Movement, embodiment, kinesemiotics: Interdisciplinary approaches to movement-based communication

Edited by
Arianna Maiorani, John A. Bateman, Sandra Petroni,
Bettina E. Bläsing and Vito Evola

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Movement, embodiment, kinesemiotics: Interdisciplinary approaches to movement-based communication

Topic editors

Arianna Maiorani — Loughborough University, United Kingdom

John A. Bateman — University of Bremen, Germany

Sandra Petroni — University of Rome Tor Vergata, Italy

Bettina E. Bläsing — Technical University Dortmund, Germany

Vito Evola — NOVA University of Lisbon, Portugal

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Editorial: Movement, embodiment, Kinesemiotics: interdisciplinary approaches to movement-based communication

Arianna Maiorani[1]*, Vito Evola[2], Sandra Petroni[3],
Bettina E. Bläsing[4] and John A. Bateman[5]

[1]Loughborough University, Loughborough, United Kingdom, [2]NOVA University of Lisbon, Lisbon,
Portugal, [3]University of Rome Tor Vergata, Rome, Italy, [4]Technical University Dortmund, Dortmund,
Germany, [5]University of Bremen, Bremen, Germany

Editorial on the Research Topic
Movement, embodiment, Kinesemiotics: interdisciplinary approaches to
movement-based communication

This Research Topic was created with the idea of offering an interdisciplinary platform for scholars and readers who are interested in movement-based communication and whose work is usually located within traditionally "distant" research fields. Movement-based communication studies are an emerging area of interest within the wider field of Multimodality, an area that offers a real opportunity for exploring new theories and methodologies. The articles in this Research Topic cover a variety of contexts and practices: the common goal is the investigation of the movement-based communication as a multimodal performance with different functions that can be approached by a variety of perspectives contributing to the theoretical and methodological development of this fascinating research area. Specific schools of thought grounded in linguistics and social semiotics have provided groundbreaking analytical tools to Multimodality and have allowed for this research area to develop in multiple ways. However, this disciplinary appropriation did not facilitate much contact with theoretical developments and analytical frameworks generated by a much more diversified ensemble of approaches: this Research Topic wishes to reinforce precisely this type of contact, and it highlights four specific areas of research interest where different disciplines converge.

Movement as exchange of embodied experience and knowledge

The articles that address this area share an interest in investigating common practices as multimodal embodied cognitive experiences. The very act of reading is approached through this innovative perspective by Trasmundi et al. (*Human Pacemakers and Experiential Reading*), who focus on the phenomenon of *cognitive pacemaking*, whereby readers

control attention. The article considers attention shifts as the embodiment of temporality modulations and argues that the meaning derived by readings is not only made by the comprehension of the verbal language used but also by the multimodal engagement emerging from embodied cognitive pacemaking. Embodied interaction is also the focus of the article by Rohlfing et al. (Which "motionese" parameters change with children's age? Disentangling attention-getting from action-structuring modifications), who work on adults-children embodied communicative behavior by investigating *motionese*. The authors describe in this way action demonstrations and demonstrate how these change with children's age through a study based on four analytic parameters—Motion Pace, Velocity, Acceleration, Pauses. In a different context but focusing as well on embodied interaction between adults and children, Katila and Philipsen (Forms of professional interkinesthesia in nurses' body work: a case study of an infant's stepping) explore the complex phenomenon of co-movement of nurse and baby when a baby within its first month of life is checked by a professional nurse to assess neonatal stepping ability. This particular operation is seen as an example of professional interkinesthesia that allows for important information on body development to emerge. This study also opens the door to further investigation into this particular professional skill that is applied in various other areas of body healthcare. In a context that crosses the boundary between embodied communication and embodied performance, Gómez-Lozano et al. (*Influence of Aikido and Taijiquan-Tuishou on Contact Improvisation*) explore the practice of Contact Improvisation in several martial arts, providing a state-of-the-art overview of how this shared practice functions to facilitate a choreographed exchange of embodied cultural knowledge.

Embodied cognition of movement in figurative arts

The articles addressing this area propose new multimodal approaches to explore the embodiment of movement in its pictorial and literary representations, thus showing a new path for reconsidering the experience of described movement. Bolens (*Embodied Cognition, Kinaesthetic Knowledge, and Kinesic Imagination in Literature and Visual Arts*) proposes a new model for studying art reception as embodied cognition. Her article argues that embodiment, kinaesthetic knowledge, and kinetic interaction do not only inhere the act of creation but also the experience of art. She supports her claim with examples based on figurative art and literature, highlighting how representations of dynamicity necessarily involve an embodied elaboration of represented acts of movement, a multimodal, multisensorial experience that that connects to personal perception of kinesis. O'Connor and Cienki (*The materiality of lines: The kinaesthetics of bodily movement uniting dance and prehistoric cave art*) move in the same area but integrating dance practice and prehistoric cave art through a multimodal approach to lines seen as embodiment of movement experience. Drawing on cognitive archaeology and phenomenology, their article foregrounds a new interpretation of *linealogy* and the kinaesthetic response that bodies have to lines as animate entities delineating movement. Both static and dynamic

lines are treated as components of the extended mind which have a phenomenological and representational nature to them; thus, examples of lines and tracings in artistic practices are explored as acts of extended cognition.

Movement as integrated embodied instructions in performance rehearsals

New approaches in the study of the nature and use of embodied instructions in performance rehearsals offer an opportunity to reconsider the value and function of movement as embodied communication in context. In the context of theater drama rehearsals, Schmidt and Deppermann (*Showing and telling—How directors combine embodied demonstrations and verbal descriptions to instruct in theater rehearsals*) use an adapted multimodal conversation-analytical approach to examine interactions between theater directors and actors during rehearsals. Drawing on a large corpus of filmed interactions from three theater productions, they observe that directors manage to produce in their practice a division of labor between *telling* and *showing* where verbal descriptions and embodied demonstrations stand in a mutual reflexive relationship. On the other hand, in the context of dance rehearsals, Krug (*Temporal procedures of mutual alignment and synchronization in collaborative meaning-making activities in a dance rehearsal*) explores the temporal procedures of mutual alignment and synchronization, focusing on how they are used by interactants in a dance performance in order to establish resonance and synchronize with other participants in terms of intensity, speed, and multimodal ensemble. Ingram and Wallace (*Making a mark: Transforming everyday work of city arborists into dance*), instead, conduct a fascinating investigation that integrates two communities, dancers and arborists, in the creation of a dance rehearsal based on the practice of marking together. Their article focuses on movement marking, a type of activity widely used by dancers that is also used by other communities of practice to memorize and co-ordinate movement-based activities.

Movement-based discursive strategies in performing arts

The scholars addressing this area focus on music, dance, and singing performances, showing a specific convergence of interests in researching new approaches to the study of movement-based discourse and the innovative insights these provide. Drawing on Kinesemiotics and Psychomusicology, Prové (*Measuring embodied conceptualizations of pitch in singing performances: Insights from an OpenPose study*) aims at empirically analyzing how conventionality and situatedness interact in embodying spatial conceptualizations of pitch as a property of music. Through the use of the *OpenPose* algorithm to track the movement trajectories, this study investigates the head movements of musically trained and untrained speakers of Dutch in a melody reproduction task as embodied instantiations of a vertical conceptualization of pitch. Drawing as well on Kinesemiotics and the Functional Grammar of Dance, Maiorani and Liu (*Developing Kinesemiotics: Challenges and solutions using the Functional Grammar of Dance*) move

from previous work on classical ballet and apply a new type of annotation to a seminal modern choreography by Martha Graham. Their analysis offers the opportunity for expanding this innovative analytical method and provides new insights into the way specific discursive patterns and functional interaction with costumes are created through choreography. The article by Meissl et al. (*Mapping musical dynamics in space. A qualitative analysis of conductors' movements in orchestra rehearsals*) offers instead a multimodal analysis of five conductors' gestures and movements during orchestra rehearsals that focuses on how dynamics in the music are being elicited via various movement patterns. Interestingly, in their data some instructions are given via mismatched movements, like the use of an upward movement to request louder as well as softer sound. These unexpected cases are described as more than just metaphorically motivated.

The editors of this Research Topic are grateful for the invaluable contributions offered by these scholars and hope that the range of contexts, case studies, and practices covered by these articles will be an example that will inspire the development of future interdisciplinary dialogue and collaborations for the development of Multimodality.

Author contributions

Conflict of interest

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Human Pacemakers and Experiential Reading

Sarah Bro Trasmundi[1,2]*, Juan Toro[2] and Anne Mangen[3]

[1] Department of Literature, Area Studies and European Languages, University of Oslo, Oslo, Norway, [2] Department of Language and Communication, University of Southern Denmark, Centre for Human Interactivity, Odense, Denmark, [3] University of Stavanger, Norwegian Reading Center, Stavanger, Norway

This paper applies an embodied perspective to the study of reading and has a two-fold aim: (i) to discuss how reading is best understood in terms of cultural-cognitive performance that involves living bodies who actively engage with reading materials, and (ii) to spark a dialogue with neighboring disciplines, such as multimodality studies and movement studies, which likewise pivot on how practices and performances involve moving bodies: life is something we *do*. An embodied cognitive perspective considers how performance is constrained by and draws on expertise such as lived experience as well as the material affordances available in the situation. Such a perspective is crucial for reading research as this domain has been, and largely still is, dominated by the view that reading is a silent, disembodied activity that takes place in the reader's brain by means of neural mechanisms. However, recent studies of reading practices are starting to develop new explanations emphasizing the multimodal engagement in reading as crucial for managing the activity. While this perspective is still empirically underexplored, we seek to highlight how reading is managed by readers' dynamic, embodied engagement with the material. We call this engagement *cognitive pacemaking*, an action-perception phenomenon we argue should be considered as the key mechanism for controlling attention. We present here a framework to understand reading in terms of pacemaking by emphasizing attentional shifts constituted by embodied modulations of lived temporality. Methodologically, we combine a close reading of a classic literary text, with the focus on attentional modulation with a qualitative study of university students reading different short texts. We highlight how meaning emerges not primarily from linguistic decoding and comprehension, but also from cognitive-cultural, multimodal engagement with the text. Finally, we conclude that empirical reading research should focus on how embodied reading differs across contexts, genres, media and personalities to better scaffold and design reading settings in accordance with those aspects.

Keywords: reading, embodied cognition, cognitive pacemaking, attention, reading education

INTRODUCTION: READING IS ACTIONAL AND PUNCTUATED

A recent report by *OECD, Future of Education and Skills 2030* (OECD, 2018), highlights two essential and desirable cognitive and socio-emotional skills in modern society: creativity and empathy. In short, the dominant currency in the modern knowledge society is *critical thinking* and its related cousins: imagination, sincerity, and openness to great ideas on which to build

resilient societies. In education, they are often associated with literary reading (e.g., Nussbaum, 1995; Schrijvers et al., 2019) allowing for the creation of fanciful universes, bold thinking, and exploration of various scenarios by engaging in affective-emotional as well as cognitive processes (Mar and Oatley, 2008; Kukkonen, 2016; Wolf, 2016; Mumper and Gerrig, 2017; Dodell-Feder and Tamir, 2018; Trasmundi and Cowley, 2020; Baron, 2021). Importantly, such processes go beyond a simple notion of conjuring (primarily visual) mental images (e.g., Kuzmičová, 2014). However, knowledge about how such cognitive processes are enabled, is scarce. While there is a dawning realization that reading is embodied and interesting work emerges within this field (see for instance; Mangen, 2008; Pirini, 2014; Mangen and Van der Weel, 2016; Norris, 2019; Hillesund et al., 2022), a disembodied view on reading continues to dominate in research as well as in pedagogical practice.

A disembodied view treats reading as a primarily mental operation of meaning-making. On such a view, there is little room to consider the function of the living, encultured body, that is, the person who *does* the reading. Still largely theoretical, work on embodied reading might seem a radical conceptualization; hence, empirical, qualitative work on what the body does and functions during reading is needed to further our understanding of the scientific and educational implications of the embodied turn in reading. Interestingly, modern neuroscience opens questions about the function of the body and culture and claims that cultural life indeed has increased capacities of the human primate brain. Dehaene (2009) argues that neuroscience should be integrated with cultural knowledge about how humans engage in social practices: "The new science of reading is so young and fast-moving that it is still relatively unknown outside the scientific community" (Dehaene, 2009:2). In a similar vein other reading researchers (e.g., Trasmundi et al., 2021) argue that little is communicated across disciplines, and that education is strongly biased by a mental understanding of reading, giving no room for teaching, and assessing reading as an embodied phenomenon in a systematic and scientific manner. In sum, reading is not primarily a silent, mental activity; it is an active, meaningful multimodal performance involving a living, moving, experiential, and encultured body.

As mentioned, only recently—approximately in the last two decades—there has been an increasing interest in the various ways in which reading is embodied (see, e.g., Mangen and Van der Weel, 2016; McLaughlin, 2016; Caracciolo and Kukkonen, 2021; Trasmundi et al., 2021; Hillesund et al., 2022) and multimodal (Pirini, 2014; Norris, 2019). While movement is key in human performances, the questions that remain are how this movement *changes* over time, and how it is enabled. By that we mean how the flow is ruptured, how breaks emerge and how performances are constantly punctuated, slowed down, or speeded up by the pacemaker (that is, the reader).

