauri, 2021), and topic (Schaewitz et al., 2020)—are purposefully manipulated and used by online propagandists to alter the attitudes and behaviors of their targeted audience.

Investigations focusing on the second factor explore how the very design of SNPs affects the way information is accessed, processed, and finally evaluated. Indeed, such environments are characterized by an overabundance of informational stimuli constantly competing for users’ attention—a condition that impairs the ability to process and evaluate information analytically (Pittman and Haley, 2023) and that, as such, can be exploited by online propagandists to enhance the circulation of their messages (e.g., Islam et al., 2020; Apuke and Omar, 2021; Sanderson et al., 2022).

Finally, when exploring the role recipients’ characteristics have in affecting online propaganda persuasive outcome, demand-side scholars tend to concentrate on those aspects that are in direct relation to the piece of information evaluated, namely receivers’

“prior attitudes” and “evaluative beliefs” toward the issue addressed by propaganda messages (e.g., Ma et al., 2019; Hameleers et al., 2020; Rhodes, 2022), as well as the “motivation” (e.g., Van Bavel and Pereira, 2018; Stanley et al., 2020) and “effort” (e.g., Pennycook and Rand, 2019) these actors put into processing the information they are exposed to.

To provide compelling explanations on how these factors affect the evaluation process of online propaganda material and determine a voluntary change of attitudes and/or behavior in the targeted audience, researchers often resort to the concept of *heuristic reasoning*. This draws from the Dual Process Models of Cognition—a theory that envisages the existence of two distinct but interdependent systems that regulate the thinking process (Gilovich et al., 2002; Vaisey, 2009; Kahneman, 2011; Lizardo et al., 2016; Bryanov and Vziatysheva, 2021). Despite the ongoing debate on the specific characteristics and relations between these two systems (Cerulo et al., 2021), scholars agree on their basic functioning: one system is intuitive and does not require controlled attention during information processing, while the other is deliberate and necessitates more cognitive resources to perform mental tasks (Gilovich et al., 2002).

Because of its speed and (low) cognitive-energy demands, the former system is often employed in situations where reasoning capacity is impaired—such as in the case of high informational load (Ayres and van Gog, 2009)—or in cases of high uncertainty—when fast solutions are preferred (Kahneman et al., 1982). Though satisfactory for reaching immediate goals, this system is subject to systematic bias, as it relies on the uncritical application of preexisting knowledge structures (i.e., heuristics) rather than an in-depth analysis of the information received (DiMaggio, 1997). Therefore, the reliance on this system when processing information can lead to flawed evaluations and behavior (Gilovich et al., 2002).

Given its premises, the Dual Process Model—and, in particular, the concept of heuristic processing—has been largely employed by demand-side scholars to theoretically postulate and then empirically explore the cognitive mechanisms underpinning the assessment of online propaganda. Regardless of the specific factor (treatments, settings, or receivers) or outcome (evaluations or sharing behavior) investigated, empirical discoveries offered by this strand of the literature indicate that heuristic reasoning plays an important role in the persuasion process prompted by online propaganda (Bryanov and Vziatysheva, 2021).

Though compelling, these results are affected by some important limitations that mostly concern the way these cognitive mechanisms are conceived and, consequently, assessed. Overall, studies building on the Dual Process Model framework tend to have a universal approach to cognition, meaning that they conceive cognitive processes as common procedures shared by all individuals regardless of their socioeconomic, cultural, ethnic, or political background (Lamont et al., 2017; Kuo and Marwick, 2021). However, such factors have been demonstrated to play an important role in shaping these processes, as they make cognitive referents more accessible or prominent than others during information assessment and decision-making (Bruch and Feinberg, 2017; Lamont et al., 2017).

Neglecting these elements could limit result interpretation and, thus, potentially hinder the overall understanding of the mechanisms underlying complex social phenomena—especially if

9 Intended as the extent to which there are reasonable grounds for believing information conveyed (Sundar, 2008).

10 Understood as the quality of being trustable because of previous experience indicating so (Gauld and Williams, 2009).

11 Intended as the ability of information-providers to convey correct information (Tate, 2009).

they involve communication practices, as in the case of online propaganda. Indeed, numerous studies have highlighted how communication is affected by sociocultural factors, that do not only influence the way a message is processed and evaluated, but also how that very message is designed and conveyed (e.g., [Servaes, 1989](#); [Lareau, 2011](#); [Samovar et al., 2016](#)).

Notwithstanding such arguments, demand-side investigations of online propaganda impact tend to neglect sociocultural differences in both treatment design ([Kuo and Marwick, 2021](#)) and effect assessment ([Guess and Lyons, 2020](#)). Engaging with sociocultural factors would, therefore, help this strand of the literature to relax the homogeneity assumptions that currently characterize its investigations—as these are rarely justifiable when compared to real-world scenarios characterized by high intrinsic diversity, both in terms of propaganda material and recipients' characteristics.

6. Discussion: bridging online propaganda literature

Employing the GP framework as a common frame of reference to analyze the disconnected body of literature on online propaganda offers a dual advantage. Firstly, it facilitates the identification of variations among different strands of the literature in terms of the specific dimensions and components addressed, thus supporting the development of a structured overview of the state-of-the-art. Secondly, it enables the placement of gaps and limitations of each strand within these dimensions and components.

In this sense, the adoption of a common framework proves beneficial not only in clearly identifying the shortcomings of both supply- and demand-side strands, but also in exploring avenues to bridge such strands. Indeed, this systematization has highlighted how this bridging process can be streamlined: on the one hand, by comprehending how the identified differences can be translated into valuable insights that each strand can employ to overcome its limitations; on the other hand, by exploring how the contributions offered by other research programs that focus on the interaction between cognitive and sociocultural factors can provide additional support to address such shortcomings. This integration of diverse perspectives would reduce fragmentation by harmonizing currently disjointed theoretical conceptualizations and empirical findings. Moreover, it would advance the research agenda on online propaganda by explicitly considering the interplay between its cognitive and social components.

6.1. Getting the dialogue going: how each strand of literature on online propaganda can contribute to the development of the other

Engaging in a constructive dialogue between the supply-side and demand-side strands of online propaganda literature can be advantageous for both, as each strand has the potential to offer

valuable research tools to the other, aiding in the resolution of certain limitations that impact their respective areas.

As previously discussed, the supply-side strand is preoccupied with the socio-political factors leading to the emergence and endurance of online propaganda. To this aim, it focuses its investigations on the political actors involved in the production and dissemination of such political content and the strategies they employ to amplify its circulation. Notwithstanding its compelling findings, this strand remains primarily descriptive, with a disproportioned focus on the “speakers” component and some untested assumptions on the persuasive outcomes this type of communication generates ([Jungherr et al., 2020](#); [Camargo and Simon, 2022](#)).

To better understand the persuasive power of online propaganda and its resulting effects, it is essential for this strand to consider the “receivers” component and the cognitive mechanisms that underpin their information processing and evaluation. This does not imply replicating or fully incorporating the research conducted by the demand-side strand, but rather acknowledging its existence and drawing from it when discussing online propaganda outcomes. By doing so, these contributions can be better positioned within the existing literature and in relation to the demand-side strand. Additionally, this would also enable a reevaluation of the (potential) social harm associated with online propaganda, as some have raised concerns about the validity of claims based solely on computationally intensive methods applied to social media data, without reference to real-world populations ([Rauchfleisch and Kaiser, 2020](#); [Camargo and Simon, 2022](#)).

Conversely, the demand-side strand delves into the persuasion processes triggered by online propaganda, assessing its impact on users' evaluations and behavior. As such, it investigates how individuals process and respond to these persuasive stimuli to identify the cognitive mechanisms underlying such reactions.

Though rich in insightful findings on the outcomes produced by this kind of communication, this account as well is affected by some important limitations. By primarily focusing on the “recipients” component, investigations belonging to the demand-side strand tend to systematically overlook the socio-political context in which propaganda is created and disseminated when assessing its impact on the targeted audience. Furthermore, such assessments often adopt a universalistic perspective on cognition, assuming that cognitive processes underlying the evaluation of political content are universally applicable—an assumption that completely neglects the impact sociocultural factors have on cognition ([Lamont et al., 2017](#)) and, thus, on the evaluation of online propaganda content ([Rampersad and Althiyabi, 2020](#)).

However, drawing from the insights offered by the supply-side strand could help to partially mitigate such shortcomings and achieve a better interpretation of experimental results. The descriptive findings provided by the supply-side literature regarding, on the one hand, the actors involved in online propaganda production (including the political settings in which they operate) and, on the other hand, the consumption and diffusion patterns of propaganda on SNPs, can help contextualize the effects of exposure to online propaganda. Indeed, by drawing from these contributions, it would be possible to delve into the specificities of the socio-political context in which

online propaganda is produced and disseminated, facilitating the development of more consistent stimuli tailored to specific subpopulations under investigation. Moreover, knowledge of the circulation and consumption patterns of online propaganda can be extremely useful for verifying the intuitions guiding the experimental assessment of the effect this communication practice has on users' judgments and behavior, as these real-world observations can be used as ground rules to compare (and substantiate) experimental findings with.

Overall, considering how each strand of the literature can build on the other to overcome its limitations is the first important step toward bridging online propaganda literature. However, this would still not be sufficient to address all the shortcomings affecting both strands, particularly those related to the neglect of sociocultural factors when investigating the functioning and outcomes of online propaganda. As previously mentioned, these factors profoundly affect human communication practices, including the way people process and evaluate messages (Martin and Nakayama, 1999). Therefore, they should be acknowledged when investigating online propaganda, as they can help interpret and contextualize findings, and provide a more comprehensive understanding of the underlying mechanisms that produce them.

6.2. How cultural and cognitive sociology can further bridge and enhance online propaganda scholarship

To address these remaining shortcomings, I argue that drawing from sociology—in particular, from its cultural and cognitive branches—would be beneficial, as this literature provides important insights and research tools to disentangle and evaluate the role played by supra-individual factors in the production, distribution, consumption, and evaluation of online propaganda. Indeed, utilizing the contributions provided by this scholarship would help in better contextualizing the settings in which online propaganda is produced and supplied, as well as advancing the understanding of the mechanisms underlying online propaganda outcomes.