Despite acknowledged contributions from multimodal studies (e.g., Norris and Pirini, 2016), the role and nature of empirical breaks during reading performances is poorly understood. Typically, these breaks are discussed in negative terms, and conceived as distractive, interruptive, and economically inefficient by reference to, for instance, how digital reading environments cue inattentiveness (Delgado and Salmerón, 2021), constrain attention span (Wolf, 2018), or how a reader struggles to get into what Csikszentmihalyi (1975, 1990) coined as "flow." This critique might be true in terms of external disturbances when, e.g., a reader is distracted by a notification of an incoming e-mail. However, punctuations can also be self-enacted, as when the reader's attention is prompted by curiosity which enables her to scrutinize a phenomenon further. Thus, different from ruptures imposed externally, breaks in the reading flow enacted by the reader are not necessarily disrupting or detrimental to reading.

In this paper, we emphasize the nature of the pacemaking and punctuations, the shifts in flow and breaks for reading experience. We hypothesize that these pacemaking processes in reading *amount to* imaginative and critical reading. In the next sections we will elaborate on what pacemaking is, what embodied processes it comprises, and what we understand by imaginative and critical reading. However, we can advance already that if our proposal is correct, it will be possible to find empirical support showing that imaginative and critical reading is accompanied by complex pacemaking processes enacted by the reader while reading and, correlatively, that cases in which the reader's pacemaking is partially inhibited—by her own reading habits or by the situation—there will be a diminished level of imaginative and critical reading. We suggest that this focus will generate insights about how readers engage with texts by use of very different embodied engagement patterns.

Adequately accounting for reading thus requires (1) applying embodied frameworks to cases of reading and (2) expanding the boundaries of movement studies to include neighboring disciplines that due to its more subtle interaction dynamics will showcase the value of embodied approaches to higher cognition practices, such as reading. Our focus is modulation of attention in reading through an embodied cultural-cognitive framework. We suggest combining movement and multimodality studies to cognitive-oriented views to demolish the internal-external boundaries between communication and cognition (Trasmundi, 2016) to foreground skilled, experiential bodies (Trasmundi and Harvey, 2018).

Imaginative Reading: Pacemaking and Timescales

Consider the simple question: What is reading? To answer that question, you will need to consider an array of activities that go on as you engage with written material. For instance, imagine every rapid embodied adjustment and gesture your body makes: how often you vocalize, re-read syllables, words or passages; how you speed up or slow down; imagine the rapid saccading that goes on, or how you look up and away from the page, how you impose rhythmicality, stop, continue, go back, make connections and free associations, how you leaf through passages, point to the material, put it down or move it closer to you, how you underline, sigh, laugh, and generally experience emotional responses such as frustration, joy, and confusion. Consider the ongoing imagery, the ineffable aesthetic experiences—which consist of much more than the "linguistic

meaning" of the words you read. You constantly make *embodied-affective judgements*. Those judgements are the human mortar of *imagining*.[1] That is, your reading is much more multi-actional, punctuated, dynamic, and non-linear than commonly described in the reading research literature.

Punctuations play an important but hitherto neglected role in reading experience and performance (Trasmundi et al., 2022). Specifically, such ruptures and breaks may be fuelling the development of higher cognitive processes such as imagining as it requires the reader to make judgements during the reading, hence, to control the reading pace very dynamically. In what follows, we suggest viewing imagining as grounded in a particular reading practice which is bounded by how flexibly a reader adapts to and exploits emotional responses. The degree of a reader's executive freedom depends on how well the reader improvises *in situ*; a result of both experiential backgrounds and social norms for curious behavior (Montani, 2019; Loaiza et al., 2020). Within an embodied approach, imagining is thus treated as a depicting; that is, a creation rather than a representation (Asma, 2017; Trasmundi, 2020). This view has been characterized as the embodied cognitive turn in imagination research and a steppingstone toward the development of an anti-representational model of imagining in reading (Van Dijk and Rietveld, 2020). However, studies of embodied imagining remain anchored in goal-oriented and highly performative contexts (sports, arts, music, design, etc.) where the coordination of the body and body-tool relation is the locus of interest (Malafouris, 2014). Embodied imagination researchers have been reluctant to enter territories that are saturated by language—such as alphabetic reading. Rather than approaching imagining as an operation of structuring semantics based on grammatical constructions on a page or screen, an embodied approach turns to the reader's rapid, observable judgements *during* reading. Thus, breaks are assumed to function as a "construction resource" that enables the reader to exceed control over imagining, because temporal delays can be exploited for sculpturing and strengthening a reader's stance. However, to our knowledge, no one has studied reading as a performance that changes over time. Embedded in reading, imagining becomes a complex process where the words on the page or screen play only a part (Duncker, 2021), and where the reader engages with her own engagement to read what is *not* in the text. While it is commonly agreed that reading involves more than decoding (Duncker, 2021; Kravchenko, 2021; Trybulec, 2021), the "more" is nevertheless a mysterious field. Often "the more" is ignored, or, alternatively it is treated as an epiphenomenon secondary to and depending on other underlying cognitive functions. Who you are, what you know, and your current mood constrain what you do with the text, and vice versa. Nevertheless, dimensions such as these are rarely considered part of reading proper, by reading researchers across disciplines.

To fill this gap, we propose a framework that models reading (regardless of its specific cultural manifestation) as an embodied and distributed performance (Benne, 2021; Trasmundi and Cobley, 2021; Trasmundi et al., 2021) emerging from the integration of different timescales (see **Figure 1**).

The model provides an analytical focus on how embodied reading is enabled by a reader's ability to manage the pace—a process that we will coin "pacemaking"—and how the reading can thus be observed as unfolding on a pico-micro-macro continuum. When the analyst zooms in on the rapid movements of the reader [the pico-scale[2]], the reader's modulations of attention and the attentional shifts can be tracked empirically as saccading, rapid zooming in or out, etc.

When focusing on the ecological, micro-conversational scale of interaction[3] (this scale is concerned with situations/interactions unfolding in seconds and minutes), the embodied strategies that constitute the modulations of attention enacted by the reader during reading will surface, and can be identified as strategies or tricks to manage the task such as note-taking, highlighting, pointing, etc. Finally, when the analyst considers slower timescales pertaining to the reader's lived experience (the macro scale), affective-cognitive judgements can be identified as the reader's habitual forms of engagement, such as motivation, values, norms, interests, etc. Empirically, this socio-personal style is often interpreted in the emerging pattern of selective judgements; e.g., fixation on aspects, skipping others, emotional stances such as frustration, curiosity, etc.

The model we propose of imaginative reading consisting of processes unfolding at different timescales bears an interesting resemblance with, and can be enriched through, the analytical tools provided by multimodal interaction analysis (MIA) as developed by scholars like S. Norris and J. Pirini (see Norris and Pirini, 2016). Indeed, MIA provides a framework to perform detailed analysis of mediated actions (social actions) which comprise higher and lower level actions. Lower level actions, according to Norris and Pirini, include embodied processes like gestures and postural shifts, which seem to correlate with what we have called here embodied punctuations at the micro-timescale. In the same line, what we have called here modulations of lived temporality, at the macro-scale, could be interpreted within the MIA framework as higher level actions, which are defined within MIA as a chain of lower level actions. In sum, we conjecture that including insights from the MIA framework to the present enquiry would shed light on the issues here addressed. We leave open this line of enquiry for future research.

Crucially, as reading happens in the here-and-now, it is enabled by and draws on this temporal meshwork. The bi-directional focus of pico-micro-macro allows the analyst to interpret how the slower timescales are inherent in the rapid and how the rapid coordination movements sculpture the slower habitual forms of engagement.

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[1]In our parlance, *imagination* relates to the outcome of a process, whereas *imagining* is the creative, constitutive process of sensational impressions.

[2]Pico-scale refers to Thibault's (2011) notion of the rapid flow of minuscule, fast inter-bodily movements that enable humans to self-organize—often these processes happen below 200 ms.

[3]Gibson, referred to the 'human perception timescale' as ecological: "*Human observers cannot perceive the erosion of a mountain, but they can detect the fall of a rock. They can notice the displacement of a chair in a room but not the shift of an electron in an atom. [...] [E]mphasis will be placed on events, cycles and changes at the terrestrial level of the physical world. The changes we shall study are those that occur in the environment.*" (Gibson, 1979:12).

FIGURE 1 | Model of reading as a process unfolding at multiple intertwined timescales spanning pico, micro and macro behaviors. The model is elaborated further in **Figure 6**.

By approaching reading from this multi-temporal and embodied perspective, we develop an account of reading that considers it as a much more complex and richer phenomenon than the act of decoding and interpreting symbols on a page or a screen.[4] We thus argue that readers are cognitive pacemakers, who—due to their experiential, embodied agency—are able to mesh multiple timescales for situational purposes. Imaginative reading, we will see, is centrally involved in the reader's capacity to modulate attention, modulate embodied processes, and modulate lived temporality in reading.

METHODOLOGY: THEORETICAL FRAMEWORK AND DATA

Our point of departure is an embodied and distributed understanding of reading that takes seriously the neuroscientific evidence suggesting that different readers experience texts differently (Hruby and Goswami, 2011; Trasmundi and Cowley, 2020; Trasmundi et al., 2021) This fact entails the deceptively simple questions: *what does the reader attend to while reading, and how is that attention enabled and managed?* Answering these questions requires investigations of situated reading practices to explore how readers control attention. However, we also need to inquire into essential aspects beyond the reading that constrain how attentional processes unfold; like the role of the reader's previous knowledge of the text, her personal memories, and the argument or story being developed by the author in the text, among many other elements. We thus designed an empirical study that allowed investigations of such questions. Specifically, our qualitative analysis of embodied reading is informed by empirical data that we have gathered through a semi-experimental setup in which university students read an academic article and a short story on paper. In this study 8 university students were asked to read a literary short story and

an academic article. The reading set-up was semi-experimental: the project team decided the time, place, and texts, however, there were no specific task beyond the instruction to read as they used to read both genres. We video-recorded their readings of both texts. After each reading, they filled in a questionnaire about their immersion and absorption processes, and they were interviewed and asked to elaborate on their reading experiences. The dataset gives a broad indication of how students engage with texts and how attention relates to embodied affective-cognitive experiences.

In the following analytical section, we use interview data from this study to shed light on how reading processes are experienced and constrained in practice. With this dual theoretical-empirical perspective we intend to show (1) the value of an embodied and multiscalar approach to reading, and (2) how the categories in the proposed model translate to empirical observations of readers' embodied engagements with texts. The outcome of such a deductive-inductive analytical procedure will be an innovative and interdisciplinary theoretical framework for understanding experiential reading, particularly focused on explicating the temporal complexity in actual reading performances. This complexity, we claim, is observed in how the readers *perform* reading through different embodied strategies.

The main objective of this article is to develop the aforementioned framework, which renders a more comprehensive and nuanced, embodied model of reading that treats it as multi-scalar, and which opens up for its punctuated nature in relation to attentional shifts. To do this, we have adapted and further developed a theory of the structure of consciousness initially proposed by the phenomenological philosopher Gurwitsch (2010). Our framework is based on theoretical and analytical considerations about the processes we have identified as crucial in reading (see **Figure 1** above). The real value of this framework, we argue, depends on its applicability to generate, interpret, and integrate empirical reading data.

To illustrate the central notions of our embodied framework of imaginative reading, we combine in section Analysis: From Reading to Readers a close reading of the well-known novel *Don Quixote* with findings from a semi-experimental study of university students' reading performances. We introduce a close reading of excerpts of chapter 22 of Cervantes' *Don Quixote* with the sole purpose of illustrating the notion of

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[4]Empirical evidence indicates that it may make a difference for higher-order reading processes such as comprehension whether the symbols are displayed on paper pages in a book or on a screen display (for meta-analyses, see Delgado et al., 2018; Clinton, 2019). Word limit prevents a more thorough exploration of the role of the substrate on which the text is displayed, but see Mangen (2006, 2008) for a phenomenologically inspired approach to the distinction between reading on paper vs. on screens.

attentional sphere and the attentional shifts that we consider central to a description of reading in terms of attentional processes. The formulations of the attentional transformations proposed by Gurwitsch can be very abstract, so we consider that applying them to a concrete case—a Don Quixote's adventure— will make them easier to comprehend. In addition, applying the attentional transformations to a concrete case of reading helps clarify how attentional processes unfolds during the act of reading.

On the other hand, the role of the experiential reports in the general argument of this article, although illustrative too, is to provide actual experiences of readers as reported by them briefly after reading. Through these experiential reports we aim at highlighting how the attentional shifts are associated with embodied processes in real life cases, and how some attentional shifts can be identified in the reports offered by the participants.

Therefore, the general aim of combining experiential reports and a close reading of Don Quixote is to highlight and explain the key components in the framework and to showcase the framework's relevance more generally by using it as an analytical tool for analyzing empirical data of how students engage with different kinds of texts.

We now turn to the analytical section in which we develop the theoretical framework of attention modulation during reading. In addition, we show how that abstract model can be applied to interpret and integrate various types of empirical data.

ANALYSIS: FROM READING TO READERS

The attentional processes underlying reading at the pico-timescale are much more varied and complex than previous theories of reading and of attention portray (see, e.g., LaBerge and Samuels, 1974; LaBerge, 2002). In addition, identifying some of the crucial mechanisms underlying attentional processes in reading can shed light on how imagination, creative and critical thinking are constrained by and developed through different reading strategies.

We claim that these attentional processes underlying reading do not unfold in a disembodied abstract mind: readers are always reading in a socio-material context. Following the principles of embodied cognitive science, we conceive the reader as an embodied and situated agent. This perspective means (a) that a study of reading must, in turn, involve a study of the reader, and (b) that we treat the reader's attentional processes as fundamentally embodied, yet also shaped by previous embodied experiences. We apply these insights in our analytical framework, which we will develop throughout the article, by emphasizing how embodied strategies of pacemaking in the range from pico- to macro-timescales co-determine the attentional shifts unfolding during reading. Altogether, this multi-scalar perspective reveals how readers rely on basic cognitive pacemaking skills to constitute the pace of reading at every moment of the process: slowing down here, accelerating there, and stopping altogether over there. This pacemaking trajectory is dynamic and thus changes during reading as the reader's attention is prompted. The model is further elaborated

and introduces a heuristic of categories unfolding on each temporal scale that the analyst can attend to (see below).

Below follows a step-by-step description of the framework which, illustrated with empirical case examples throughout. The description covers the categories and their relation to different temporal scales as depicted in the model above. First, we introduce the notion of attention, conceived as a multi-scalar and embodied modulation of reading behavior (section The Role of Attention for Imaginative Reading). We argue that this basic notion of embodied attention is necessary to understand how imaginative processes emerge in reading (section Setting the Scene: Imaginative Pacemaking in a Close Reading of Don Quixote). In section Attentional Shifts and Transformations by Pacemaking Readers, we describe four kinds of attentional shifts (serial shifting, singling out, synthesis, and enlargement) at the reading pico-timescale (cf. the left box in **Figure 2**). We integrate the concomitant embodied punctuations at the micro-timescale (cf. the middle box) and the modulations of lived experience at the macro- timescale (cf. the right box) in each attentional shift to underline the multi-scalar and embodied nature of reading performance. Together, this framework provides a conceptual frame for investigating imaginative reading as cognitive pacemaking instantiated in the underlying processes enacted by the reader that unfold at different timescales. In the concluding section (section Concluding Remarks and Educational Implications), we flesh out the implications of our model for educational practices around reading. Finally, we underline the untapped potential entailed in an interdisciplinary endeavor such as ours, by encouraging reading research and multimodality and performance studies to engage in fruitful dialogue about the role of embodied cognition.

The Role of Attention for Imaginative Reading

While imaginative processes require attention of some sort, we are here interested in defining the dynamic nature of attention and its enabling conditions. Within an embodied framework a model of attention must consider how attention is enabled, managed, and modulated through performance. The phenomenon of attention has been studied systematically since, at least, James' (1983) seminal work *The principles of psychology* (originally published in 1890). James' proposal reduces attention to two co-existing processes: (i) the accommodation or adjustment of the sensory organs, and (ii) the anticipatory preparation from within the ideational centers concerned with the object to which attention is paid (James, 1983:411). Importantly, James' conception of attention shows the concomitance of two kinds of processes: the embodied acts of adjustment to the object of attention, and the imagination or anticipation of it (see also Mole, 2021).

Despite James' influential contribution to the conception of attention as whole-bodied agency, its embodied aspect has been overlooked in most of the research on attention in the last 100+ years. In the 1950's, the cognitivist conception of the mind treated it is mental, and brain-bound. Attention, thus, was explained in terms of computational information processing

FIGURE 2 | General model of pacemaking in imaginative reading. The model illustrates which timescale relates to specific categories under scrutinization.

(see Thompson, 2007). This view of attention gained ground through the work of Broadbent (1958) who treated attention as *a bottleneck* in information processing. Broadbent's idea is simple and compelling: we need to filter out the noise from the overflow of information, which, he argues, becomes a job for the attention (see Mole, 2021).[5]

Within this cognitivist framework, LaBerge and Samuels (1974) proposed a seminal account of reading in terms of prevalent theories of attention. According to their proposal, two attentional processes are involved in reading: an automatic letter-word decoding process, and a controlled

translation/comprehension of entire sentences. Simply put; it is the brain that reads. The logic underlying this idea is that due to the limited information-processing capacity of our brains, it is important to automatize some of those processes through statistical learning. By automatizing such processes, the system liberates capacity to perform the more demanding information processing tasks. This is how LaBerge (2002:223) describes the process:

> Upon first exposure, letters and words require attention in order to be perceived as units, but with repeated exposures they can be perceived without attention, i.e., automatically. Attention also is required at first to associate perceived words with their meanings, but with practice, a word can evoke its meaning without attention, i.e., automatically. Thus, when visual words are perceived and their meanings accessed automatically, attention can be dedicated entirely to the goal of reading, which is the comprehension of the combined word meanings in sentences.

In this model, reading is "flat" and denotative, in the sense that nothing emerges beyond the meaning "already there." Despite the problems of LaBerge and Samuel's (1974) proposal, its theoretical value is undeniable, especially if considered together with later developments (e.g., LaBerge, 2002). Specifically, LaBerge and Samuel showed how some of the attentional processes gradually become less conscious and more automatic. The most important shortcomings of their account derive from some of its core cognitivist assumptions. First, in line with the cognitivist paradigm, LaBerge and Samuel assumed that reading happened in the brain, and they thus disregarded the living body, the reader. Second, even though in some respects the theory can be interpreted as a description of the reading experience, it is mostly concerned with the sub-personal mechanisms underlying

[5]Another highly influential account of attention, developed in the 1980s by Anne Treisman, is that according to which attention is a process that binds together the different properties (color, shape, smell, motion, etc.) into a unitary object of perception. Attention solves what is known as the binding problem, derived from the claim that the properties of the object perceived are processed by different detection centers in the brain (one for color, another for shape and so on). In very general terms, the Feature Integration Theory claims that by delimiting spatially the "window" of attention (i.e., by focusing on the space in which the object is located) all the features perceived at one location are merged into one and the same object (see Treisman and Gelade, 1980; Treisman, 2003). Probably the contemporary theory of attention that has moved more decidedly toward an embodied account has been the selection-for-action theory proposed by Neumann and Allport independently of each other in 1987 (see Allport, 1987; Neumann, 1987), and later taken up by Wu (2014) and other theorists. Wu formulates it as a conditional: "If subject S selects X for some action A, then S attends to X" (Wu, 2014, 83). If, for instance, I select out of a set of many objects a football to kick it with my left foot, I have selectively attended the football for my action of kicking. This is not the place to analyze in detail this theory of attention, however, we would like to emphasize two aspects of it that are relevant for our present purpose: it proposes an account of attention that gives pride of place to bodily action, and it describes attention at the personal level of explanation. Despite these two important features of the selection for action theory, it still doesn't take us very far when it comes to describing the highly complex attentional processes occurring in the act of reading.

FIGURE 3 | Simplified model of Arvidson's interpretation of Gurwitsch's account of the field of consciousness.

reading, such as neuronal structures. For this reason, the description of the experience of being attentive to the content of the text, and to the symbols displayed on the paper (or screen) is superficial. And third, the conception of reading is narrow and reductionist as it conceives reading as the act through which the reader grasps some fixed meaning encoded in a text (i.e., reading defined as information processing).

To address the above-mentioned shortcomings, we adapt Gurwitsch's (2010) schema of attention to a recent embodied cognition framework. In Gurwitsch's theory, the structure of attention can be likened to a sphere constituted by three dimensions: *the theme* (at the core) *the context* (surrounding the theme), and *the margin*, as the outer shell. This idea has been visualized in Arvidson's (2006) reinterpretation of Gurwitsch's theory (see **Figure 3**).

Setting the Scene: Imaginative Pacemaking in a Close Reading of Don Quixote

To illustrate how the content of a specific experience is distributed in the dimensions of the attentional sphere, imagine you're reading the novel *Don Quixote* in the 1008-page paperback version published in the Oxford UP World's Classics series. *The theme* corresponds to the focus of attention, in which the object of attention appears as a well-formed, unified, and coherent whole. You are for the moment focused on the event in which Don Quixote liberates 12 prisoners who are being taken to the galleys by the King's orders (Cervantes, 2008:Ch. 22). That event is the theme of your attention. Don Quixote's encounter with the prisoners emerges, as the object of your attention, from *a context*, and the encounter between Don Quixote and the prisoners gets its meaning from it. Here the context is constituted by many elements: what you've read so far about the adventures of Don Quixote (you already know about his madness), your personal memories about similar or related events, the knowledge you have about literature, about history, etcetera. There is, then, a relation of relevance and co-dependency between the context and

the theme, and both constitute a gestalt unity of foreground and background. Some parts of the context might be more relevant for the theme than others, but all of them hold a relation of coherence insofar as they serve as the context for the theme. Since attention is a dynamic process, whenever there are changes in the theme, there are necessarily corresponding changes in the context. You could, for instance, focus for a moment only on one word and its meaning in a specific sentence. In that case, the encounter of Don Quixote and the prisoners ceases to be in the theme and becomes part of the context of your attention (this is one of the many possible attentional transformations).

Finally, *the margin of attention* presents the socio-material situation more generally, which is not directly related to the theme and the context but is nevertheless co-present with them. While you are reading, focused on Don Quixote's adventures, there might be the noise from someone mowing the grass outside. This not necessarily disturb your experience of reading, but it is still noticed as unimportant. At the same time, you may be aware that the light is dim, and that the room is warm, and that in general there is a whole environment around you, but none of this appears as part of your focus on Don Quixote. You are also aware of the time passing by while you read, but you are not focusing on that either. Your progress through the thick paperback is indicated by the tactile feedback of the substrate (volume) of the book, indicating roughly how much you have read of the text, and how much remains. By comparison, if you read this novel as an e-book, such information is rendered only visually. Whereas, you may not be aware of it, empirical evidence suggests that the differences in sensorimotor contingencies between a print book and a digital display may affect aspects of the reading experience (Mangen and Kuiken, 2014; Mangen et al., 2019). And, finally, you may also be aware that you are sitting on a sofa, with your legs crossed, and a bit tilted to the side, so you catch the light from the lamp beside you.

In this description the three orders of the margin identified by Gurwitsch are present: (1) a certain sector of our perceptual environment, (2) the stream of consciousness, and (3) our embodied existence (see Gurwitsch, 2010). The stream of consciousness refers to the lived time that is necessarily co-present with any experience, and the embodied existence concerns the pre-reflective awareness of being in a certain bodily posture and performing some specific bodily act—e.g., turning the page by swiping across a screen or turning over a sheet of paper in a print book. From a phenomenological point of view, the three orders of existence in the margin are far from being contingent or unimportant: they are, in Gurwitsch's words "*an a priori necessary condition of consciousness*" (2010:448; see also Merleau-Ponty, 2012).

This account of attention applied to the specific case of reading makes progress in important regards compared to previous accounts. It introduces the topic of embodiment as a necessary element in the theory of attention. Moreover, Gurwitsch's account calls attention to the lived temporality and its transcendental role in all attentional processes (which we will develop further below, in relation to pacemaking). And, finally, by conceiving attention as a struggle of inter- and intra-dimensional forces, we can develop an account of reading that goes beyond the act

of decoding letters and words, and grasping meanings encoded therein. Attention is thus not fixed, but a flow that changes throughout the course of reading, and finally it is a cultural practice that also impacts how habits and forms of attending proves useful within a certain sociocultural niche. We will now present how those specific attentional shifts are enabled and how they relate to imaginative reading including creative and critical thinking.
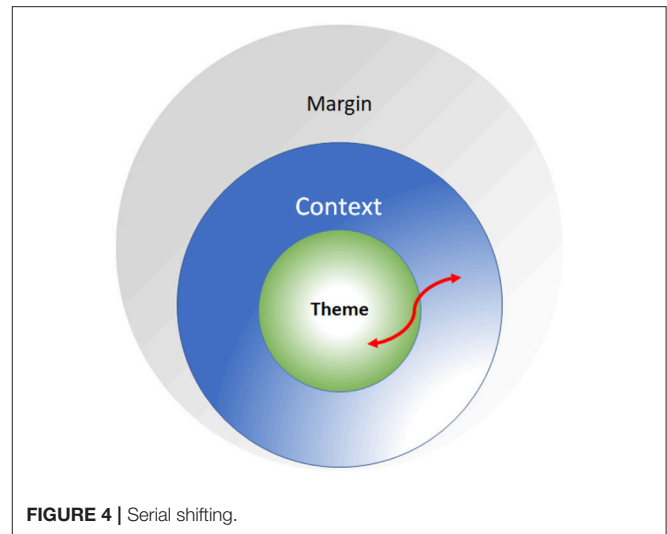
Attentional Shifts and Transformations by Pacemaking Readers

We have emphasized the dynamic and bodily character of attention. The fact that we frequently shift our focus during performances reveals an intrinsic feature of attention: it is a tension—a battlefield of forces, pulling us to attend to these forces at every moment. As fleeting as our attention might be, the transformations it undergoes hold a regularity that can be described in terms of the modifications of the theme, the context, and the margin. Some attentional shifts occur within one of these dimensions, others are more radical and modify all dimensions at once. In what follows, we describe some of the most relevant transformations of attention in principle (see Arvidson, 2006 and Gurwitsch, 2009:ch. 10), and propose how reading can be understood in terms of those transformations within an embodied framework. We elaborate on the embodied punctuations as pacemaking operations that are the empirical anchor points around these attentional transformations. We suggest a heuristic of four kinds of attentional transformations as visualized in **Figure 2**: serial shifting, singling out, synthesis, and enlargement. For the sake of simplicity, we continue to refer to the reading of the novel *Don Quixote* in the medium of a print book. The role of the medium (and substrate) for experiential aspects of reading is only beginning to be understood (see, e.g., Spence, 2020; Baron, 2021; Hillesund et al., 2022), and a more in-depth exploration of the ways in which the affordances of the substrate may affect embodied-affective reading is currently pursued in a follow-up paper.