By exploring and comparing the role that history, language, cultural system, and social differentiation play in the production and distribution of online propaganda across different contexts, it would be possible to evaluate how these factors influence and differentiate online propaganda dynamics. This contextualization could potentially aid the interpretation of existing findings that show significant variations in terms of speakers involved and persuasion strategies employed across settings (Bradshaw and Howard, 2018), since salience, credibility, and effectiveness of certain political actors or messages are likely to (also) depend on the sociocultural specificities characterizing the society in which this form of communication takes place (Rampersad and Althiyabi, 2020).

Furthermore, an improved understanding of the outcomes and underlying mechanisms of online propaganda can be achieved by examining how sociocultural factors interact with cognition and mutually shape each other, thereby influencing the evaluation of online propaganda messages. Contributions from cognitive and

cultural sociology have, indeed, demonstrated that the cognitive mechanisms involved in information processing and decision-making are not universally applicable, as they are influenced by cultural repertoires—namely “the available schemas, frames, narratives, scripts and boundaries that actors draw on in social situations” (Lamont et al., 2017, p. 866). These repertoires are distributed unevenly among individuals who share the same national membership due to their transmission and diffusion by specific intermediaries—such as religious leaders, political parties, and media outlets—which may vary in prominence across different social groups (Rosen, 2017; Rucks-Ahidiana, 2022). Social differentiation thus plays a crucial role in determining the accessibility of cultural repertoires to different groups, as differently structured social environments enable certain cultural references to be more readily available to some individuals than others (Lamont et al., 2017). Consequently, this has an impact on how messages are processed, interpreted, and evaluated—a crucial insight that should be taken into account by scholars who are interested in identifying the different components underpinning the evaluation of online propaganda.

Therefore, engaging with sociocultural factors when investigating the functioning and outcomes of online propaganda would have the dual advantage of helping overcome the limitations affecting both research strands and further bridging the overall literature on online propaganda.

By considering sociocultural factors, researchers can move beyond a descriptive—and often Anglocentric—understanding of online propaganda production and distribution, reaching more comprehensive conclusions regarding the prominence and significance of specific platforms, actors, and diffusion patterns across different national and subnational context (Camargo and Simon, 2022). Supply-side scholars can, therefore, enhance their findings by incorporating these factors into their investigations, thus also responding to recent calls numerous researchers have made to ground online propaganda studies in history, society, culture, and politics to avoid neglecting the role race, ethnicity, language, colonial legacy, gender, and class have in this phenomenon (e.g., Siegel, 2020; Kreiss, 2021; Kuo and Marwick, 2021; Ngujén et al., 2022).

To do so, new theoretical and empirical analyses should focus on how social differentiation influences the dynamics of persuasive communication. For instance, when examining consumption and diffusion patterns of online propaganda on SNPs, researchers could explore whether the most prominent accounts in these networks exhibit specific characteristics that symbolize their belonging to a trusted and authoritative group within the socio-cultural context. Similarly, they could expand upon insights from political bot research by investigating whether the display of cultural-specific traits and codes, such as jargon, religious symbols, or impersonation of community members, aids automated accounts in spreading propaganda content on social networking platforms and building trust among their targeted audience.

Acknowledging the influence of sociocultural factors would also enable researchers to move beyond a universal and static perspective of the cognitive mechanisms involved in the evaluation of online propaganda. By recognizing that cultural repertoires shape cognition and that their distribution varies among

diverse social groups, demand-side scholars can achieve a more comprehensive understanding of how sociocultural factors shape cognitive processes and subsequently impact attitudinal and behavioral outcomes produced by this form of communication. Indeed, including sociocultural factors in the formulation and evaluation of the mechanisms underpinning online propaganda effects would allow researchers to relax the homogeneity assumption previously discussed and provide stronger causal explanations for the variations observed among recipients in terms of their response to online propaganda. To achieve such an objective, researcher could, for example, collect sociocultural information along with the “more classical” demographics during experimental assessments of online propaganda’s impact on users’ evaluations and behavior. This would allow for the estimation of heterogeneous treatment effects to assess whether individuals with similar sociocultural backgrounds exhibit consistent responses to specific propaganda stimuli.

By employing this approach, it would be possible to gain a deeper understanding of whether susceptibility to online propaganda persuasion strategies is influenced by supra-individual characteristics. This would provide scholars with new lens through which to explore and analyze patterns of vulnerability, thus further developing our understanding of online propaganda impact on individuals.

The acknowledgment and inclusion of sociocultural factors when investigating online propaganda functioning would further bridge the supply- and demand-side strands of literature. Indeed, adopting a consistent research approach that incorporates sociocultural factors in both conceptualizations and empirical assessments would facilitate the dialogue between the two strands, fostering meaningful knowledge exchange about this type of communication.

Moreover, adopting a sociocultural approach would serve as a cautionary measure against generalized—and, sometimes, oversimplified—policy proposals aimed at countering online propaganda. Whether these proposals target the persuasive influence of propaganda (e.g., debiasing treatments) or seek to regulate its dissemination (e.g., SNPs and content regulations), I argue that considering the sociocultural specificity of different target audiences is crucial.

For instance, scholars developing debiasing treatments that target cognition (e.g., Dai et al., 2021; Lewandowsky and van der Linden, 2021) would benefit from the inclusion of sociocultural factors in their analyses as this would allow them to develop more effective debiasing stimuli that account for the diversity characterizing online propaganda audience. Indeed, by taking into account that individuals’ sociocultural background affects the availability of cultural repertoires and, thus, the cognitive mechanisms underlying information-processing and decision-making, researchers would be able to design tailored debiasing treatments that work best for specific socio-cultural groups (Sy’bandari et al., 2022).

Similarly, regulations that prescribe content and behavior limitations on SNPs¹²—and envisage social media companies’

responsibilities in implementing such restrains—should be designed by considering how sociocultural factors interact with the production and consumption of online propaganda. On the one hand, this means acknowledging the specific use that political actors and citizens make of these platforms in different contexts, by identifying and assessing, for example, the most prominent platforms for political communication, the extent to which automation is employed, the type of actors involved in dubious communication activities, and the characteristics of diffusion and consumption patterns. On the other hand, it means considering the broader characteristics of the online media ecosystem, including how its ownership structure and the power dynamics that emerge from its interaction with the offline social world influence the production and consumption of such political content (Fuchs, 2019).

Overall, integrating the demand- and supply-side strands of research on online propaganda would enhance our knowledge of how propaganda impacts individuals’ cognitive processes and behavior within specific socio-political contexts. By incorporating insights from both perspectives, researchers can conduct more rigorous and comprehensive analyses, making valuable contributions to the field. Moreover, by drawing on the insights offered by cultural and cognitive sociology, an improved understanding of the outcomes and underlying mechanisms of online propaganda can be achieved. Embracing a cultural perspective in the study of online propaganda would contribute to a more holistic understanding of this communication phenomenon. Indeed, it would allow scholars to explore factors that account for significant variations among diverse social groups, which often stem from existing patterns of inequality that result in uneven distributions of material and cultural resources.

Author contributions

The author confirms sole responsibility for the study conception and design, analysis and interpretation of bibliographic sources, and manuscript preparation.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

¹² For an overview of governance responses in the European system see Saurwein and Spencer-Smith (2020).

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Between alternative and traditional social platforms: the case of gab in exploring the narratives on the pandemic and vaccines

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The phenomenon of deplatforming intended as the removal of social media accounts because of breaking rules on mainstream platforms such as Facebook, Twitter, YouTube, and Instagram recently increased due to new terms and conditions of use of digital media, and new alternative social media platforms emerged and presented themselves as protectors of freedom expression. In this way, it becomes interesting to understand better the context of these platforms' so-called *web suburbs* that consist in those digital places that «host what we can generally call "subcultures," including fandoms, religious sects, political extremists, and subcultures». Since April 2020, Gab can be considered the most widespread alternative platform in Western countries, with twenty million users daily, born as Twitter and Facebook alternative social media. The alternative social media platforms are intended as other connection services between users, which is halfway between a social media and a discussion forum born to boycott the censorship actions of the main social media platforms (Meta Group, Twitter, etc.) and celebrate free speech even on controversial positions. How are sensitive topics, such as the one that concerns the skepticism related to the approvals of vaccines during the pandemic, addressed on the alternative social media platform compared to how they are dealt with on the mainstream social media platforms? This explorative work wonders about the users' points of view on vaccine concerns and the relevant differences between Gab and Facebook in addressing this topic. The empirical part of this work has been set starting from the dataset composed of Gab and Facebook content posted between March 2020 and July 2021. The posts were extracted with web scraping techniques (for Gab) and proprietary data tools (for Facebook), querying the keywords: *vaccine*, *vaccines*, *anti-vax* (*no-vax*), *Covid*, *Covid-19*, *coronavirus*. The collection procedure considered the different platforms' structure and their different organization of the interaction spaces. The population consisted of 8000 English writers' posts, from which 2000 posts with the highest interaction value were extracted. The dataset was analyzed using Topic Modeling, Factor, and Classification Analysis techniques. Our work's methodological output deals with comparing these social media platforms, bearing in mind their ontological objects and their algorithms' role. From the analysis emerged the differences and similarities of the social media platforms in terms of the type of content published, rates of involvement, sources of information, and directions of the considered speech. These differences have been duly highlighted by three clusters related to discourse orientation and communication approach: Conflict of views, Emotional externalization, Recommendation and practices. In addition to the type of communication and information circulating on a powerful platform such

as Gab, the results help us understand the different narratives promoted on the two social media platforms and their role in the possible promotion of the same sentiment, opinions, and ideological polarization.

KEYWORDS

deplatforming, alternative platform, content analysis, COVID and vaccines, pandemic reactions

Introduction

Digital cultures play an essential role in radicalization processes and are always considered a relational experience (online or offline), with a significant impact on consolidating individual and group identity (Antonelli, 2022).

According to Dow et al. (2021), the pandemic has disrupted traditional and social structures to which we were accustomed. Facing these disruptions, people «turn online to seek alternative cognitive and social structures. Once there, social media radicalizes beliefs and increase contagion (rapid spread) and stickiness (resistance to change) of conspiracy theories» (Dow et al., 2021, p. 1).