Serial Shifting

Serial shifting emerges in a specific kind of exchange between the theme and the context: from the context emerges a content that becomes the new theme, and the former theme becomes then part of the new context (see **Figure 4** below). Gurwitsch describes it as a progress "*from one theme to another; however, to a theme which was materially related to the one 'held in grasp' before, both belonging to one and the same sphere of objects*" (Gurwitsch, 2009:255). Other examples of serial shifting are listening to a song, performing a step-by-step task, and listening to a story (see Arvidson, 2006).

We claim that the main attentional progression in reading corresponds to serial shifting. To continue with the example of reading Don Quixote, let's suppose you are now reading about the encounter of Don Quixote with the prisoners. You keep reading about the reasons why the prisoners have been sent to the galleys by the king, and how Don Quixote ends up attacking the guards to release the prisoners. Here, the theme of attention goes from Don Quixote's encounter to the reasons why they have been held

FIGURE 4 | Serial shifting.

prisoners, then to Don Quixote's deliberations about why they should be set free, and finally to his attack of the guards. At each progression, the former theme becomes part of the context, and the context frames the theme. While you read about the reasons the prisoners give for being held captive, the whole scene of the men tied with chains recedes to the context and now the focus (the theme) is the reason that one of the prisoners give: "I am going for making a little too free with two she-cousins-german of mine, and with two other cousins-german not mine: in short, I carried the jest so far with them all, that the result of it was the increasing of kindred so intricately, that no casuist can make it out" (Cervantes, 2008:167). Don Quixote keeps asking the prisoners, and he concludes that they should be set free. While you read his thought process, the stories of the prisoners become the context, thus informing Don Quixote's argument to liberate them. And, finally, when you read that Don Quixote charges against the guards, the previous events you have read about constitute part of the context, which gives meaning to Don Quixote's attack.

In reading, then, we see an attentional progression in which each part that has just been read becomes the context for the new theme, while, at the same time, an element that was in the context only vaguely or implicitly, is addressed and developed in the theme. Surely, there are many ways to read, beside the "orthodox" one: the reader might skim pages, go back to look for a specific paragraph, and so on. However, even in these cases, serial shifting is taking place, though possibly in a hybrid form, combined with other attentional transformations. This attentional progression at the temporal rapid scale is necessarily linked to embodied processes ranging from temporally pico- to micro scales that make the progression possible and regulate it. Trivially, the movements of the eyes over the letters and words are embodied processes associated with serial shifting. But, in addition, we find here the movements of the hands to hold the book at the right distance, the legs and torso to keep the posture adequate for concentrating on the text, the often the unconscious

movements of the mouth that accompany difficult parts of the text, etc.

If readers adapt to the social norms for reading in this scale, thus avoiding becoming reflectively self-aware, we can claim, following Gurwitsch, that the embodied processes remain at the margin of this attentional progression. While you are pre-reflectively aware of many bodily processes unfolding while you focus on Don Quixote's misadventures, you are aware of your (lack of) effort to maintain the flow: for instance, by keeping the right distance of the book to your eyes, and of the book to the lamp, among many other embodied acts. Nonetheless, even though all these processes are integral to your act of reading, they mostly remain outside of your focus on the story when absorbed, but rather they are supporting it, making it possible, and regulating it. Sartre describes similarly the consciousness of the body while reading: "The body is in no way grasped for itself, but it is a point of view and a point of departure: one after the other, the words slide before me; I *make them slide*" (…) (Sartre, 2018:443. Italics in the original). If the embodied processes forced their way into the theme, they would disturb the act of reading, and the body would cease to be a 'point of departure' to become the focus of the activity. This is how one of the participants in our semi-experimental study describes her experience of reading in bed: "*[when I read] in bed I can't just stay in one position, so I have to change: I will lie down a little, now I'll turn around on my stomach, and there are all this things; whereas if I'm sitting at my desk the most I'll do is probably swing from side to side (in the chair), but I can still keep my eyes on the text even when I'm doing that (swinging in the chair).*" And she added, in relation to reading an academic text, "*I definitely think it is easier to concentrate on a text like this when you are sitting in a more formal setting, whereas if it's more cozy I would feel tempted to just fall into the coziness.*"

However, becoming aware of these embodied processes while reading can sometimes be very helpful for the reader too. In our empirical data we observe how readers would read aloud to feel the words in the mouth, or repeat a word because it sounds strange, moving around and paraphrasing the text to simulate an author, yet at the cost of not remembering *what* it said, only *how* it felt saying it. In our account, it is worth paying attention to, rather than ignore, how those embodied breaks are often at odds with normative, serial shifting, because reading is not simply functional, it can be an aesthetic, playful activity too (Trasmundi and Cowley, 2020).

There are more than the embodied processes associated with serial shifting that lead the reader's way while reading. The reader is also pre-reflectively aware of lived time. We are less concerned with chronological time and emphasize how experienced time and the ability to make temporal regulations of action-perception is fundamental. For instance, the reader feels in control of time insofar as she can slow down in a part of the story that seems obscure or hard to understand, or she goes fast because she is eager to know what will happen next (see, e.g., Kukkonen, 2021 on how this may play out during the reading of various types of narratives). She is, as a reader, a cognitive pacemaker: she modulates time in relation to what she's reading, to how she makes sense of it. And, in modulating time, she adjusts her body accordingly, which should also accord with the attentional

progression going on. This modulation of lived time unfolds at the macroscale of temporality (see **Figure 1**).

This characterization of reading as embodied and temporal serial shifting provides elements to distinguish it from other cases of serial shifting, like listening to an audiobook or listening to a song. The differences do not pertain to the attentional progression itself, but on the embodied and temporal aspects that necessarily accompany each of them. The capacity of the reader to modulate the rhythm and pace of reading is unique, compared to listening to a story, where the flow and pace is constrained and fixed by a narrator. This difference has crucial implications regarding the sense-making of what is being read. The sole possibility of slowing down as the story gets complicated, intriguing, etc. is enough to show the cognitive relevance of modulating the lived time. It is when the reader engages and controls the pace, that she allows for her imagination to shoot ahead too. If needed, an embodied punctuation at the temporal micro-scale can be enacted, and this may in turn allow ideas to percolate. This modulation is what we define as "the glue of imagination," as it is always *there*, going on, and it requires an extreme degree of timing to develop and manifest. The import of the modulation of time, embodiment and attention while reading will be elaborated further as we present other attentional transformations that can be essential for experiential reading.

Singling Out

Singling out is one of the most researched attention transformations, also known as "selective attention" (Arvidson, 2006). In it, an element of the theme becomes the entire focus of the theme, in a process similar to "zooming in" (Gurwitsch, 2009:266–270). This attentional transformation modifies both the theme and the context: the theme is now entirely occupied by what previously was just a part of it, and the rest of the elements in the former theme become part of the new context (see **Figure 5**).

Imagine you keep reading about how Don Quixote liberated the king's prisoners, and you get to the part in which, in return of the favor, Don Quixote asks the prisoners to:

> "laden with this chain, which I have taken from your necks, you immediately set out, and go to the city of Toboso, and there present yourselves before the lady Dulcinea del Toboso, and tell to her, that her Knight of the Sorrowful Figure sends you to present his service to her; and recount to her every tittle and circumstance of this memorable adventure, to the point of setting you at your wished-for liberty" (Cervantes, 2008:172).

This request seems extremely peculiar to you, so you might stop reading, and pay further attention to it. You go back and re-read the passage: what is Don Quixote really asking? Did you understand it well? Why would he ask something so unusual? What would he get out of it? In this case, the rest of the event of the prisoners recede to the background (i.e., to the context), and now your focus is exclusively on Don Quixote's eccentric request.

Singling out, at the micro timescale, is a central modulation of attention in quality reading. For a proficient reader, a text is always uneven in relation to what is relevant or interesting,

FIGURE 5 | Singling out.

some parts of the text immediately call for careful attention for the reader for many possible reasons (personal, normative, tactile/material). When a reader identifies a part of the text as relevant, several coordinated processes at different timescales start in association with the attentional transformation of singling-out: the reader might go back and re-read the relevant excerpt. This is a part of an experiential report of another participant in our study: "*Whenever I read any kind of sexual act or a physical act in a book, even if it's not sexual, whenever an author tries to describe a physical thing, either be punching or whatever it is (gesturing bodily movements), I always kind of have a problem visualizing it, I kind of always need to re-read it.*"

Also, the reader might stop reading and take some notes in the margins of the text to develop further the ideas evoked by the relevant section. All these embodied processes are identified in multiple multimodal shifts: highlighting, taking notes, re-reading the sentences, and so on. All these embodied strategies are self-enacted modulations of attention. The act of highlighting, for instance, makes the reader attend on a specific part of the text because it seemed relevant for her, and it also demands a modulation of reading pace. In the same line, one participant in our sub-study explained why she usually takes notes: "*I stopped to write some notes because I can't read and write at the same time (…), it [taking notes] does make me stop and have to think about what I actually just read.*"

An important but often unnoticed process of singling out in embodied reading is the reader's vocalization of the relevant part of the text. As one of the readers in our study describes it: "*this text was relatively easy to understand but sometimes when I read some of the texts you have to read for class, with some of the longer and more complicated words, it helps for me to say it out loud 'cause otherwise my brain makes like a word mambo-jumbo. Then, I have to say it out loud slowly because otherwise I will be like 'what?'*".

In all the embodied processes mentioned here, there is a link between the modulation of attention and the embodied processes underlying such modulation. Concomitantly, we see at play the pace-making capacity of the reader. Reading a part of the text that awakens special attention does not leave untouched the rhythm of reading. The reader initially might slow down when noticing that the point being developed there deserves a more careful consideration. Zooming in at the temporal microscale is also, necessarily, slowing down at the temporal macroscale, or even stopping altogether. Notice that if the reader, for any reason, would be unable to slow down, the very modulation of attention would also be impossible—or the cost would be missing what follows, which is often the case in audio-books, where the pace/speed of reading is set by the voice narrating the story. The challenges related to this externally determined reading pace/speed is a plausible reason why categories such as thrillers, mysteries and suspense stories top the lists of audiobook titles, as these do not consistently demand the listener's full attention (Baron, 2021:ch. 7; see also Have and Pedersen, 2015). When thinking of something particular, the speaker continues the narrative of which it becomes impossible to attend at the same time. Pacemaking is here, as in the other attentional transformations, essential for the freedom to control the attention-modulation, something we take to be crucial for the quality of imaginative reading.

Synthesis

In synthesis, the attention undergoes a transformation that is the opposite to singling out: what previously constituted the whole theme becomes an element of the new theme, which now encompasses more elements, coming mostly or entirely from what formerly was the context. It is, accordingly, a sort of "zooming out" (see **Figure 6**).

To illustrate this attentional shift, now imagine you read the part in which the prisoners end up throwing stones at Don Quixote, for his insistence that they should be honorable and grateful and go to Dulcinea del Toboso to pay their respects. The chapter ends with a sad tone:

"The ass and Rosinante, Sancho and Don Quixote, remained by themselves; the ass hanging his head and pensive, and now and then shaking his ears, thinking that the storm of stones was not yet over, but still whizzing about his head; Rosinante stretched along close by his master, he also being knocked down with another

FIGURE 6 | Synthesis.

stone; Sancho in his doublet, and afraid of the Holy Brotherhood: and Don Quixote very much out of humor to find himself so ill treated by those very persons to whom he had done so much good" (Cervantes, 2008:173).

You might find that there is a strong similarity between the end of this adventure, and that of other previous adventures of Don Quixote, in which he and Sancho end up being beaten up by strangers, like those of chapters 15, 16 and 18 so far. You also wonder whether all these times it has been because of Don Quixote's disturbed sense of reality. In these cases, the theme of your attention is much wider than the sole event of the king's prisoners: now it also involves other elements provided by Cervantes in previous chapters of the book that were previously held in the contextual order of your attention sphere. You might keep zooming out and think about other stories you have read in which the main character suffers as much as Don Quixote, or for similar reasons.

The attentional transformation of synthesis is crucial for processes like voluntary reflection and mind-wandering, which, we claim, are in turn essential for quality reading. In voluntary reflection, the reader has a high degree of control of her cognitive processes. If, for instance, she is interested in the notion of justice, she might bring different ideas of justice to bear on a discussion about whether liberating the prisoners was an act of justice or not. Again, we claim that such inferences often go on *as* readers engage with the material, and not just after analyzing "the already read"—people do all sorts of imaginative detours during the act of reading, which is exactly enabled by the pacemaking capacities. If we had no control of regulating action-perception we would be prisoners of a fixed timescale in which only certain events could unfold. The ecological timescale in which we live (cf. Gibson, 1979) is not reduced to being able to perceive only seconds and events, we can actually manipulate action-perception to the extent that it allows us to live in a (life)world in which we can move ourselves, but to see micro and macro-scale life unfold.

Is mind-wandering also an essential process for quality reading? This idea goes against many theorists doing research on reading and mind-wandering, according to whom mind-wandering is related to lower quality of reading, and it is even opposed to reading (see Smallwood et al., 2008; Varao Sousa et al., 2013; Broadway et al., 2015). However, as Fabri and Kukkonen (2019) rightly point out, these claims presuppose a narrow conception of reading (and the "task of reading") as information retrieving from a text.

There are two ways to resist the idea that mind-wandering is necessarily detrimental for quality reading: (i) to broaden the conception of reading as a much more complex phenomenon than just the retrieval of information from a text, and (ii) to distinguish between different kinds of mind-wandering, as Smallwood et al. (2007) propose. The attempt to broaden the conception of reading is at the basis of this article. Let us now examine what kinds of mind-wandering are there.