In this way, increased online presence during the COVID-19 pandemic and the long periods of lockdown have created a particularly fertile ground for spreading conspiracy theories, especially of the right-wing (Bessi et al., 2015; Antonelli, 2022). The spread of conspiracy theories is a particularly crucial problem today given the impact such beliefs have on individual behavior and, therefore, collective behavior; for instance, the people who believed the pandemic was all a farce and decided not to adopt the preventive behaviors recommended by the government (Chan et al., 2021). It is even more so if we consider the ease with which these theories generate radicalization phenomena that can lead to forms of polarization and violent extremism. The power of mass media in social and political changes is not new (Thompson, 2011); the real revolution is the speed at which social media platforms respond to users' social connections and information needs worldwide. In the end, the permanence of conspiracy theories and the subsequent radicalization process is facilitated by the way platforms work based on algorithms that facilitate the circulation of information in line with users' opinions (Cinelli et al., 2021). In this way, following Terren and Borge-Bravo (2021) and Del Vicario et al. (2017), if a user tends to consume conspiratorial content on social media, then the platform will tend to offer him more content in line with his conspiratorial interest to optimize his user experience. Consequently, the platform will indirectly reinforce his opinion and not allow him to come into contact with content that may question his conspiratorial opinion.

Ascertaining this background, this work aims to investigate how content relating to the Covid-19 pandemic and the vaccination campaign are communicated on alternative social media platforms, precisely because of their different regulation than traditional platforms. These are used to host content and content creators that traditional social media platforms may not tolerate.

At the same time, many studies have discussed the role of traditional social media in disseminating alternative information

related to COVID-19 and vaccines (Chan et al., 2020; Gesser-Edelsburg, 2021). On the one hand, it is possible to hypothesize that alternative social media platforms can become attractive to conspiracy theorists and other users marked by radical positions already banned by traditional social media platforms; on the other hand, they are also frequented by users who have intentionally migrated from other digital spaces not attended by institutional actors and where content regulation policies are not (or differently) addressed (Innes and Innes, 2021).

The purpose of this work is not oriented to understanding which conditions push banned users from migrating to alternative social media platforms. Instead, it is to shed light, by a first comparison exploration, on the many ways to approach such a relevant topic surfing different regulated digital spaces. Gab and Facebook are two social media platforms offering different interaction modes and functionality (Cinelli et al., 2020a). The first one has been chosen for this case-comparison study because it can be considered the most widespread alternative social media platform in Western countries with twenty million users a day (Longo, 2021) born as Twitter and Facebook alternative social media (Nieborg and Poell, 2018). The alternative social platforms are intended as other connection services between users, which is halfway between a social media and a discussion forum born to boycott the censorship actions of the main social media platforms (Meta Group, Twitter, etc.) and celebrate free speech (Zannettou et al., 2018).

Although Gab and similar social media platforms may have been created and populated by users with explicitly political aims and discourses, their consolidation and growing popularity have inevitably led to other non-political topics being discussed online (Dehghan and Nagappa, 2022). In particular, the vaccine topic (Broniatowski et al., 2021). Facebook, on the other hand, can be considered the most established and popular social network site that enables relationships and discourse patterns between digital publics. Such patterns are intended as social formations made of temporary associations and cooperations among strangers with mutual agendas which disappear after a few hours of intense shared experience (Arvidsson and Caliandro, 2016). Our goal is to explore the narratives on them. In light of this, the research questions that motivate the exploration of the present work are:

- RQ1: What narratives are being built around the themes of COVID and vaccination campaigns on Facebook and Gab?
- RQ2: Considering the different functioning of the alternative social media platform, do users radicalize about vaccines and COVID issues?

From alternative to extreme social media platforms

Social media represents an essential space for individual self-expression and collective association; however, users often transform the freedom these social media platforms offer to promote hate speech, disinformation, and conspiracy theories. To improve the safety of their users, social media platforms enforce their terms of service by performing strict moderation that includes removing certain contents or suspending particular users.

These actions have in turn led to the emergence of a substantial “alternative ecosystem” (Rogers, 2020), i.e., a set of discussion platforms (microblogging, social media, and messaging services) of less regulation and moderation that are used to host content and content creators that are not tolerated by traditional social media platforms (like Twitter and Meta group). What is “alternative social media”? How can we distinguish it from “traditional” social media? To answer these questions, Gehl (2015) conceptualizes alternative social media platforms using the classic alternative media theory that arose before the dominance of social media giants such as Facebook and Twitter. Alternative media were born as a response to older mass media and to counter its large corporate power to promote communication and the construction of public opinion along democratic lines.

This definition makes it difficult to consider “traditional” social media as an alternative to mainstream media. On the one hand, the dominant social media – Facebook and Twitter – may be seen as a first response to the public’s demand for broader participation in the production and distribution of content. On the other hand, however, it cannot be denied that these platforms have maintained or even intensified some of the characteristics of mainstream mass media power described by earlier alternative media theorists, such as centralized and controlled communication (Gehl, 2015).

Indeed, traditional social media, being proprietary profit-seeking companies, can become hostile to ideas, discourses, and organizations, especially when in conflict with corporate hegemony, while allowing people to be content producers. So, as Gehl (2015) claims, alternative social media can be seen as a critical response to traditional social media that allows users to share content and connect and have more access to shape the underlying technical infrastructure and radically experiment with surveillance regimes.

Indeed, these social media platforms promote themselves as alternative solutions for those who want a different social media experience or are dissatisfied with the content moderation of major social media platforms. Over time, this business logic has supplanted the idealism of a free and participatory space that was promoted when the first social media was born, just as censorship and the algorithmic manipulation of messages have replaced unlimited social flows (Poell, 2014).

The result of all this has been the birth of alternative social media platforms that try to recover the founding principles of the first social media. This demonstrates what Waltz (2005) and Atton (2002) argue: there will always be alternative media alongside traditional media. Therefore, dissenting opinions and practices will always find new spaces of expression in opposition to the hegemonic ones.

While on the one hand, alternative social networks were created to offer decentralized and accessible methods of content production that challenge the power of proprietary companies, on the other hand, this free content production can take on dangerous characteristics. The infodemic (Rothkopf, 2003) understood as facts, mixed with fear, speculation, and rumor, amplified and relayed swiftly worldwide by modern information technologies has contributed to the out-of-control spread of conspiracy theories and disinformation.

Recently, the infodemic effect has been made acute by the COVID-19 pandemic in the way people were exposed to large quantities of both accurate and misleading information related to a health topic (Buchanan, 2020; Eysenbach, 2020), trying to ‘know what or whom to trust, especially when faced with conflicting claims or information’ (Gruzd et al., 2021, p. 2).

To address the issue and respond to growing public and regulatory pressure, traditional social media platforms banned all conspiracy theory-related content, with influential conspiracy theory personalities and controversial entities and groups restricted or prevented from spreading extreme narratives (Mahl et al., 2021).

In this way, traditional social media platforms increased their role as content moderators and expelled users or groups that promoted controversial content from their services. Rather than limiting the circulation of this type of viewpoint, however, these actions have led to the emergence of alternative social media platforms that soon became a comfortable refuge for conspiracy theorists and other users with radical positions, obscured by traditional social media platforms which were not seen as a suitable communication space to express their positions. In addition to defining them as “alternative” social media platforms, we could also define these discussion spaces as “extreme” social media platforms, understood as those platforms on which users with extreme positions deplatformed by traditional social media platforms gather to share their radical ideas freely.

The emergence of these hyper-radicalized communication spaces motivated the genesis of our work. It is possible to argue that extreme social media platforms share communication practices with traditional social media platforms (the users can create, share, and interact with content in different ways), the essential differences being the organization of the interaction spaces and the criteria for selection of content on the platforms (Cinelli et al., 2020a). Following Zeng and Schäfer (2021) in highlighting the characteristics that differentiate extreme social media platforms from traditional ones, we adopt the theoretical framework proposed by Nieborg and Poell (2018) which includes governance, users, and technological infrastructure.

In regard to governance, these social media platforms celebrate the liberation of content: they have gained popularity by promoting their image as defenders of freedom of information, often resulting in conspiracy theories, racist hate speech, and toxic information being promoted (Thibault, 2016). These alternative social media platforms thus host personalities with radicalized and controversial positions who no longer find freedom of discussion on traditional social media platforms that moderate content. The lack of acceptance by society (or in this case by the digital space) is an additional emergent item of the radicalization process (Antonelli, 2022).

This perception leads users to seek refuge, acceptance, and understanding within digitally created ad hoc spaces dominated by extremist, simplistic narratives based on the exaltation of violent positions.

Regarding the technological infrastructure and the functioning of alternative extreme social media platforms like Gab, no apps are synchronized because they are banned from all app stores. It differs from social media platforms like Facebook, which depend heavily on the news feed algorithm (Acampa, 2022). In this way, on an alternative extreme social media platform such as Gab, content producers can communicate with, and receive suggestions, directly from their most loyal followers who support their positions.

This migration can be considered as the full realization of a selective information space: in this case, the user gets out of the echo chambers of traditional social media and immerse himself in a real “echo platform”, i.e., platforms in which the contents produced and shared are exclusively in line with the beliefs of the users who live in it.

While many studies have questioned the role of traditional social media in disseminating “alternative information” (Cinelli et al., 2020b; Jhaver et al., 2021), these alternative social media platforms remain little investigated in social media studies. For this reason, it is interesting to understand how these social media platforms operate in the new peripheries of the web (Thibault, 2016) and form a part of a broader communication ecology.

The role of social media in the COVID-19 pandemic

The use of the web and social media during the first phase of the pandemic significantly increased, allowing users to stay connected with friends, relatives, or colleagues, disseminate protocols on care and personal protective equipment, and retrieve real-time information about what was happening at that moment. Social media played an essential role in creating a sense of community and solidarity during lockdowns and restrictions imposed by the pandemic. Social media users shared individual experiences and stories of daily life, creating a sense of belonging and closeness among people facing similar problems (Wong et al., 2021).