Smallwood et al. (2007) identify two kinds of mind-wandering: *tuning out* and *zoning out*. In the former, the reader is aware of her mind-wandering and is to some degree capable of controlling her train of thought. In zoning out the reader is surprised to become aware of her mind-wandering and is therefore not in control of it (see also Metzinger, 2018). Adopting this conception of mind-wandering, we see that there is a spectrum in reflection that goes from almost total control of the train of thought (in voluntary reflection), to almost total absence of control in zoning out, and with tuning out somewhere in the middle of the spectrum.

Importantly, in all three of them the attentional transformation of synthesis is at play. In reflection this is clear: the person voluntarily takes a step back from the text and engages in a very complex embodied cognitive process of establishing conceptual connections between the topic just read and elements that were previously in the attentional context of reading. If reflection goes deep enough, it can even bring elements that were only in the attentional margin to become part of the theme. This operation can be very productive in enriching the content of the text just read, and it involves central skills like imagination and creative thinking. In other cases, reflection can be prompted by a feeling of fatigue or boredom with the text. This feeling can be seen in the description of the experience of reading given by another participant: *"the only astray thought I*

had reading this text was how long this text was. So I even stopped and checked (makes a gesture of revising how many pages were left)." Tuning out has a similar structure of voluntary reflection, but with a more marked role of marginal content in the train of thought. Many thoughts or ideas will be involuntarily introduced into the current theme coming from the marginal dimension of attention, allowing the person to establish connections that were unlikely to occur within voluntary reflection. For this reason, tuning out can have a primary role in an imaginative and creative engagement with the content of what is being read. And even zoning out, in which the current theme will be composed of elements from the former context and margin, can produce, involuntarily, relevant connections with the former theme (the story or argument just read). As an example of zoning out, consider the following report of another participant in our sub-study: "*I think on page three, my mind kind of, uh, I kind of started wandering a bit. (…) Actually, it was because the topic was dating, my mind kind of wandered off to the last girl I…. I had a girl that asked me out recently, who I said no to. I kind of very quickly thought about that girl for like a few minutes. Less than few minutes, but it felt like minutes.*"
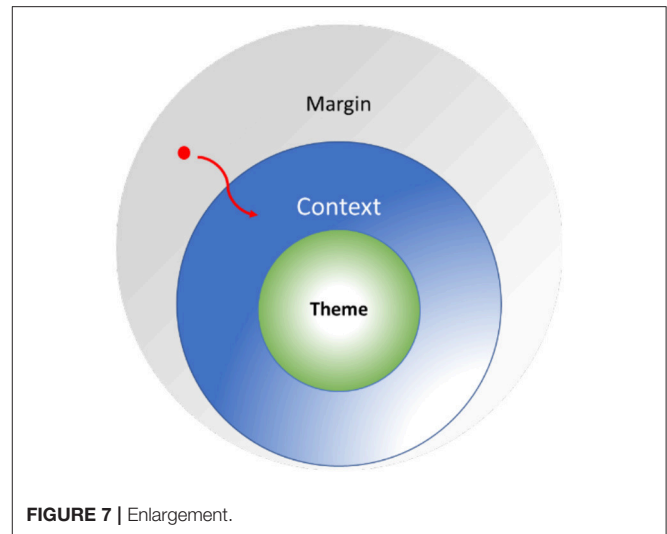
It is essential for imaginary reading to open the space for connections from the different dimensions of attention to interact more freely. Narrowing down reading to a process occurring only or mostly at the theme of attention closes creative and imaginative engagements of the reader with the text.

All instances of reflection and mind-wandering occur in strict co-dependency with embodied and pacemaking processes. In terms of embodied punctuations, attentional syntheses are usually related to a more introspective and less worldly engaged bodily attitude. The reader puts down the book and adopts a posture that embodies the "disengaged" attitude, i.e., the person takes some distance from the affordances in the room associated with practical engagements. Her gaze might be lost or focused on nothing. She might unconsciously play with her hair, or with a pen on the table, but with no specific aim. This embodied introspective attitude is strictly co-dependent with a delicate modulation of the lived time: the person has stopped reading, and now the lived temporality is at once fast and slow. The temporality of events in the environment has necessarily slowed down, to give space for the person's thoughts and ideas to succeed one another at a quick pace.

Enlargement

In enlargement, the theme remains unchanged while the context grows in content, thus providing a new meaning to the theme. Some important sources of enlargement are personal memories and general knowledge on some matter that can be called upon by association or implication to the theme. Then, "the horizon of memories belonging to a certain thing broadens again, the same thing continues being given, but it has acquired new 'meaning', a new significance for the whole of my life, it appears in a new light; I see it—the noematically same thing—in a different attitude" (Gurwitsch, 2009:248) (see **Figure 7**).

In this attentional shift, the enlargement of the context through a personal memory allows you to see the theme under a new light, even though the theme has not changed itself. One of

FIGURE 7 | Enlargement.

the participants in our study found the events of the story she was reading to be very similar to specific memories of her childhood: "*It's funny because as a child we had a summer house in Sweden and I always with my sister collected blueberries and I actually pictured them [the characters of the story] collecting blueberries somewhere in Sweden.*" And she adds, "*at some point of the story I stopped [reading] because I thought 'this could be me.'*"

Enlargement is the least radical of the attentional transformations considered so far. In the case of reading, it can occur in a hybrid combination with serial shifting. This means that the reader keeps reading (serial shifting) while, at the same time, the story or argument being read awakens in her personal memories/knowledge implicated in the theme. The embodied punctuations can be highlighting the part of the text that, because of the enlargement, gained a special significance for the reader. For the same reason, the reader can take notes making explicit the new meaning of the theme. The pace of reading is also necessarily modulated in enlargement. Depending on how much of the context is enriched, and how much that enrichment affects the meaning of the theme, the pace of reading will be slowed down accordingly. Keeping the pace or accelerating it might be attentionally too demanding for the reader.

CONCLUDING REMARKS AND EDUCATIONAL IMPLICATIONS

So far, we have presented some of the most relevant attentional shifts in reading and the co-dependent embodied punctuations and pace-making processes in which the reader necessarily engages, thus meshing processes at different timescales (see **Figure 2**). By doing so, we have aimed at providing a more nuanced picture of reading than those more commonly provided, by questioning the idea that an uninterrupted flow of reading (avoiding embodied punctuations) is the optimal reading strategy. Our account portrays a reader multimodally and multi-temporally engaged in the highly diverse and

complex sense-making reading processes where a reader is compelled to reflect, to revisit personal memories, to focus more closely on specific aspects of the text, to slow down or halt the pace of reading thus facilitating a richer grasp of the text, to take notes, highlight, etcetera. It should also be clear by now how the multimodal, embodied imagination, creative and critical thinking are necessarily related to every attentional transformation, every embodied punctuation, and every modulation of lived temporality through the reader's active engagement with the text.

Furthermore, the account of cognitive pacemaking and imaginative reading here developed is grounded on an empirically testable and falsifiable thesis. In section Introduction: Reading is Actional and Punctuated we proposed that if our proposal is right, it should be possible to observe a strong correlation between the reader's pacemaking while reading and the level of imaginative and critical reading. This means that modulations of attention, note taking, highlighting, mindwandering, modulation of reading pace, etcetera, should be accompanied by what we have characterized as imaginative and creative reading. This claim is in clear opposition to a still dominant picture of reading according to which interruptions to the reading flow are undesirable and are to be avoided (see subsection Synthesis).

In addition, our hypothesis opens paths of exploration that can be theoretically and practically relevant: consider, for instance, the effects of artificially disturbing pacemaking processes, like the modulation of lived temporality in the reader. The reader's modulation of temporality is an essential feature of reading processes, since it enables the reader to adjust the reading pace in tune with all the other processes occurring in parallel during reading. What would be the effects of fixing the reading pace for the reader—as it happens when listening to an audiobook-? Would it have a beneficial effect to artificially induce pauses in the reading? These and other considerations springing from our proposal may open up paths to explore and design optimally scaffolding and inspiring environments for reading across texts, technologies and purposes, in various educational practices.

The account of reading proposed here differs in many respects from common reading instruction and practice in educational contexts, regardless of grade level and subject. Reading in school is commonly geared toward speed and fluency, and cognitive outcomes such as comprehension, with or without an accompanying test. A potential exception here is individual (literary) reading programs, in which students read for extended (typically, 20–30 min) periods of time in their self-selected book without any explicit goal or purpose beyond that of, simply, reading for pleasure. Experiential aspects of reading related to affective-embodied and emotional facets of the experience, are less prevalent. Even in empirical research on reading, the focus is most commonly on cognitive outcomes, whereas studies focusing explicitly on emotional aspects of the process and experience,

are less common (Jacobs, 2015; Kaakinen et al., 2018). A large observational study of, specifically, literary reading in language arts classes in lower secondary schools in Norway (Gabrielsen et al., 2019) showed that the primary objectives of reading literary texts were related to analysis and interpretation of theme(s), labeling the text according to genre and/or epoch, and learning about stylistic devices (e.g., metaphors, contrasts), often for the purpose of employing them in students' own writing. As David Miall has pointed out, such rather reductionist and instrumental use of literary texts goes against the *raison d'être* of literary reading (Miall, 1996), according to which literary texts have the unique potential to prompt emotional and affective-embodied experiences not easily captured—nor nurtured—by a typical "schooled" approach to literary reading (see also Mangen et al., 2018).

One implication of the above-outlined view of reading is that a more experimentally rich and emotionally evocative reading can be nurtured by providing ample room, and time, for the readers' self-initiated breaks and ruptures during reading in the classroom (see also Trasmundi et al., 2022). Not restricted to the reading of literary texts specifically, the approach outlined above has the potential to turn reading into an experience of personal resonance, because of being better tuned to the readers' own trajectories of attention and pacemaking. This requires increased awareness of the ways in which reading is at once a deeply personal experience which is fundamentally affective-embodied, and always socio-materially situated. Reading research more generally, has a lot to learn from and offer to neighboring disciplines dealing with embodiment, movement and performances.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary materials, 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. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ST and JT wrote a first draft. All authors discussed and contributed to the final version of the article.

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![frontiers] Frontiers in Communication

Embodied Cognition, Kinaesthetic Knowledge, and Kinesic Imagination in Literature and Visual Arts

Guillemette Bolens*

Department of English, Faculty of Humanities, University of Geneva, Geneva, Switzerland

Embodied cognition, kinaesthetic knowledge, and kinesic imagination are central not only to acts of creation but also to the reception of artworks. This article substantiates this claim by focusing on sensorimotricity in art and literature, presenting two sets of analytical distinctions that pertain to dynamics in gesture and movement. The first set of distinctions—kinesis, kinaesthesia, kinetics, and kinematics—and the second set— timing, tempo, and momentum—are used to analyse literary descriptions and visual depictions of movements. The first set of distinctions is discussed in the first part of the article in relation to medieval drawings and literary excerpts from different historical periods (in works by Ovid, Shakespeare, and Proust). The second part focuses on visual arts and leads to an analysis of Bruegel's *Fall of the Rebel Angels*, while the third part presents a kinesic analysis of the Apollo and Daphne episode in Ovid's *Metamorphoses*. A heightened attention to the cognitive processing of kinesic features in acts of reception enhances the role and responsibility of readers and viewers in the ways in which they grasp the movement-based meanings formalized by artists of various cultures and historical periods.

Keywords: kinesis, gesture, sensorimotricity, cognition, Ovid, Daphne, Bruegel, Bosch

1. INTRODUCTION

Movement-based communication is grounded in the cognitive activation of perceptual simulations. Within the theoretical field of embodied cognition, the phrase *perceptual simulation* (also *embodied simulation*) refers to the dynamic activation of sensorimotor aspects in the pre-reflective cognitive processing of multimodal events[1]. Perceptual simulations are central to any act of artistic practice and/or reception, whether the artwork is a performance (e.g., dance, drama, music, martial arts) or the formalized configuration of gestures and actions in verbal or visual works (e.g., a poem or a drawing). The method of *kinesic analysis*, applied in this article, focuses on the specific ways in which a verbal or visual artwork creates movement-based meanings by eliciting in readers and viewers perceptual simulations of sensorimotor events. An important aspect of kinesic analysis consists in paying close attention to the outputs of pre-reflective perceptual simulations, bringing

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[1] For a discussion of perceptual simulations and the theoretical background relative to this notion, see the introductions in Bolens, 2012, 2021.

them to the reflective level—not to stabilize them into mental representations, but to account for their dynamic and sensorimotor readerly effects[2].

The article focuses on two sets of distinctions which are applied in kinesic analysis. The first set, called the 4Ks, distinguishes between *kinetics* (laws of physics relative to movement in general, e.g., gravity), *kinaesthesia* (the sensations of movement in one's body), *kinesis* (the perception of movements), and *kinematics* (physiological configurations and biomechanical constraints, e.g., joint orientation). While the 4Ks are generally correlated in actual movements, the precision of a movement analysis is increased by distinguishing between such aspects.

The second set of distinctions is relative to time and distinguishes between *tempo* (or rhythm of beats), *timing*, and *momentum*. Momentum in physics refers to the quantity of motion in a moving body, expressed as the product of its mass and velocity. It has to do with the impetus gained by movement, and with the force or energy exhibited by the moving body. Figuratively, it refers to the driving force or advancing strength of a development or course of events. Momentum is often correlated with tempo through the repetition of a specific movement, and with timing in the exact succession in which events are unfolding. For example, the momentum of runners may vary according to the tempo of their steps, which has an impact on the timing of such an event as a fall. Depending on the momentum in the action of running, the fall may be more or less sudden and more or less hurtful.