According to data produced by “We Are Social” in January 2022, out of a global population of 7.91 billion people, there are ~5.31 billion mobile users (67%), 4.95 billion users connected to the Internet (62%), and 4.62 billion active people (which generally means a person who has connected at least once a month) on at least one social media (58%). These numbers describe a digital transformation underway for almost two decades globally as Internet and social media penetration rates have constantly increased. The growth of users of social media platforms has more than tripled in the last 10 years, from 1.48 billion in 2012 to 4.62 billion in January 2022, which is an annual average growth of 12%.

Since the unexpected beginning and first wave of the COVID-19 pandemic, global terms such as social distancing, gathering, smart working, and lockdown have assumed importance. Social media platforms have proved to be potent tools as they have allowed all users, especially the most followed, to spread the rules to limit the spread of the virus as much as possible.

Among the most characteristic functions of social media platforms during this pandemic have been the rapid dissemination of protocols at regional, national, and international levels. Sharing protocols about treatment, personal protection equipment, or even proposals for fair allocation of scarce resources in medical settings have now become the new standard (González-Padilla and Tortolero-Blanco, 2020).

They played an essential role in communication during the pandemic, providing a channel through which people could stay in touch and exchange information about the spread of the virus, prevention measures, and safety recommendations (Wong et al., 2021).

However, as the manufacturing and distribution of vaccines ramped up, false and misleading information about vaccines’ efficacy, safety, and side effects increased on social media (Gruzd et al., 2021).

On the other side, subjective opinions, prejudices, and conspiracies have been intertwined with these reports, generating an enormous proliferation of false news and misinformation in general. This has also occurred because of the speed with which the news circulated, also among the main newspapers.

Of course, when we think about social media platforms, one cannot ignore what Pariser (2011) called “bubble filters”, according to which users live in a “custom ecosystem” governed by algorithms that choose and predict preferences and results according to their own biases. These bubbles produce a cycle of comparable content that prevents the user from seeing other sources to counter the information and, therefore, any fake content. The use of “social media platforms was perceived as easy and accessible to everyone for sharing, posting, and reacting to any information – also medical information – regarding the pandemic. While people continued to work from home and ensured social distancing, most users supported family and friends and attempted to raise awareness by sharing and circulating a range of information within their closed social networks (Saud et al., 2020).

However, misperceptions negatively influenced the perceived severity, susceptibility, and efficacy of government preventive measures, which may have ultimately resulted in decreased compliance (Meppelink et al., 2022).

During the pandemic, social networks were the place for four types of users to meet and clash: pros, cons, neutrals, and those hesitant about the scientific aspects of the vaccination campaign. In this case, social media platforms, particularly those with large user bases, were most culpable of spreading vaccine-related misinformation that may have contributed to vaccine hesitancy (Gruzd et al., 2021). Several times in this way, social media contents are featured by verbal aggressions that can be framed as “a personality trait that predisposes persons to attack the self-concepts of other people instead of, or in addition to, their positions on topics of communication” (Infante and Wigley, 1986: 61).

Many studies described how social media, despite their efforts to remove COVID-19 vaccine-related misinformation, have featured as vectors for vaccination hesitation in many countries worldwide (Lou and Ahmed, 2019; Burki, 2020; Gruzd et al., 2023). In this way, hesitant reactions were driven by many different reasons related to any other effects of misinformation

as in the AstraZeneca case in Italy (Crescentini and Padricelli, 2023), through false crossclaims about the vaccine efficiency 'not constrained within a single platform' (Gruzd et al., 2023). Considering this, public communication policies provided fast resilience policies oriented to monitoring and restraining the impact of misinformation, taking care that as in the U.K. case, 'government-generated messages may be less effective than those of other actors' (Bloomfield et al., 2021).

According to this, social media platforms have had the role of disseminating not only scientific and technological content but also the opinions of scientific experts even though they are not widely used. The importance of scientific communication – understood not as “popularization”, that is, bringing people closer to knowledge but as a means to transmit and spread messages – is constantly neglected and denied by scientists. However, there are many exceptions in the national and international scene. In this way, scientific experts struggled to maintain their previously unchallenged authority due to differing opinions and inefficient communication. At the same time, the web broke the sequential order and tightness of a series of 'filters' that previously distinguished the pathway of scientific results from the researcher to the general public (Bucchi, 2006, p. 72).

Alternative social media platforms and alternative narrations?

To answer the research questions mentioned in the introduction section, this work, from a comparative perspective, will explore the narratives of two examples of these respective types of social media platforms, Facebook and Gab, as they offer different modes of interaction and the ability to amplify content. It will also reflect on the ontological aspects of the social media platforms themselves, such as the role of algorithms in the dissemination of content and the polarization of public opinion. The data were collected through a query strategy and then the database was subjected to a content analysis. To better answer these questions, an in-depth comparison was made of content posted by users on Gab and Facebook between March 2020 and July 2021. The data collection procedure involved gathering content posted by users on both social media platforms in the selected timespan through a query that contained the following keys: vaccine, vaccines, anti-vax, COVID, COVID-19, coronavirus. Web scraping procedures were used for Gab's extraction while for Facebook, we availed ourselves of Crowdtangle, an insight tool reserved for the academic community that only tracks publicly available posts on Meta's group social media platforms.

To achieve the objectives of this research, it is necessary to equip oneself with the tools and techniques useful for extracting meaning from the available information. This is the case with content analysis, a technique aimed at breaking down any type of message into “simpler constituent elements, the recurrence of which can be calculated, also in view of further processing, possibly after classification in

appropriate systems of categories” (Amaturo and Punziano, 2013, p. 24).

In this specific application case, which follows a content analysis of the third type (Rositi, 1988),¹ the empirical basis was created by preparing a standardized grid for data collection (Table 1). Through this grid, the collection of all cultural products containing the selected keywords during the identified observation period was organized.

Thanks to the guidance provided by the grid, in addition to the identifying variable of the social media platform on which the collected content was posted, the variable regarding the total reactions to the posts made by users was operationalized. The latter consists of the sum of the number of likes, comments, and content shares. This cardinal variable was subsequently discretized into an ordered-categorical variable, which follows a specific ordering as an ordered series along a continuum characterized by a precise range. This transformation operation was conducted by identifying the central value along the frequency distribution of the entire variable and then dividing it into tertials, where each interval had an equal number of observed cases. Subsequently, the variable was reclassified into low-medium and high reactivity levels, respecting a monotonic relationship between the intervals (Marradi, 2007).

The empirical base initially composed of 8000 observations was reduced to a dataset of 2000 posts, selecting an equal number of cases retrieved from the two social media platforms. The selection of the first 1000 posts from Gab and the first 1000 posts on Facebook was based on replies to rates (we selected 333 low-rate, 333 medium-rate, and 334 high-rate posts from each platform).

Furthermore, variables related to the type of published post and the nature of any external sources contained within the published material were operationalized.

The first variable consists of identifying the communicative codes characterizing each case observed, whether they are textual (post and status), audio-visual (live video complete, native video, photo, screen, meme, and Video), or contain hyperlinks to external social media platforms (Link).

The origin of these external sources is operationalized in the second variable, which distinguishes those contents not belonging to Gab or Facebook. Among these, there are academic-scientific sources (academic journals, academic press, and scientific reports), commercial sources (Amazon), blogs, document archives (cloud and documents), institutional press releases, fundraising campaigns, petitions, and other social media platforms or instant messaging platforms (YouTube, Twitter, Telegram, and Video platform).

All the collected data were processed with a multi-stage content analysis that consisted of three separate analytical phases:

1 Content analysis can be divided into «three different types based on the chosen classification units. In the third type, there is no decomposition into elements, but the classification unit coincides with the contextual unit. In practice, it is as if the examined communication were subjected to a real questionnaire, “asking” an advertising message, for example, if a female character appears, what role she plays, and so on» (Amaturo and Punziano, 2013, p. 55–56).

TABLE 1 Content analysis standard grid.

Social media platform	Total reactions	External sources	Post type	Message
Facebook - Gab	Low – Medium – High levels	Academic journal – Academic press – Amazon – Blogs – Cloud – Documents – Institutional – Petition – Scientific reports – Telegram – Twitter – Video Platform – Youtube	Link – Live video complete – Meme – Native video – Photo – Post – Screen – Status – Video	Post text

the application of the main seven topics of *topic modeling*² from our dataset in order to understand the narrative features created by users among Gab and Facebook; the application of a *Lexical Correspondence Analysis* (LCA)³ to detect the latent mining dimension detectable from the combination of the emerging topics with the proper functions of both social media platforms; and a *cluster analysis*⁴ that synthesizes all of the information used in few and homogeneous groups.

The topic model and LCA

After building the dataset, the first analytical procedure was used to identify, via the considerable amount of information in the textual variables, the narrative features related to and emerging from the material collected. Despite the difficulty in tracing the semantic structure of the texts, topic modeling offered an empirical basis for a simple, automated, and statistically robust solution. This technique identified topics within the analyzed works that were explored through the textual variable. As the first step, the database was imported into T-Lab, a specific quantitative content analysis software that processed patterns based on textual context. Later, the textual variable was submitted for the thematic analysis procedure of T-Lab. Prior to the preparation of the text for automatic analysis, lemmatization, lexicalization, and segmentation procedures were followed and finally, the frequency threshold was set at 10 occurrences. In this way, a final database comprising ~969 total words was obtained.

After this corpus building, a model was set up through which seven topics were extracted and appropriately renamed to respect statistical criteria as follows: the consideration of specific word occurrences featuring the topic; low-high shared word occurrences among all topics; and semantic tagging of selected contexts in order to “detect the right document meaning in order to solve disambiguation and identifying concepts by a set of words.”

(Bolasco, 2013, p. 126). Since each of the texts analyzed comprised a document composed of words, this text could be subdivided into elementary contexts, i.e., smaller portions of text such as sentences, in which the specific combination of words was more or less likely to lead back to a specific topic. The topic would then be the set of specific words belonging only to that topic plus several other words shared with greater or less probability with other topics. The combination of these sets of specific and shared words leads to different semantic universes. This allows the topic to be correctly labeled considering the specific words, shared words, and elementary context I within the topic, which helps contextualize the words in specific portions and deduce a general meaning of the topic.

Finally, as summarized in Table 2, the seven topics were classified, taking account of the 3,450 emerging elementary contexts that comprise the total corpus of documents analyzed. Following Habert (2005), the greater significance of parts of the documents depends on the information weight of its elementary contexts, featured by its discursive formulas, their position in the document, and the specific weight of each word related to its distribution in the document. In this study, T-Lab returned the following summary of elementary contexts with a hierarchical order based on the informative score of single elementary contexts in which text reduction has been synthesized by a 95% threshold.

Lexical Correspondence Analysis (LCA) was then implemented to answer RQ1 to encapsulate the narration on both social media platforms, Gab and Facebook, and underline the main differences between them in framing and discourse-building about the COVID vaccine issues during the pandemic period. After this, a cluster analysis was implemented to retrieve three uniform groups representing the major communication patterns users utilize. Figures 1, 2 show the main results.

Before discussing the results of the analysis, it is necessary to describe how the LCA (Lexical correspondence Analysis) plan is constructed and how emerged the main latent dimensions thanks to the multidimensional approach we used to process and analyze textual material. The first one, on the horizontal axis, is concerned with the primary communication approach to Covid and vaccine issues. It synthesizes the reactions to the pandemic situation during the first period of the pandemic. Facebook and its related behavioral approaches are to the left of the axis. Here, we emphasized and concentrated on the precautionary ways of self-protection from contagion, such as staying at home and avoiding interactions. Contrariwise, the right of the axis where Gab is positioned focuses on the meditative and wise approaches open to the debate among users and their reactions to the pandemic issue over the longer term. Here, it is possible to detect those posts linked to the discussions on the control measures, COVID victims, and vaccine reliability.

² A model applied to topic extraction was based on the Latent Dirichlet Allocation, a “generative probabilistic model for text document collections based on a three-level hierarchical Bayesian model, in which each item of a collection is modelled as a finite mixture over an underlying set of topics. Each topic is, in turn, modelled as an infinite mixture over an underlying set of topic probabilities. In the context of text modelling, the topic probabilities provide an explicit representation of a document” (Blei et al., 2003).

³ Lexical Correspondence Analysis is a factorial technique concerning textual data and is useful to synthesize information contained in texts, make graphic displays of association networks among words and between words and texts, and show the connections between text and context data (Lebart et al., 1998).

⁴ Cluster analysis is an analytical technique that aims to synthesize observed objects into a few representative groups (Lebart, 1994).

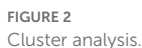


TABLE 2 Topic name, featuring words, and examples of elementary context.

Topic name	Featuring words	Examples of elementary context
Business Spamming	business; need; support; help; service; learn; work; job; money; time	- 5 Days To Go! Are you pivoting toward a pandemic-proof business? Get to showcase what you do or your business to The Business_Marketplace_Global community through your 60-sec pitch. Find solutions to your business needs by meeting people with the right skills and knowledge. Meet new prospects and generate referrals to get high-quality leads.
Corona updates and behavioral communication	active; IndiaFightsCorona; case; Texas; Unite2FightCorona; restaurant; recovery; StaySafe; Total_Cases_till; Total_Recoveries_till total_tests_till; sanitize	- # IndiaFightsCorona # Unite2FightCorona # Maharashtra # COVID19_Updates as_of 18/06/2021: and New Cases - 9,798 and Recoveries - 14,347 and Active Cases - 1, 34, 747 and Total_Cases_till date - 59, 54, 508 and Total_Recoveries_till date - 56, 99, 983 and Total_tests_till date - 3, 90, 78, 541 # StaySafe # Unite2FightCorona # IndiaFightsCorona
Home business speculating	fee; stayhome; ppe; workfromhome; facemask Coronavirus; workathome quarantine; onlinejobs homebusiness howtomakemoney internetmarketing makethatmoney	- Get Free “Viral” Traffic For ANY Website or Affiliate Link, With 1000s of REAL Visitors. In Just 41 Seconds! #howtomakemoney #makethatmoney #workathome #workfromhome #homebusiness #internetmarketing #onlinejobs #coronavirus #lockdown #stayhome #pandemic #quarantine #facemask #ppe #KN95 #N95 #Covid19 #stayathome
Quarantine diary	COVID19; love; day; god; view; music; hope; play; window; howl; enjoy; stay safe; quarantine beautiful; home; kind; stay; fire; walk	- Day 22 of #lockdown. Pretoria, South Africa ZA. A big Highveld thunderstorm is brewing after a chilly day. Rolling thunder and lighting. Home is the best place to be right now. Stay safe #Covid19 - Staying home in Indianapolis, IN, USA, sitting on my couch, looking at the window, and thinking how fortunate I am. Stay home, Stay safe! Photo taken April 26, 2020 #Covid19
Risk perception and Covid treatments	virus; study; cause; cell; risk disease; vaccine; university; spike protein; ivermectin COVID-19; approve; SARS-CoV-2 rate	- One of the basic conditions for the emergency use authorization granted to the vaccines currently being used against Covid is that there are no alternative treatments available for the disease. As such, if ivermectin or some other promising medicine such as fluvoxamine were approved as an effective early treatment for Covid-19, the vaccines could be stripped of authorization. - That might explain the company's recent statement claiming that there is “no scientific basis whatsoever for a potential therapeutic effect of ivermectin against COVID-19. If approved as a Covid-19 treatment, ivermectin could even threaten the emergency use authorization granted to Covid-19 vaccines.
Skepticism and critics of pandemic	people; patient; vaccinate; doctor; mention; Fauci; vaccine; tell; speak; government individual; inject	- Knowledgeable, informed Doctors around the world are warning people to stay away from those vaccinated. Vaccinated people are now believed to be super-spreaders who can shed through their skin, pores, and breath to those not yet vaccinated resulting in those people being infected as well.
Vaccine effectiveness	vaccine; death; die; COVID mention; ellipsis; REPORT; vaccination; invisible; Gate Case; data; COVID_VACCINE Mrna; Vax; reaction	- For Second Week in a Row: More COVID-19 Vaccination Deaths than COVID-19 Deaths in the US according to CDC and VAERS Websites - - by Jim Hoft. There are now 11,140 reported deaths from the COVID_VACCINE in the United States. This is up from the 9,125 reported deaths from the COVID-19 vaccinations total from last week. Two weeks ago VAERS reported 6,985 deaths due to the COVID vaccines.

Along the dimension shown on the vertical axis, higher and lower values relate to discourse orientation characterized by individual and collective experiences, respectively.

On these bases, the narration on both social media platforms is concerned with four discussion frames that emerge across these dimensions. The first frame, which emerges in the plan's first quadrant, is characterized by a sensible approach to the pandemic issue. This is oriented on the micro level and by the direct individual perspective of users. The topic related to the quarantine diaries here gathered all those elements related to the individual narration of daily life during the pandemic. This narration practice makes sharing the experiences held during the lockdown possible. It is also supported by the contents related to the contagion updates and the first treatment developed to fight the virus. In this way, a narrative reflecting conventional or popular wisdom is more

concentrated than the more scientific-oriented ones focused on in the fourth quadrant, considering the modality of scientific sources (Academical Journals, Academic Press, and Scientific Reports) from the variable of external sources addressed.

Furthermore, thanks to the support of the most frequent words, such as Pfizer, mRNA, spike protein, release, and Covid vaccine, this quadrant concentrates on all those contents that deal with more detailed information concerning the pandemic in general and the vaccine issue. In this way, a narration is featured by commenting and reviewing discussions of the scientific sources addressed by users. Among the latter, scientific papers have also been included in the preparation of the data-gathering procedures during the operativization phase.

The second quadrant takes shape as the more speculative one. Here, we find a relative need for more discussion among users.

There is instead more space reserved for storytelling practices that distinctly emphasize the potential fears the socio-economic insecurity can cause because of the lockdown isolation, a fertile ground for questionable business practices. Lastly, in the third quadrant, which crosses the impact reaction and the collective sphere, it is possible to find the narrative refrain of “stay at home” and the other behavioral practices that individuals adopted during the first pandemic phase. In summary, looking at the graph, the narration of Gab is featured in users’ confrontations and debates on a critical approach to the pandemic.

Moreover, despite the primary identifications of users present on Gab, who are defined as radicalized by scholars (Lima et al., 2018), no rude communication styles emerge from the empirical evidence in this case. At the same time, the LCA reveals a proactive debate based on scientific sources if a «polarized perspective of user opinions, bubbles, or any other elements linked to the reinforcement of their political or social views» (ivi) is not detectable. Moreover, despite what was initially expected from Gab, no opportunistic practices or phishing post-trends are disseminated by the self-regulated users, unlike what emerges when looking at the part of the graph in which Facebook narration is framed. On the one hand, the interpretative schema built on the popular social media platform appears shaped for a digital space to report “what’s going on”, in other words, to comprehend the contagion trends and to be informed about the pandemic issue. On the other hand, the debate about the situation related to the vaccination campaign goes into the background. It allows space for spamming and speculating content with no linked external sources that are not violating the strict company regulation.

The results of the later analytical procedure align with this vision. Later in the LCA, a further cluster analysis is provided. Finally, the synthesis operation is carried out on the plane constituted by the intersection of the two syntheses. In this way, it is also possible to characterize the narrative differences between Gab and Facebook thanks to the contributions provided to the topics surveyed, the social media platform’s positions on the plane, and the position of three emerging groups.