The two sets of distinctions are applied in this article to human movements and their verbal description in literature and visual depiction in art. Such distinctions constitute analytical tools that are instrumental to the possibility of accounting for movement-based meaning-making practices in various historical periods. Particular attention is paid in Section 2 to the role played by kinaesthetic knowledge, and in Section 3 to kinesic imagination in literature and visual arts. Owing to shared kinaesthetic knowledge, the way a movement feels may be inferred from penned lines on a medieval parchment despite historical and cultural differences. Even when an artwork is centuries old, core aspects of kinaesthetic features are inferred by viewers, inflecting the dynamics of their perceptual simulations in acts of reception. This fact is illustrated in Section 2 with visual examples taken from medieval illuminated manuscripts and with literary examples from works written by Ovid (43 BC-17/18 AD), William Shakespeare (1564–1616), and Marcel Proust (1871–1922). These drawings and texts are expressive in as much as they trigger prompt and flexible sensorimotor simulations in viewers and readers. Their meaningful effects are in their inferred sensorial and perceptual dynamics.

Kinesic imagination is central to the ability to foster novel relations with our sensorimotor and interpersonal reality. Literature and art are often the fields where sensorimotor experimentation and innovation take place. Through centuries, artists and authors have found ways of activating viewers' and readers' kinaesthetic knowledge and kinesic imagination, prompting the retrieval of complex sensorial and perceptual information[3]. Section 3 focuses on the iconographic tradition representing the fall of the rebel angels. The Fall of mankind as it is narrated in *Genesis* elicited a desire to imagine a prequel to the events leading to Adam and Eve's transgression. This prequel is the fall of rebel angels. The three temporal distinctions of tempo, timing, and momentum are discussed in this section in relation to Pieter Bruegel's pictorial response to Hieronymus Bosch's paintings of the fall of the rebel angels and the Fall of mankind.

After illustrating the presence of kinesic, kinaesthetic, kinetic, and kinematic features in connection with tempo, timing, and momentum in art and literature of different historical periods, the article focuses in Section 4 on the Apollo and Daphne episode in Ovid's *Metamorphoses*. The two sets of distinctions discussed in Sections 2 and 3 are applied in Section 4 to literary analysis, offering a kinesic perspective on this much debated narrative. In the introduction to their 2020 collective volume, Sharrock et al. (2020, p. 4) call Ovid's *Metamorphoses* "one of the best known and popular works of classical literature, and, with the possible exception of Virgil's *Aeneid*, perhaps the most influential of all on later European literature and culture". Embodiment and movement-based meanings call for attention in both Virgil's *Aeneid* and Ovid's *Metamorphoses*. I show elsewhere that the complexity of embodiment in the *Aeneid* can only be addressed through a careful analysis of narrated movements (Bolens, 2003). In the present article, I argue that a greater focus on sensorimotricity in Ovid's work suggests that movement-based meaning-making pervades the *Metamorphoses* and grounds the ways in which Ovid transformed his sources of inspiration into an artifact that influenced Western art and literature for centuries.

2. KINAESTHETIC KNOWLEDGE IN DRAWINGS AND TROPES

All arts and sports are grounded in an interconnection between the kinaesthetic ability to feel movements, indispensable for autonomous motricity, and the ability to see, hear, taste, smell, and touch. This interconnection between motricity and the senses is called sensorimotricity. In the arts, dance activates *a minima* kinaesthesia and haptics (the term *haptic* refers to the connection between touch and kinaesthesia). Haptics in dance includes the contact between feet and ground. In musical performance, hearing and haptics via contact with the instruments are cardinal. Kinaesthetic knowledge is manifest in the dexterity which artists develop in their practice, whether their skills involve an ability to swing their body or to pinch the strings of a musical artifact. Such skills entail a type of knowledge that expands through sensorial practice[4]. A person sensorially learns by practice and henceforth knows how a movement feels (Sheets-Johnstone, 2003, 2017). This knowledge is kinaesthetic,

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[2]For a discussion of the ways in which the output of pre-reflective perceptual simulations can become the focus of reflective attention, see Bolens, 2018b, 2021. In Bolens, 2021, each chapter illustrates this possibility and its relevance to the fields of literary analysis and embodied cognition.

[3]Instances of sensorimotor experimentation in medieval drawings are discussed in Bolens, 2022b.

[4]On embodied intelligence in skilled performance, see Sutton, 2007; Sutton et al., 2011; McIlwain and Sutton, 2014; Toner et al., 2016; Bicknell, 2021.

FIGURE 1 | The Utrecht Psalter (Utrecht, Universiteitsbibliotheek, MS 32), fol. 49v, Psalm 84, detail, https://psalter.library.uu.nl/page/106.

and it may be activated either when the person iteratively induces targeted sensations[5], or when they see a movement that triggers in them the cognitive inferencing of such sensations.

The acts of writing and drawing also involve movements, generally movements of the hands. As in dance and music reception, the actions of reading a poem or examining a drawing do not necessarily entail performing actual movements, whether the latter are correlated to the movements narrated or depicted in the artworks, or whether they are inferred from, say, the energetic qualities of a sketched line. However, in the same way as watching a dance triggers a cognitive processing that taps directly into the motor and premotor areas of the brain and the mirror system, literary and visual reception also activates cognitive faculties that are grounded in sensorimotricity (Noë, 2004; Gibbs, 2005; Jeannerod, 2007; Bolens, 2012; Cave, 2016; Coello and Fischer, 2016). The pen drawing in **Figure 1** is an occasion to observe how static data, here in the shape of lines, can lead to dynamic inferences[6]. The hands of the couple at the center of the drawing suggest rapid movements of the fingers and the kind of dynamic gestures interlocutors tend to perform when engaged in a conversation. A few sketchy lines are enough to prompt viewers to infer open palms and lithe, jiggly fingers. Because of the visual context, i.e., two humans face to face at speaking distance, viewers read those lines dynamically, supplementing the communicative function gestures generally have in a conversation (Breckinridge Church et al., 2017; Morgenstern and Goldin-Meadow, 2022). The dynamics of gesture is central to the reception of this drawing, and it is inferred whether or not viewers reflect on the cognitive process that leads to the way they make sense of the drawing. In kinesic analysis, the pre-reflective inferential output of motor cognition is brought to the reflective level and acknowledged as sensorimotor and dynamic.

The drawing in **Figure 1** is part of the deservedly famous Utrecht Psalter, which was made in the early ninth century near Reims (Horst et al., 1996). The drawing illustrates line 11 of Psalm 84: *Misericordia et veritas obviaverunt sibi; justitia et pax osculatæ sunt* (Vulgate, Ps 84:11) [Mercy and truth have met

each other: justice and peace have kissed] [Douay-Rheims Bible (1609/1955/1963), Ps 84:11]. The human figures are allegories, which explains why we find in a medieval psalter the unusual and endearing representation of two people kissing on the mouth. On the left of the drawing, Justice and Peace are indeed tightly kissing with full facial contact. On the right, the Psalmist is addressing the Lord with his whole right arm raised and his hand open upward. At the center, Mercy and Truth are interacting with animation. More than ten centuries later, viewers easily recognize in a few energetic lines a fundamental type of interaction— speaking and gesturing—, which to this day remains familiar at the level of perception, sensation, and intersubjective experience. Although the historical, sociocultural, and idiosyncratic ways in which people speak and gesture vary, basic sensorimotor features, involved in such actions, remain accessible across the centuries[7].

The drawings of the Utrecht Psalter are remarkably expressive because the artists who penned them were able to communicate about dynamics in movement. The intensity of their art comes from their ability to prompt perceptual simulations of kinaesthetic sensations in viewers. In the action of drawing, the physical dynamic of the artists' hands successfully translated into lines that express dynamics in the gestures of represented hands. **Figure 2** shows angels with equally animated hands, postures, and facial expressions. The angels are represented with human bodies simply endowed with wings, their invisible feet sharply planted in clouds, and their expressive gestures and neck postures prompting nuanced kinaesthetic inferences read as human feelings and mental states. Viewers' kinaesthetic knowledge is manifest in the activation of motor cognition in the visual processing of such a drawing. In the left hand of the angel on the right of **Figure 2**, a few curved lines are enough to convey a sense of intense tonicity in outstretched angelic fingers. The processing of these sketchy lines taps into our kinaesthetic knowledge of how it feels in the hand to open it as widely as possible. In such an instance, a perceptual simulation of this accessible sensation is not the representation of an abstracted object of knowledge, but the responsive activation of sensorial experiential knowledge.

An ability to understand gestures and movements does not entail an ability to describe them verbally or depict them visually. There is no continuum between the ability to perform a movement and that of accounting for it verbally or pictorially. To now focus on language, sensorimotor concepts and verbal concepts must be distinguished, and the translation of the former into the latter (or vice versa) cannot be taken for granted[8]. A person may be able to perform a complex gesture consciously, repeatedly, and skilfully without knowing how to describe it verbally. The reverse is also true: to know how to identify a movement and what to call it (e.g., summersault) does not entail an ability to perform it. In certain domains and arts, such as dance, a coded terminology may exist that helps communicate verbally about movements (e.g., Labanotation and

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[5]For example, singers learn to produce, feel, and recognize sensations in their soft palate, jaws, throat, and chest that lead to desired sound effects.
[6]I discuss the inferencing of dynamics in Bolens, 2018a,b, 2021.

[7]For a detailed discussion of this claim, see Bolens, 2022a.
[8]An attention to this issue is central to kinesic analysis. I discuss it in *Kinesic Humor*, 2021: 13-18 and analyse concrete instances of it throughout the book.

FIGURE 2 | The Utrecht Psalter (Utrecht, Universiteitsbibliotheek, MS 32), fol. 51r, Psalm 87, detail, https://psalter.library.uu.nl/page/109.

Benesh notation)[9]. Yet, even when a coding system is available, the exact manner of a gesture remains challenging to convey. In this respect, literature is a valuable source of information, as authors through centuries have found ways of using language to express complex sensorial and perceptual information.

A writer who was clearly interested in the sense of movement is Ovid. I will consider three short passages of the *Metamorphoses* (two here and one in Section 4), before turning to the Apollo and Daphne episode. In the first passage, Actaeon in the woods sees Diana naked, and she transforms him into a stag.

> *[…] nec plura minata*
> *dat sparso capiti uiuacis cornua cerui,*
> *dat spatium collo summasque cacuminat aures*
> *cum pedibusque manus, cum longis bracchia mutat*
> *cruribus et uelat maculoso uellere corpus;*
> *additus et pauor est. fugit Autonoeius heros*
> *et se tam celerem cursu miratur in ipso.* (*Met.* 3.193-199—Ovid, 2015, *Metamorphoses*, hereafter *Met.*)
> [Without more threats, she gave the horns of a mature stag to the head she had sprinkled (with water), lengthening his neck, making his ear-tips pointed, changing feet for hands, long legs for arms, and covering his body with a dappled hide. And then she added fear. Autonoë's brave son (Actaeon) flies off, marveling at such swift speed, within himself (trans. Kline, 2000)].

The line *et se tam celerem cursu miratur in ipso*, "marveling at such swift speed within himself" (*Met.* 3.199) refers to Actaeon's kinaesthetic sensations and the way he feels within himself, *in ipso*, while the momentum of his flight uncannily increases. Ovid foregrounds Actaeon's surprise at experiencing a transformation at the level of such sensations, as Actaeon is not yet aware of the transformation of his shape into that of a running stag.

A similar emphasis on the experience of a kinaesthetic shift can be found in the story of Picus turned into a bird by

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[9]For a thorough discussion of such issues, see Maiorani, 2021, chap. 1: "How to Capture Dance Discourse?" 4-25.

Circe (*Met.* 14.320-396). Like Actaeon, Picus becomes aware of his metamorphosis because of his kinaesthetic sensations and after he has become aware of them: *ille fugit, sed se solito uelocius ipse / currere miratur; pennas in corpore uidit* (*Met.* 14.388-389), "He ran, but was surprised to find himself running faster than before: he saw wings appear on his body" (trans. Kline, 2000). The transformation is first experienced in relation to kinaesthesia and the motoric sensations Picus is surprised to feel when moving. Because of this change in sensations, Picus looks at his body and sees feathers. Visual information comes in a second time and as a confirmation of kinaesthetic sensations. Interestingly, Ovid's phrasing creates a split between kinaesthetic sensations and visual perception. To express Picus's surprise, Ovid writes: *sed se solito uelocius ipse / currere miratur*, "but he was surprised that himself (*ipse*) was running faster than he himself (*se*) was used to." The reflexive self is doubled and then split by the experience of its transformation. Picus's self becomes other, first sensorially and then perceptually as well.

While kinaesthetic sensations are internal, their manifestation is often perceptible externally. The specific quality of a gesture or movement is relative to kinaesthetic sensations within the moving person, but it can be perceived kinesically by an onlooker. I use the adjective *kinesic* to refer to the *perception* of movements and gestures. The perception of a gesture is distinct from its sensation. But kinesic perception often involves inferences that we draw from our empirical knowledge of kinaesthetic sensations. When we know what a gesture feels like, we infer its kinaesthetic quality by means of such knowledge. It is generally the case that we understand the meaning of a gesture because of such pre-reflective inferences, which connect kinesic perception with kinaesthetic sensations. In the following example, Marcel Proust conveys the specific kinesic quality of a gesture by means of tropes (or figures of speech, e.g., similes) that trigger sensorimotor simulations of kinaesthetic sensations, whereby the interactional meaning of the gesture is communicated.