As shown in Figure 2, the first group, which contains most of the information of the dataset (65%), gathers the social narration that was held on Facebook and was related to the collective sphere. Here, there are concentrated words and posts that reflect the recommendation and practices to be followed during the lockdown, which was experienced as the “stay at home” wave and the need to respect social distancing. As shown by the most frequent words inside this cluster, these recommendations gained more frequency and relevance than contents related to the topic of home business speculation in the cluster. The advice on approaching new forms of sociality, such as going outside only for emergency purposes, wearing masks, and promoting social distancing, occurred because of the pandemic. These recommendation practices have been replaced by those contents that concern and promote remote working practices from home that, as promised by the users, drive easy online economic earnings, such as online investments, buying and selling products, etc. In an opposed position, Gab takes precedence in the second cluster, comprising 25% of the information contained in the dataset, which relates to the collective sphere. In this case, elements concerning risk perception and

discussion concerning vaccine effectiveness gain more space. Users’ knowledge construction opened to the conflict of views between them and any other actor related to the Government or conspiracy engagements. As shown in Table 2, the elementary context and the more frequent words underline these conflictual oppositions: “Vaccinated people are now believed to be super-spreaders who can shed through their skin, pores, and breath to those not yet vaccinated, resulting in those people being infected as well”. In this last group is found content more frequently posted on Gab than on Facebook, constituting 10% of the full information. Here, content relates to the emotional externalization of the individual experiences during the pandemic. These are related to those social constructions that feature positive and negative experiences. They depend on the learning processes and the social mechanism connected to a new experience as the pandemic. Despite the lack of proper methods and instruments to detect and comprehend these elements, other investigative perspectives must support the study of emotions. In this case, the application of traditional techniques related to the qualitative approach can be helpful in two ways: to shed light on the traces already left reported by the quarantine diaries and then to identify interesting research paths to go in-depth into a specific emotion or sensation that can be later translated by individuals in a specific attitude, social construction, or action.

Conclusion and future work

The content analysis highlighted the differences and similarities of the social media platforms in terms of the type of content published, rates of involvement, sources of information, and directions of the considered speech. The results helped to answer RQ1 and provided insight into the different narratives promoted on the two social media platforms. In fact, to the issue investigated and in contrast to what was hypothesized about the Gab social media platform, a particularly radical, sectarian, or conspiratorial environment did not emerge. The empirical exploration to compare Gab and Facebook underlines that Gab is a narration more oriented to structures, reactions, debating, and emotional assumptions, while with respect to Facebook, a more impactful orientation. Referring to RQ2, while Facebook functioned as the platform where users spread best practices to deal with the pandemic, Gab on the other hand emerged as a platform characterized by different narratives opposing the mainstream narratives, which includes users who address, on one hand, critical and sensitive issues related to the emergency, and on the other hand conflictual and critical public argumentations. In the case of this study, the alternative ecosystem that was born from an attempt to find spaces of expression not subject to regulation and censorship did not generate an information environment based on all the same information and positions. On Gab, different positions and consumption of different information sources were detected; this information source was curated collaboratively and used to formulate or reframe explanations about the pandemic and the vaccine campaign. This explains that extremism, in all its forms, is a cumulative and incremental phenomenon or a process that arises or amplifies as a reaction to exposure or prolonged contact with an ideologically different type (Antonelli, 2022).

The major focus of studies on social media platforms like Gab has limited itself to either explicitly political topics or certain problematic discourses and content such as hate speech, misinformation, and conspiracy theories (Dehghan and Nagappa, 2022), but our analysis shows the emergence of Gab as a space for comparison and sharing of information sources and differing worldviews that is lacking on Facebook. Gab claims to promote freedom of speech and provide an environment where users can express their opinions without fear of being censored or banned. Relating to RQ2, as LCA outcomes show, the themes investigated a user who expresses a position against the tide on Facebook that most likely triggers a real “shitstorm” against him, generating a polarization of positions that in a short time turns into hate speech, thus preventing a meaningful contest between different opinions. On the contrary, on Gab, the idea of being able to express a position (albeit controversial and not widely shared by public opinion) with a users’ audience, who probably share that same position and are more prone to confrontation than to attack, generates a discussion environment that is less polarized and more open to the exchange of opinions. The lack of radicalization of communication may be associated with the sharing of opinions regarding particular themes and the non-existence of users who can counter them. A limitation of the work is undoubtedly linked to the themes investigated in a particular and singular historical moment for the entire world; different results could emerge if investigating incredibly divisive themes traditionally used to support conspiratorial propaganda. An expansion of the work could be done from a comparative perspective between social media platforms and relevant themes in each historical moment.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Ethics statement

Ethical approval was not required for the study involving human data in accordance with the local legislation and institutional requirements. The research involving social media data was conducted in accordance with the platforms’ terms of use and all relevant national and institutional guidelines.

Author contributions

This article should be considered a collaboration, in particular, in its conclusions. However, the introduction and paragraph 1 are to be attributed to SA, paragraphs 2 and 3 to NC, and paragraph 4 to GMP. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The metaverse of violence

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The metaverse appears to be a composite concept and a complex environment from an ontological perspective and from a purely dimensional point of view. Exploring its defining features not only allows one to identify the nature and effects of the social relations existing therein, but also influences the legal reading of what it contains and produces. Bringing to light the peculiar characteristics of the metaverse—for which the dichotomy between “real” and “virtual” sounds outdated—this article emphasizes the urgency to rethink the traditional forms of interpretation and design of preventive and repressive measures to counter deviant and illegal phenomena of a violent nature.

KEYWORDS

metaverse, violence, law, rights, crime, deviance, physicality, virtuality

1 “Social territories”: representations and essence of the metaverse

Space constitutes one of the dimensions through which human action unfolds. The concatenation of territories and events takes on peculiar declinations that sink their roots and explain their effects in the complex realms of Law, where the totality of social relations—at the same time an elusive reality and a stable model—is conceived and systematized. Given that “there is no space independent of subjects” (von Uexküll, 2013, p. 75), it is precisely in the manifold, and not always peaceful, relationship between the environment and its users that aspirations and limits of human projections are felt, which largely lead to visions and re-visions of the history and future of rights. This applies not only to genuinely physical spaces but also to digital spaces and even to the combination between them.

The emergence of the metaverse, understood as a universal environment capable of forging and intercepting the complexity of the network of social connections in a new, typical digital extension, appears to be an event, albeit with non-homogeneous and non-linear features, with the potential to disruptively affect our understanding of reality. In particular, the innovation resulting from the appearance of the metaverse cannot be reduced to a process of mere transposition of a concrete, non-digital reality carried out by means of a next-generation “internetization.” On the contrary, it should be taken as one step on the path toward the establishment of a stand-alone reality whose essence lies in the lack of separation between the spheres of existence.

If depicted as the three-dimensional cyberspace in which natural persons can operate, produce, and interact in different ways for a variety of purposes, and by making use of increasingly customized tools and services, the digital universe thus constituted—endowed with persistence and interactivity among interconnected contexts enabling real-time actions and relations to take place (Ball, 2022)—ultimately molds a reality that is not fictitious (any longer), but if anything is implemented. Accordingly, such a technologically affirmed reality, made up of informational galaxies or suburbs, is not conceivable as a parallel dimension but rather as part of mutually integrated realities.

At the heart of its development, there is an acceleration in scientific applications, an advancement in the branch of digital ecology, and, finally, a technological integration of

“virtual” and “physical” contents (China Institutes of Contemporary International Relations – CICIR, 2021), through that path of hyper-connection that has already largely hybridized the frontiers of an “onlife” life (Floridi, 2015)—commonly referred to with the term *phygital* (Council of the European Union, General Secretariat – C.EU, 2022).

Nonetheless, it is still unclear whether such a scientific growth will contribute to the consolidation of greater forms of “technological anthropocentrism” (Dertouzos, 2001), also considering that the nature of the *prosumer* remains controversial in terms of economic and commercial rights—being in unstable equilibrium between freedom and imposition (Pascali, 2022).¹ Nevertheless, the user of this new world shows a remarkable potential to become a driver of innovation—at once consumer and producer of ideas—and, as such, to generate an inevitable, albeit not total, horizontality of contents.

Rejecting the assumption of the existence of an absolute dualism between what is real and what is virtual thus becomes pivotal to a proper understanding of the theoretical frameworks within which the socio-digital objects of research are to be discussed (Rogers, 2013; Caliendo and Gandini, 2017). Accordingly, the methods used to investigate “digitality” must conform to the permeability of the material and digital spheres, taking into account the possibility of using them as analysis data (and “pre-data”) that can be acquired. The underlying idea is, indeed, that the “boundless” virtual space and the concrete reality (cf. Stephenson, 1992) are not separate dimensions (although subject to a mutual and permanent exchange, cf. Riva, 2014, p. 60), but concurrent spheres that might experience overlaps and fusions and sometimes reflect different aspects of the same reality.

In an epistemological and methodological perspective, both dimensions are thus to be regarded as “real” since they have a *real* impact on phenomena. In other words, the notion of the circularity of the spheres in which a given phenomenon occurs is preliminary to any study of the phenomenon itself. This also implies that even in cases where the event seems destined to be confined to a single, specific dimension, it could progressively and massively explode in such an overall horizon and finally deflagrate in circumscribed spaces.² Based on the above, neither concrete reality nor cyberspace should be qualified as “abstract,” especially considering the socio-psychological implications of what can be achieved in the metaverse (Oleksy et al., 2022).

To clarify the definition of “virtual/digital,” it is important to note that the incorporation of new technologies into social worlds requires a re-discussion of the concept of individuality (Lupton, 2015, p. 188 ff.), as well as considering the ways in which social research may be “reinvented.” This is particularly relevant given the purely social character of these technologies themselves (Marres, 2017). By observing how actions and subjects interact cohesively in a diverse environment, we can gain a better understanding of critical analysis perspectives (Orton-Johnson and Prior, 2023) and the need to reassess

the value of spatial boundaries that have traditionally been considered fixed.

The growing weld between “*meatspace*” and “*cyberspace*” (Weatherby, 2018) has thus been established for defining purposes. Furthermore, space—which is no longer conceived merely as physical data but also as a social construct—now appears to be inevitably thinkable in terms of its becoming, also through the transduction process by means of which software produces its conditions of existence, in an endless generative work that goes beyond a simple mixing effect (Accoto, 2017, p. 88 ff.). Then again, techno-regulation, in itself, is evidently readable as a process capable of conforming the environment in which subjects interact (Durante, 2019, p. 49).

2 Dimensions of violence

The digital dimension, which is now included in almost all areas of social relations, must also necessarily be taken into account by studies that deal sociologically with the phenomena of deviance and crime. This entails the observation of new social facts that can be included in these macro-categories and obliges us to address, first and foremost, novel definitional problems.

With regard to the “original” character of digital phenomena of this origin and of a “violent” nature or purpose, it should therefore be noted that even many of them are not categorized in a real and a virtual level, nor is there exclusively a synergy between sectors that are in any case (thought and acted upon) as distinct. Rather, in their diversity, these episodes subsist and move in a substantial-conceptual unicum.

It should then be noted that the novelty present and to be considered is both social and legal, even from a socio-legal perspective. It is precisely the criterion of novelty that can be used to detect the specific nature of the matter under consideration, being expressed with respect to many of the aspects in question. More precisely, the innovative part may, indeed, from time to time, concern the range of means, the type of actions, the actors involved in these dynamics, the place where they are expressed, and even their very purpose.

According to an approach that largely assumes a divergence—at least an ideal one—between areas, a distinctive criterion that can be used to assess the ontology of the subject at hand could be to ascertain whether the acts examined are completely original digital-real expressions or new digital manifestations of classic real dynamics.³ Virtual and physical environments should thus be considered as speculatively endowed with exclusive meanings and bearers of exact terms, while maintaining their mutual accessibility. In this way, the digital domain becomes the expressive and instrumental space of actions,⁴ as in the second case, or otherwise precisely the source and

1 On the complexity of the prosumption process, particularly in relation to data generated in the cultural sphere, see Beer and Burrows (2013).

2 It should be noted that the construction of current—and somewhat “elusive”—metaversal dimensionalities is in line with the technological-cultural evolution observed in recent decades. For example, Bell and Kennedy (2007) discuss the deep-rooted implication of cyberculture on various individual and social aspects.

3 Alternatively, existing offenses are aggravated by the use of new technologies, as in the case of legislation already enacted, for instance, on the subject of terrorism and stalking.

4 Suffice it to recall, as legally established, cases of incitement to commit a criminal offense or cases involving the solicitation of minors under the age of 16—by means of trickery, flattery, or threats, carried out also through the use of the Internet or other networks or means of communication—for the purpose of committing particularly odious offenses.

reason for those actions (thus relating to an activity of production and not only of reproduction, and even less of pure representation; Pascali, 2008). In this sense, it is still possible for identities, whether virtual or digital, to be dissociated, in part due to online disinhibition effects, which are linked to processes such as dissociative anonymity, invisibility, asynchrony, solipsistic introjection, dissociative imagination, and the minimization of authority (Suler, 2004). Thanks to the synchronism and immersiveness afforded by technologically mediated actions, where the very perception of the existence of the tool employed disappears, what is accomplished⁵ can be influenced by one's own digital representations (according to what has been termed the "Proteus effect"; Yee et al., 2009). Noting the above has led to highlighting the "normality" of online behavior connected to processes of de-individuation, with obvious repercussions on the physical plane as well. The danger of unknowingly engendering widespread body dysmorphism must therefore be set alongside that of deliberately generating sensitive dysfunctions in others.

Nevertheless, in a legal interpretation of any unlawful acts of a violent nature attempted or carried out in the metaverse, the consideration of a basic uniqueness (or lack thereof) in connection with the *locus commissi delicti* and/or the place where the effect of the offense may have occurred leads, in any case, back to the proper scope where the typical constituent elements of criminal action can be included. At the outset, a crucial consideration is the classification of the metaverse from a spatial standpoint,⁶ as it has also been characterized as a heterotopia rather than a place (De Simone, 2023). This has inevitably impacted the definition of the criteria for the identification of the process underlying the actions performed.

Instances of cyberbullying, extortion with sexual motivations or characteristics, unlawful media dissemination of other people's data and images, including intimate ones, and cyber instigation to perform unlawful or self-harm acts—all of which, in a broad sense, have underlying psychic dynamics of coercion and physical or moral violence—as well as clearly demonstrating the real repercussions of virtual environments (even constituting hypotheses of death as a consequence of another crime), already widely established, require referral to and comparison with hypothetically incriminating offenses, either generically or specifically envisaged.

For other legal profiles, it should be noted that law enforcement interest in the metaverse⁷ is now apparent (Interpol, 2022a),⁸ not only as a possible area of attention and subsequent repressive action but indeed as a site where to establish a *normal* presence and also for ordinary prevention (Ferri, 2022). In fact, the metaverse seems to

be already characterized by a high degree of harassment and similar behaviors (Patel, 2021). Moreover, such behaviors are destined to result in increasingly invasive effects thanks to improvements in haptic technologies, which can bring about a shift from the sense of pleasure to the actual sensation, not merely psychological, of the violence endured (Mazer, 2022). To address this problem, efforts are being made from several fronts and for different reasons. In addition to the necessary, but sensitive, delegation of the issue to "experts" on the matter, this also points back to the question of risk management, implemented alternatively or in parallel by private companies that organize metaversal information and social spaces. These are obviously affected by business logic (Lombardi, 2022; Pierattini, 2022), with potential improper intrusions in terms of freedom rights. Indeed, it is precisely the issue of governance of social conflicts—together with that of recognizing the nature and property value of the new *res* created (and, therefore, their necessary protection; Wildman and McDonnell, 2020)—that appears to be central already in the first articulated configurations of "virtual worlds" (Lastowka and Hunter, 2004), to be included in a complex geopolitical framework (cf. Vanorio, 2021).⁹ This theme brings us back to the question of examining the legitimacy of the rules imposed in virtual communities. For some (Rolfes, 2022), such legitimacy could be positively qualified only through the prerequisites of consent by the individual user and pursuit of the common good of the user community, which, moreover, must be filled with meaning.

Thus, there is the rise of new modes and new forms of "abusive" behavior in a system that leads to the realization of that pre-conceived perception of an unmediated experiential presence (unmediated but direct and "natural," as well as immersive, shared, and dense with a realism that is also social; Lombard and Ditton, 1997). The problem represented by such a rise is logically followed by the central question of the anticipatory definition of those behaviors, and that of the legitimacy and appropriateness of the remedies put in place to prevent or repress them.

Alongside this, there remains the discussion on the legal liability profiles to be recognized for the various activities carried out by providers of telematic services (Fornasari, 2004, p. 423 ff.), which cannot be limited to omissive conduct (Bassoli, 2009, p. 170 ff.). Therefore, it is important to consider the legal and administrative role of digital platforms in contemporary society. Despite the common narrative (cf. Morozov, 2011), these platforms may actually encourage illicit and deviant behavior (Pascali, 2023) and its public dissemination through their affordances. Additionally, the restructuring and reorganizing process of the underlying network technologies can have an impact on the architecture of relevant publics (Boyd, 2010). Furthermore, this is related to a broader question about the possible and desirable qualities of an "electronic" justice system (Kostenko, 2022), especially given significant scientific advancements (Scorza, 2022, p. 13).

In a way, we are witnessing an incessant chase between new socio-technological developments and rights that can be invoked, also in

5 In addition to the perception of the actions endured.

6 Reference is made to the definition of the Internet not as a place or space but as an instrument for multiple forms of digital communication (Pica, 2004, p. 429).

7 The "challenges" that would be faced—as schematically expressed in Interpol (2022b)—would be recognizing digital identities, protecting data collected in various ways, managing operability between different systems, ensuring cybersecurity, counteracting the effects of the digital divide, and regulating new criminal acts.

8 After all, the world of *Second Life* was already subject not only to the "external" monitoring of postal police sections against various alleged offenses but also, albeit in a piecemeal fashion, to the establishment of specific divisions operating through virtual agents.

9 With ramifications, among other things, on the labor law and labor market levels, as well as in the area strictly related to the regulation of international trade.

relation to concepts such as personal identity¹⁰ and social control and to processes of behavioral engineering, with which every “metacosm” is interwoven (cf. De Vivo, 2009).

For all these aspects, we are brought back to the debate on the nature of objects and events present in these realities, between “realist” and “irrealist” positions, with all the nuances that can be extended therein (McDonnell and Wildman, 2019) and the applicable distinctions between digital and virtual goods.

Incidentally, it must be said that even for these matters—which refer, moreover, to a general jurisdictional question—one cannot overlook how the all-encompassing centrality of digital forms of expression during the pandemic confinement have certainly contributed to accelerating the embryonic establishment of models of contrast.

3 Legal issues: discussions and concluding remarks

The diminishing of a rigid reading of illicit acts carried out through the use of new technologies as purely “projective” manifestations of a traditionally concrete action seems appropriate for an exact framing of “computerized/realized” deviant and criminal behavior of a violent kind—linked to conditions, intentions, and actions—which give different form to the already detected processes of victimization occurring in online spaces (Martellozzo and Jane, 2019).

The assumption of this non-disjunctive action must therefore be compared with the hypotheses of the separation of rights and those rights themselves.

In addition to the inherent long-standing investigative difficulties, for instance, pertaining to the existing mechanisms for identifying in the real world those who operate in the virtual world, through and behind screens (with repercussions, therefore, also on the judicial formation of evidence; Aterno, 2023, pp. 428 ff.), the prosecution of crimes belonging to the above-mentioned categories raises complex issues. Here, it is necessary to relate to a more general discourse on the hypothetical inadequacy of the schemes that govern criminal offenses and, at the same time, to possible reform proposals in light of the protections underpinning it.¹¹

On the one hand, a clear penal caesura between the plans and subjective boundaries of action, though logically clear and for many aspects obligatory, risks being the premise of operations that are unsuitable for fully containing cases that are “elusive” from this point of view. On the other hand, regardless of the hypothesis of an effective

theoretical-paraxial deconstruction of the liberal paradigm in the face of new actions proper to *homo communicans* who came out of the networks of interplanetary communication (Torrão, 2014, p. 61), the possible extension of the criminal prosecution plan, without a decisive framing within the constituent cornerstone of the field, appears to be a prospect with extremely serious consequences and, even more so, a systemically unthinkable one. Although some pronouncements on the subject of the recognition for legal purposes of the character of a public place or a place open to the public with regard to the immateriality of virtual squares (cf. Criminal Court of Cassation, sect. I, sentence no. 37596/2014, on the subject of harassment or disturbance of others) appear to be endowed with a certain exegetic consistency, the risk is still that of an improper and anti-systemic use of the existing cases “for the (social) good.”