In *À la recherche du temps perdu*, Proust narrates the interactions of his narrator Marcel, who is also his main intradiegetic protagonist, with a wide range of characters, including members of the French aristocracy. One of the latter is the Duchess of Guermantes. Proust often provides detailed information regarding the kinesic styles of his characters and the variable relational implications of their gestures (Bolens, 2017). For instance, the gesture of bowing to greet an interlocutor is a recurrent focus of attention. In the quotation below, the Duchess of Guermantes greets Marcel because he is in company of her nephew Saint-Loup.

> *Elle laissa pleuvoir sur moi la lumière de son regard bleu, hésita un instant, déplia et tendit la tige de son bras, pencha en avant son corps qui se redressa rapidement en arrière comme un arbuste qu'on a couché et qui, laissé libre, revient à sa position naturelle.*
> [Proust (1988, p. 245), *Le Côté de Guermantes* I, 1920–1921].
> [She let the light of her blue gaze rain upon me, hesitated for a moment, unfolded and stretched out the stem of her arm, leant forward her body which sprang back rapidly like a small tree

that has been flattened and which, once released, returns to its natural position].

Social power games are often at the core of narrated scenes in *La Recherche*, and Proust regularly injects irony in his account of them. The passage quoted above (involving the natural setting of rain, flower, and tree) is relatively neutral in comparison to others. I selected it because its readerly activation typically taps into kinaesthetic knowledge. The metaphorical notion of an arm unfolding like the stem of a flower develops into a simile that shows the duchess's body bowing with the dynamics of a supple tree. The narrator's point of view is that of Marcel, the description pertaining to the kinesic perception of the act of bowing. However, the metaphor and simile, while being perceptual, elicit a translation of perception into sensation: the way the slim trunk of a small, supple tree (*arbuste*) springs back into its original position is liable to trigger cognitive simulations of how such dynamics may feel kinaesthetically. The analogy specifically targets the dynamic of the described movement, since human flesh, flower stems, and wooden trees entirely differ in terms of their materiality and autonomous motricity. Proust refers to *tige* (stem) and *arbuste* (small tree) not to prompt a formal representation but to convey the specific interactional and dynamic qualities of a character's gesture and bowing movement. It is by cognitively enacting this passage that its meaning becomes accessible.

Kinaesthetic knowledge can be activated via a kinesic trope that sheds light on the specific manner of a gesture. Such tropes may also convey information about an emotional state and the sensations it involves. In Shakespeare's *Macbeth*, after ordering the murder of Banquo and his son Fleance, Macbeth learns from the assassins that Banquo's throat has been cut, but that Fleance escaped, becoming a surviving witness of his culpability and ferocity. To express Macbeth's emotional experience of the situation, Shakespeare chooses powerful similes (Lyne, 2011; Crane, 2018).

> Then comes my fit again; I had else been perfect,
> Whole as the marble, founded as the rock,
> As broad and general as the casing air,
> But now I am cabined, cribbed, confined, bound in
> To saucy doubts and fears (Shakespeare, 1986/2005, *Macbeth*, 3. 4. 20–24).

When he believes that the double murder has been completed, Macbeth's sense of relief and satisfaction is conveyed by mineral similes that prompt a cognitive activation of kinaesthetic sensations. Macbeth's feeling of security is akin to the fullness of marble and the solidity of a rock firmly entrenched in the ground. In the same way as Proust activates readers' sensorimotor knowledge of the movement of a supple tree springing back to its natural position to convey the exact manner of a bowing gesture, Shakespeare prompts perceptual simulations of wholeness based on the density of marble and the stability of grounded rocks. In his speech, Macbeth conveys with such similes the emotional and sensorial state he was experiencing the moment preceding the cognitive shock caused by the news

FIGURE 3 | Bodleian Library MS. Junius 11, fol. 3r, 1000, Oxford, Bodleian Library, detail, https://digital.bodleian.ox.ac.uk/objects/d5e3a9fc-abaa-4649-ae48-be207ce8da15/surfaces/82365036-24f3-4c43-95fe-0a4a4d94d90a/. Terms of use: CC-BY-NC 4.0. Copyright holder Photo: © Bodleian Libraries, University of Oxford.

he received: his tyrannical order to kill has created a new form of danger. This abrupt cognitive reversal takes him from a sense a perfect limitlessness, similar to the air that encompasses everything, to its radical opposite: confinement in a minimal, cribbing space, a constraining cabin where he lies shackled to his own paranoid and impudent self-delusions. The tropes that build the expression of Macbeth's emotional fracture involve the translation of physical data (associated with marble, rock, air, and a confined space) into kinaesthetic sensorial simulations.

Thus, kinaesthetic knowledge can be activated in literature by a kinesic trope that sheds light on the specific manner of a gesture (as in Proust) or an emotional feeling (as in Shakespeare). It may be at the core of visual representations that base their expressiveness on kinaesthetic inferences (as in the Utrecht Psalter) or also on kinematics, as can now be seen in folio 3 of MS Junius 11 (**Figure 3**). In the latter, rebel angels are hurled away from heaven, in the primordial fall that takes them down to hell. This drawing was made around 1000 in England by skilful artists who knew how to represent the kinematics of human bodies.

It may be claimed that these artists decided to use kinematics as an expressive mean, because they do not depict a knee (or

any other joint) bent backward anywhere else in the manuscript. In **Figure 3**, the upper left figure is represented with arms stretched over his head and with legs entangled into impossible kinematic directions. This deliberate pictorial decision mobilizes viewers' knowledge of the kinematics of human joints, prompting kinaesthetic inferences of what such a movement would feel like. A sense of contortion is induced, which powerfully expresses a distressing loss of orientation caused by the violent speed of the fall. The expressiveness of this group of falling angels is relative to viewers' kinaesthetic inferences based on their kinematic knowledge. In MS Junius 11 as in the Utrecht Psalter, viewers can make sense of depicted movements, while everything else has historically changed.

Among the technological changes that have transformed perception in the 20th century, cinema is first and foremost. The moving pictures made it technically possible to see a fall in slow motion. Given the speed of the event, the various stages of a fall, before the advent of cinema, had to be imagined. The falling angels of MS Junius 11 evince an effort to conceive of such intermediary stages. In the body at the top of **Figure 3**, disorientation is conveyed by a downward posture, by the distorted direction of the wings, and by the awkward positioning of the legs and right foot, the latter being twisted backward. The artists used viewers' kinematic knowledge and thwarted perceptual expectations to convey a sense of catastrophic fall.

The event of falling is based on gravity and a myriad of kinesic possibilities. The fall of the rebel angels has been repeatedly represented in Western visual arts, providing an opportunity to observe how artists used kinesic, kinaesthetic, kinematic, and kinetic features to communicate about movement-based meanings, and produce effects of tempo, timing, and momentum in static images.

3. KINESIC IMAGINATION AND FALLING ANGELS

Few laws of physics are more permanently impactful than that of gravity. It is so central to human existence and experience that it has shaped one of the most pervading conceptual metaphors in Western cultures, that of the Fall. This conceptual metaphor is the name given to a plot in which the main protagonists, Adam and Eve, do not actually fall on the ground. It is the metaphorical meaning of falling that justifies such a name, in analogy with the spatialisation of an expulsion from heaven into the world, from up to down (Gibbs, 2017). Embodied cognition has been systematically at work in the development and amplification of this narrative, supplying for instance the episode of an actual fall, that of the rebel angels, leading to revenge and the Fall of mankind. The fall of the rebel angels is an apocryphal narrative, providing a rationale for the evil intention that led to the Fall of Adam and Eve (Silver, 2009).

Visually, the fall of the rebel angels has been typically translated into a flood of downcast bodies. In **Figure 4**, the right row of seats in heaven (on God's left hand) has been vacated by rebellious angels who, in the lower section of the image, are chased down and hurled toward a globe representing a ground

FIGURE 4 | Master of rebel angels, Sienne ca. 1340–1345, The Fall of the Rebel Angels, Paris, Musée du Louvre. Sous license Creative Commons CC BY-NC-SA 2.0. https://art.rmngp.fr/fr/library/artworks/maitre-des-anges-rebelles_la-chute-des-anges-rebelles_fond-d-or?force-download=1284658 and https://www.flickr.com/photos/79505738@N03/30682612335.

containing hell. The expelled angels have been metamorphosed into entirely dark, dehumanized bodies, painted as silhouettes. The intensity and speed of their fall is conveyed by their disoriented flow, forcing them to crash into the globe at the bottom of the image. The force of the impact is suggested by the fact that they partially disappear into the ground. Even though the background is monochrome for being gilded, a sense of perspective is produced by the differing sizes of the bodies, the smaller ones suggesting greater distance.

The interplay between flow and distance was developed by Hieronymus Bosch in two representations that combine in one painting the fall of the rebel angels and the Fall of Adam and Eve. In his *Last Judgment Triptych* now in Vienna (**Figure 5**), the left wing of the triptych shows a landscape, where the land is the stage of the Fall of mankind, and the sky that of the fall of the rebel angels. The Fall of Adam and Eve is visually narrated in three stages (Eve's creation, the forbidden-fruit transgression,

FIGURE 5 | Hieronymus Bosch (1450–1516), Last Judgment Triptych, inner left wing (Paradise), 1504–1508, oil on panel, 163.7 x 60 cm, Vienna, Akademie der bildenden Künste. Public Domain: https://commons.wikimedia.org/wiki/File:BoschTheLastJudgementTriptychLeftInnerWing.jpg.

FIGURE 6 | Hieronymus Bosch, The Haywain Triptych, 1512–1515, inner left wing, 147 x 66 cm, oil and tempera on oak panel, Madrid, Museo del Prado, detail. https://www.museodelprado.es/en/the-collection/art-work/the-haywain-triptych/7673843a-d2b6-497a-ac80-16242b36c3ce?searchMeta=rebel%20angels. https://commons.wikimedia.org/wiki/File:Bosch_-_Haywain_Triptych.jpg.

Beneath God, under heavy clouds, swarms of insect-like figures represent the falling rebels, pouring down like a far-away storm. In the *Haywain Triptych* now in Madrid (**Figure 6**), Bosch repeated the same striking iconography. However, this time the rebels are more distinct in their animalistic appearance. Some fall into the sea below, but others fly like hybrid insects amidst actual birds such as a swallow followed by its brood (**Figure 7**).

In the *Haywain Triptych*, the light that surrounds God in Majesty does not have the traditional shape of a mandorla anymore. Bordered by seraphim, it is rounded and suggests the shape of the sun, partially hidden by clouds. This iconography is further developed by Pieter Bruegel the Elder in his stunning representation of the fall of the rebel angels (**Figure 8**).

Deeply inspired by Bosch, Bruegel turned the divine light surrounding God into an enormous sun, situated in the upper section of his painting. From this vast, luminous, and empty space, a crowded flow of hybrid creatures rushes toward the viewer (**Figure 9**).

It seems that Bruegel imagined zooming in on the swarms that pour from the clouds in his predecessor's paintings. Narrowing down on these buzzing bodies, Bruegel places the viewer in the path of this fast flow, creating a tornado of multimodal inferences. Working on the relation between distance and dynamic inferencing, his painting depicts a mobile chaos of embodiment that emerges from the sun and storms in our direction at maximal speed, ominously propelled by the unstoppable momentum of a chaotic flood of bodies.

The mass of visual information is so vast in this painting that viewers are led to temporally experience the perceptual process

and the expulsion from Eden), which unfold on two thirds of the painting, while the upper third of the panel represents the sky, where God in Majesty, surrounded by a mandorla of bright light, sits in the far distance.

FIGURE 7 | Hieronymus Bosch, The Haywain Triptych, 1512–1515, inner left wing, 147 x 66 cm, oil and tempera on oak panel, Madrid, Museo del Prado, detail.

FIGURE 8 | Pieter Bruegel the Elder (1527/30-1569), The *Fall of the Rebel Angels*, 1562, huile sur chêne (117 × 162 cm), Bruxelles, Musées royaux des beaux-arts de Belgique. Public domain, sous license CC BY-SA 2.0. https://fr.wikipedia.org/wiki/Fichier:Pieter_Bruegel_the_Elder_-_The_Fall_of_the_Rebel_Angels_-_Google_Art_Project.jpg.

of their successive discoveries. Within the general momentum of the flow, the painting contains multiple scenes that have their own implied timing and tempo. For instance, tempo is suggested by the gestures of the archangel Michael and his warring companions, who repeatedly slash with their swords at the magma of creatures surrounding them. The tempo of striking and the timing of each wounding impact add to the momentum of Michael's surfing in the flow of creatures, his feet planted on the back of the beast of the Apocalypse hurled headlong. The beast's enormous body is gradually discovered behind multiple

FIGURE 9 | Pieter Bruegel the Elder, *The Fall of the Rebel Angels*, 1562, detail.

alien forms, its seven heads being connected to its diving belly (Meganck, 2014)[10].

Among the myriad of details worth focusing on in Bruegel's masterpiece, two are particularly useful for an illustration of timing and momentum in relation to the 4Ks. The first is the falling duck-like bird situated in the upper left corner of the painting (**Figure 10**).

Beyond its humorous quality, this plummeting, chubby fowl keenly embodies a connection between gravity and the 4Ks. Unlike Bosch's swallows, and despite the fact that ducks and their likes can fly, this bird is not flying: it is free-falling, on its back, its feet up, and its bent wings enhancing a sense of helplessness. This body is not human and yet everything about it is understandable from the viewpoint of human kinematics linked to kinaesthesia and kinetics. Viewers can infer the type of sensations one would feel if their arms, neck, body, and legs were free-falling in that very position, anticipating the timing of a final impact caused by the crescendo momentum of such a long fall amidst angels and monsters. In this painting, Bruegel seems to have experimented with hybridity in several different ways. In the case of the duck, hybridity lies not so much in the shape of the animal as in our human cognitive understanding of this bird's uncanny experience of gravity. Its shape is not hybrid, but its inferred experience is. This duck falls in the way a human possibly would.