In any case, as far as the subject of criminal jurisdiction is concerned, it is necessary to refer to the criterion of maximum attractiveness of the sanctioning instrument for the Italian legal system—even in the face of the complex dynamics of decentralization and, disregarding other parameters,¹² whereby, *inter alia*, the unlawful act is judicially prosecutable even when performed by a foreign citizen and through platforms with a foreign registered office that have an effect on Italian soil.¹³ Nevertheless, in the interpretative adaptation of the forecasts and objections from the physical reality to the digital sphere, we do not refer only to the question of the identification of the spatial location of the acts or the results of the offense and not even to the classical discourse on the means of the offense, but to a differently genetic and real profile. In some respects, the operational and promotional aspects of violence acted out in this manner should, first and foremost, be seen as firmly materializing (or not materializing) a constitutive factor of existing offenses.

Should one then assume—for the sake of argument—that in the cases under evaluation one does not have (a centrality of) augmented reality or mixed reality but speaks exclusively of virtual reality, acting through simulations having the characteristics of reality, and, in this, the metaverse thus becomes a conceptually independent world system, but coexists and interacts in real time with the realm of physicality? This coexistence and simultaneity of physical-virtual realities also pose the problem of the dimension of subjectivity to be pursued. It has been argued in this regard that—on the basis of sweeping away the concept of personal criminal liability, exclusively of a physical nature, by the legislative recognition of such liability as also being of a corporate nature, in antithesis with the legal maxim *societas delinquere non potest*—a kind of “virtual criminal liability” could consequently be hypothesized, i.e., for “virtual subjects,”¹⁴ in any case acting in an

10 This, also in relation to debates on the legal capacity and capacity to act—and consequent responsibility—to be accorded, in various capacities, to the composite and non-homogeneous set of “virtual identities.” Specifically, addressing concerns of ethical sovereignty, legal autonomy, and technical independence of “artificial humans” (Budnik and Tedeev, 2023). Pascuzzi discusses the various meanings of digital identity in the cybernetic context (Pascuzzi, 2020, pp. 44 ff.).

11 The transition from physical to cyber-related crime requires a specific criminological approach (Jaishankar, 2008). Therefore, cyber-criminology has been developed to study the causality of crimes committed in cyberspace and their physical impact (Moise, 2020).

12 Such as that of total or partial accomplishment of the criminal act (with all the problematic nature of the computerized dematerialization of the action) or of the residence of the person who committed it, for the purpose of identifying the competent court.

13 Nonetheless, on the problem of determining the place where the crime was committed, when the passive subject is indeterminate, as in relation to cases of danger, especially abstract (Camplani, 2020).

14 On the tendency to apply a model (of abstraction) based on an idea of anthropization, also in the creation of an “electronic legal personality” (Avila Negri, 2021). In parallel, Magro reflects on the “criminal capacity” of informally artificial creations in the light of causal theory and the finalistic doctrine of action (Magro, 2019, pp. 1203 ff.).

“external world” (Ingarrica, 2022, p. 8), although the identification of “organizational fault,” in truth, seems more pertinent to the system than to the individual.¹⁵ In addition, from a strictly operational point of view, even in all these disparate cases, one is confronted with the possibility of the user-persons being able to regenerate their “innocence” through simply editing their account (whether in a planned or forced way). Moreover, even with regard to what is being protected, it is not at all certain—according to some—that legal provisions designed for “real and living persons” and not for avatars or software codes (the integrity of which would perhaps protect against acts of mere damage to “things”¹⁶) can be used, even including cases of violent annihilation fall more into the sphere of violations related to relational speech and expression¹⁷ (and can then be taken into account as factors in broader hypotheses of threats, persecutory acts and private violence against physically living individuals); and this regardless of the hypothesis of the probability of a virtual dimension of the punishment inflicted (Eberhart, 2022).¹⁸ Clearly, this brings us back, philosophically speaking, to the dilemma of the recognition of legal (and real) personalities to that of computerized creations/projections (Chalmers, 2022, p. 331 ff.) and also, in another way, to all the ethical questions concerning the determination of inadmissibility and the (s)objectivity gradations of seriousness with respect to the perpetration of unlawful acts in computerized role-playing systems (Luck, 2009).¹⁹ In any case, what is virtual is by no means, *per se*, fictitious (so much so that the earliest recorded acts of ‘sexual assault’ in the context of reproduced life²⁰ left specific post-traumatic traces²¹; Dibbell, 1993; although the very definability of power behaviors enacted as concretizing—socially and not legally—acts of such violence is not only uncertain, with regard to delimitation and

content,²² but should also be read in the complex light of “real” social constructionism; MacKinnon, 1997).²³ It should be remembered, however, that the equalization between consideration of “artistic” or digital representation and the essence of physical-anagrammatic characters has already been jurisprudentially made for the purposes of the existence of particular crimes, first and foremost in the area of child pornography (cf. Brizi, 2017; Chibelli, 2017), within a framework of social sanctionability,²⁴ expanding against what can be treated as an inaccurate “cultural danger” (at the expense of strict factuality), so much so that even self-rejuvenation, traceable in the creation and dissemination of one’s own “winking” images, has been branded as *paedo-baiting* (Stokes, 2021).

Nonetheless, whether we refer to the existence of *digital twins* (El Saddik, 2018), that virtually duplicate the presence and properties of physical counterparts (where the emergent behavior of what is physical is present within a complex system; Grieves and Vickers, 2017), and interact with them, whether we are witnessing digital nativities divorced from other levels,²⁵ linked to their own socially normative ecosystems functional to intangible content. In each case, we seem to notice a general formal regulatory deficiency²⁶—in some ways, however, sensible in the face of the ontological fragmentariness of the criminal justice system and, perhaps, partly solvable by customary civil law enforcement—and labile terms on the subject of “meta-rights” (Continiello, 2022). It seems obvious how we do not relate here to dynamics internal to mere experimentation with emotional-relational simulators (almost artificial “reduced scales of existence”): it is not a matter of sanctioning actions and attempts by personal “lab-like” characters, but to weigh the actual personal sanctionability of anagraphically determined individuals (or their

15 Another, but related, issue is that of the hypothetical legal liability of artificial intelligence systems. On this subject, *amplius* Taddei Elmi and Contaldo (2020). The debate also appears to have practical implications in light of the pervasive organization of the ‘internet of things’ (or “of everything”).

16 For a discussion of charges of unauthorized access to and misuse of the data of others (Gentile, 2008). For our legal system, we can, for instance, refer to the incriminating provisions for computer fraud and abusive access to a computer or telecommunications system.

17 Reading what is enunciated as realizing the action it deals with (and the narrative as a reality in itself) can certainly conceptually bring the field of discourse closer to the field of action, but obviously it cannot lead to any arbitrary dislocation on the normative level.

18 Clearly, the violation of more or less formalized rules of netiquette, even if only related to acts of grieving, can lead to very different consequences—collectively shared or individually attributed—from the most frequent ostracism to the rarest “avaticide.”

19 Discussions that lead back to social and juridical rules that are not entirely homogeneous with regards to the criteria that we could define as the “(intermittent) suspension of virtuality,” i.e., the consideration of real disvalue for fictional operations (where thought or being, rather than action, almost seems to be punished).

20 It should be noted that, although the reproduction-simulation of reality carried out in that context still appeared sketchy in terms of stereoscopic impressions, it nonetheless allowed for the “embodiment” of an emotional transfiguration of the peripersonal space, so to say.

21 In addition to “para-judicial” requests for “digital civilization,” some are even advocating for “virtual castrations” (Turkle, 1995, p. 251).

22 The case appears to be even more complex to resolve than that of sexual violence committed at a distance and without physical contact between the offender and victim (which was established as so by the Supreme Court in Judgment No. 25266/2020, III Criminal Section), since the approach between the parties is present but not in physical reality (taken into consideration, however, in the wording of the Supreme Court, as the place where specific acts are performed).

23 This also pertains to what can be categorized as “nonconsensual porn” acted out in the metaverse (Annison, 2022, p. 41); this label appears to be easy to guess, but the content of which appears at least elusive (between unauthorized use of others’ images and coercion on *avatars*). For some further reference to the debated constitution of new forms of pornographic expression, see Cole and Maiberg (2022) and Pandey (2022); while for some hints at the innovative possibilities of grooming and child molestation, see White (2022) and Park (2022). Moreover, this also leads to necessary reminders of the uneven amalgam that gives concrete form to charges of exploitation and, also, aiding and abetting prostitution.

24 Which, moreover, can affect the legal interpretations of adjudicable behavior in light of the appeal to social sense employed in reading them.

25 Perhaps in the context of the “dematerialization” of body and space and the rejection of clear-cut dualism (on which, philosophically and politically, see Haraway, 1991).

26 On the subject of applicable regulations, the metaverse itself, as a space for action, does not yet appear to be coherently regulated at a European level. Only on the subject of artificial intelligence is there a proposal for a European regulation—COM (2021) 206—capable of establishing harmonized rules.

possible subjection to social-preventive measures, where the commission of a *preater delictum* can be hypothesized).

Moreover, the fact that these appear to be globally shared concerns also raises the question of what kind of oversight and control is feasible in light of the nature and type of political systems of reference (see Shead, 2022), not least because standards of social unacceptability can worryingly undermine the idea of the imperative of compliance with the rule of law.

In essence, the complexity and innovative property of the metaverse—which, first of all, is a social place—derive not so much from its being a tool but, rather, from its being an unbroken proper scope as opposed to “non-virtual.” In addition, in light of this, it should be stressed once more that while the declination of the metaverse has often emphasized it as being a space of opportunity (see Duan et al., 2021) and freedom or, at the opposite end, danger (cf. Senno, 2022) and prevarication and oppression, this is precisely due to it being a space in itself, a continuum and a complement, integration of and equal to the classically real.

Some theorists of media studies, even those defined as surreality, might therefore be judged as being useful in gaining a greater understanding of the definitional and regulatory issues underlying the new reality progression.²⁷

²⁷ Given that the *Web* itself, widely considered, has re-proposed the issue of the constant dialectic—not without its highly problematic nature—between technology and rules (see, e.g., Mensi and Falletta, 2021).

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