The other falling angels combine natural features (e.g., butterfly wings) with non-natural associations, such as a musical instrument with a lobster head and limbs in **Figure 11**, which is the second detail I wish focus on.

The feeling of uncanniness produced by Bruegel's painting is due to an impression of chaos, in which a sense of incongruity is paradoxically built on common denominators and sameness. One such common denominator is the exacerbated supine posture that dramatically exposes several nightmarish underbellies and gaping mouths. Another is the shape of limbs. In **Figure 11**, the trumpeter's arms have the same rod-like shape

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[10]Cf. https://artsandculture.google.com/story/9gXx-oPTgMeLKg

FIGURE 10 | Pieter Bruegel the Elder, *The Fall of the Rebel Angels*, 1562, detail.

FIGURE 11 | Pieter Bruegel the Elder, *The Fall of the Rebel Angels*, 1562, detail.

and angular elbows as the lobster crawling above him or her. Crossing over the lobster's left limb, the arm of an artichoke-like piece of vegetable is covered in a suit of armor exactly similar to that of the archangel Michael. Meanwhile, under the artichoke's arm, yet another armed limb is part of a full suit of armor, covering a body that lost its kinematic coherence, engulfed as it is in the mass of bodies. The similarity between these different

rod-like arms increases a sense of understandable incongruity, as viewers' efforts at organizing their perception are both satisfied (identification takes place) and defeated (the identified elements belong to incoherent entities).

Multiple arms share the same rod-like shape, producing effects based on kinematic recognition even though the rest of the bodies seem unpredictably oneiric. Framing this growing mass of sliding and mutating bodies, temporality seems both frozen and rapid, made of repetition (hence tempo), catastrophic clashes (hence timing), all of it in the general momentum of a never-ending fall, prompting multimodal inferences of deafening sounds, horrendous smells, and suffocating haptic contacts. By invading his viewers with this crowded flow, Bruegel plays with effects of distance (or lack thereof), inferred movements, and the experience of time. The efficacy with which Bruegel translates momentum visually, before the invention of the motion pictures, is noteworthy. In literature, Ovid is equally notable for his ability to convey temporality by means of a static medium— written language—, evincing a focused attention to momentum, tempo, and timing in his narration of physical movements and transformations.

4. OVID'S *METAMORPHOSES* AND THE RAPE OF DAPHNE

Time in the *Metamorphoses* is an embodied phenomenon, rather than an "autonomous, abstract conceptual domain" (Sinha et al., 2011, p. 140). In Book 15, Ovid has Pythagoras declare that Time is motion, *ipsa quoque adsiduo labuntur tempora motu, / non secus ut flumen* (*Met.* 15.179-180), "the times themselves also glide in continual motion, not unlike a river." The word time is in the plural form *tempora*, and it is subject of the action verb *labor, labi, lapsus sum*, to glide. The verb *labor* is an action verb which suggests that times actively move. Times step, lapse, slip, flow. Times take shape through moving forms, such as that of a river and its waves, but also through moving bodies and, one step further, through bodies transfigured as they move. Because Ovid's text is very much about such cinematic transfigurations, it is important to pay close attention to all possible temporal aspects in the *Metamorphoses*, such as the timing and dynamics of movements and gestures.

A straightforward example of the way in which Ovid combines the three aspects of momentum, tempo and timing is the metamorphosis of Lichas. Hercules is dying, burnt inside and out by the shirt of Nessus. As he is wandering alone, agonizing, he sees the servant Lichas, who delivered the fatal gift. Terrified, Lichas is cowering in a hollow of the cliff. Hercules sees in him the agent of his death and decides to murder him. He "seized him, and, swinging him round three or four times, hurled him, more violently than a catapult bolt, into the Euboean waters": *corripit Alcides et terque quaterque rotatum / mittit in Euboicas tormento fortius undas* (*Met.* 9.217-218). The tempo of this threefold or fourfold revolving movement is followed by the hurling gesture, which is so powerful that the momentum thus gained transfigures Lichas into flint.

ille per aerias pendens induruit auras,
utque ferunt imbres gelidis concrescere uentis,
inde niues fieri, niuibus quoque molle rotatis
adstringi et spissa glomerari grandine corpus,
sic illum ualidis iactum per inane lacertis
exsanguemque metu nec quicquam umoris habentem
in rigidos uersum silices prior edidit aetas (Met. 9.219-225).
[Hanging in the air, he (Lichas) hardened with the wind. As rain freezes in the icy blasts and becomes snow; whirling snowflakes bind together in a soft mass; and they, in turn, accumulate as a body of solid hailstones: so he, the ancient tradition says, flung by strong arms through the void, bloodless with fright, and devoid of moisture, turned to hard flint (trans. Kline, 2000)].

The hard and fast tempo of Hercules's swinging gesture explains the speed and force of the hurling movement, so extreme that the victim's body dries out entirely and turns into flint (*silex*), in the same way as coalescing snowflakes turn into hailstones. In this context of violence, the metamorphosis emphasizes the importance of momentum. It is because of the speed and cumulative force of the hurled mass that the transformation takes place. In kinetic terms, the quantity of Lichas's motion is the product of its mass and velocity. The very continuance of motion is the effect of the impetus gained by the initial movement and ensuing inertia, thereby causing Lichas's mineral metamorphosis. Tempo and momentum play a key role in the transformation, leading to the timing of a fall into the sea, where Lichas forms a rock, says the text, carefully avoided by sailors who suspect that this motionless human shape might sense their presence. Because Ovid provides detailed sensorimotor explanations of the events he narrates, the processing of his text is liable to activate readers' sensorial and motor cognition.

Momentum in Ovid's *Metamorphoses* is associated with haptics, for example when a prey is hunted, and a predator is striving to seize his victim. Haptics plays out in the way one wants to touch and the other tries to escape from that grasp. Ovid tends to inject intense emotions into pre-existing legendary material. In the same way as Lichas is said to feel terror when he is hurled away and his body turns mineral, Daphne's extreme distress is emphasized when Phoebus chases her to rape her. The story of Phoebus Apollo and Daphne is a story of sexual predation, assault, and rape, where the victim is literally dehumanized and turned into a plant, the laurel, which is then used as trophy to crown winners of games and victors of imperial domination.

Classicists call this episode of the *Metamorphoses* "the first amatory episode of Ovid's poem" (Hardie, 2002, p. 71), "the first erotic tale of the poem" (Sharrock et al., 2020, p. 3; Spentzou, 2009, p. 389), a "love story" (Wheeler, 2000, p. 8), and even "a passionate love story" (Barkan, 1986, p. 226). By contrast, in his 1978 article "Rape and rape victims in the *Metamorphoses*," Leo Curran stresses the fact that this tale is a story of rape. It is about sexual violence, and Ovid's insights into the plight of rape victims is "almost unique in ancient literature" (Curran, 1978, p 237). Curran substantiates this claim with detailed attention to Ovid's text, and remarks that

The commentators' arabesques of euphemism are the verbal manifestation of certain underlying prejudices and habits of mind.

In the commentaries, as in society, it has not been the practice of men lightly to accuse another male of rape even if, as it turns out, the rapist is a figure in a myth thousands of years old. Classical scholars apparently require the same stringent proof of rape as do our least enlightened rape laws, police, and courts. When such proof is lacking, the reaction is disbelief or amusement (Curran, 1978, p. 215).

Amusement seems to be in order for Peter Knox in his 1990 article "In pursuit of Daphne":

Few, for example, have failed to notice or smile at some of the less conventional aspects of Apollo's courtship of Daphne. The incongruous portrayal of the god in hot pursuit of the maiden, producing a long speech of courtship in mid-career, is perhaps the most curious feature of Ovid's presentation—at the very least we must admire Apollo's endurance and conditioning. The incongruities of this situation alone with its humorous undertones, however, do not seem sufficient to explain Ovid's purpose here. For that, it is necessary to pursue Daphne more vigorously ourselves [...] (Knox, 1990, p. 185).

At the end of his article, Knox concludes:

Ovid chooses to forgo Apollo's song of courtship, and instead incorporates the themes appropriate to such a song into the speech delivered by Apollo on the run; the metaphor of the chase is thus expanded to become the principal subject of the narrative in a setting of thwarted passion and unmotivated aggression. A small point, perhaps; but some aspects both of Virgil's Sixth Eclogue and of the *Metamorphoses* may seem clearer if we have indeed caught up to Daphne (Knox, 1990, p. 202).

Scholars' witticisms, offering to "pursue Daphne more vigorously ourselves," may sometimes be a sign of interpretive shortcoming, no matter how erudite their contexts. This is not to say that humor is absent from the *Metamorphoses*[11], but rather that careful textual analyses should be carried out before academics declare that fun ought to be read in a story of rape. In 2009, Martin Helzle writes that "One minute one sees Apollo's pursuit of Daphne through the young woman's eyes as rape, the next moment it is seen through the god's eyes as just plain fun" (Helzle, 2009, p. 188). In short, for Helzle, it is all about readers' gendered point of view, and Ovid's text is amenable to all sorts of opinions about sexual violence. Yet, a kinesic analysis of the text suggests otherwise. My claim is not that there is only one correct way of reading Ovid's narrative, but that the perception of fun in the Phoebus and Daphne episode says more about the reader's ethical maturity than about the text itself. For the text is remarkably detailed about the sensorimotor and emotional reality of predation, involving terror, paralysis, and muteness in the victim. Ovid's attention to sensorimotricity and his ability to communicate it verbally is so central to the *Metamorphoses* that it can indeed be seen as one defining feature of his work's coherence, providing a possible answer to the

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[11]See Bolens, 2021, chap. 3: "Ovid and Chrétien de Troyes: Pyramus, Thisbe, and Yvain's hypersensitive lion," 106-131, doi: 10.1093/oso/9780190930066.003.0007.

oft-debated question of whether the *Metamorphoses* have any coherence at all (Wheeler, 2000).

A reason for scholars to call Phoebus and Daphne's tale "amorous" or "erotic" is that it involves the god Cupid. The text explains that Phoebus Apollo's "first love," *primus amor* (*Met.* 1.452), is caused by the "raging wrath of Cupid," *saeua Cupidinis ira* (*Met.* 1.453). *Amor* in Latin can denote the feeling of love as well as sexual intercourse. Apollo's first *amor* is immediately qualified as being caused by the raging/fierce/furious anger of Cupid, who creates the worst-case scenario of what can still be denoted by the word *amor* in Latin: sexual aggression and non-consensual intercourse. To decide that the episode is a love story because the word *amor* is used in it is at best simplistic. Ferocity and degradation drive the action.

Cupid is enraged because Apollo belittled him and his bow, claiming for himself the privilege of this weapon. Cupid retaliates by shooting him and Daphne with incompatible arrows: one arrow triggers sexual craving, the other precludes it (*Met.* 1.469). The interaction between Apollo and Daphne embodies this extreme tension, which interlinks in its narrative manifestation the two sets of distinctions discussed in this article. I begin by focusing on the connection between momentum and kinaesthesia. Daphne's speed and lightness is emphasized in a simile that compares her flight to wind, *fugit ocior aura* (*Met.* 1.502), she flees faster than the air. Phoebus pursues her, trying to convince her to slow down. This is the moment of his so-called courtship. The god is longwinded indeed, accumulating similes of animal predators and preys (wolf and lamb, lion and deer, eagle and dove), claiming that they do not apply to the present situation since he is not her enemy. He explains that the cause of his pursuit is *amor* (*amor est mihi causa / sequendi*, *Met.* 1.507) and tries to convince her by listing in detail his divine credentials. But the nymph, keen to emulate Diana and protect her own virginity, keeps running.

The fact that, given the action of running, Apollo's speech may feel awkward and verbose produces an important kinesic effect. The god strives to decrease Daphne's pace by means of his prolonged speech, promising to slow down if she does too: *moderatius, oro, / curre fugamque inhibe; moderatius insequar ipse* (*Met.* 1.510-511), "Slow down, I ask you, check your flight, and I too will slow" (trans. Kline, 2000). But Daphne wants to escape from his lust. Therefore, suddenly, the god's pace fires to extreme speed. The text highlights the intensity of this shift in momentum, adding that Daphne's flight further enhances her beauty as the wind reveals her body and flings her hair behind her. The timing of this turning point emphasizes the contrast between the two types of interactive and interdependent momentum.

The description of Phoebus' impetus is described by means of a hunting simile, further highlighting the abrupt shift in momentum. The interaction between Apollo and Daphne suddenly rockets into a high-speed chase, prompting kinaesthetic inferences of an extremely strained effort. Momentum and kinaesthesia interconnect both when Apollo tries to pull Daphne back by means of his speech, and when he decides to catch her regardless of her refusal. Kinaesthetic inferences concern the interconnection between the movements of both predator and prey.

> *ut canis in uacuo leporem cum Gallicus aruo*
> *uidit, et hic praedam pedibus petit, ille salutem,*
> *alter inhaesuro similis iam iamque tenere*
> *sperat et extento stringit uestigia rostro,*
> *alter in ambiguo est an sit comprensus et ipsis*
> *morsibus eripitur tangentiaque ora relinquit;*
> *sic deus et uirgo est, hic spe celer, illa timore* (*Met.* 1.533-539).
> [Like a hound of Gaul starting a hare in an empty field, that heads for its prey, she for safety: he, seeming about to clutch her, thinks now, or now, he has her fast, grazing her heels with his outstretched jaws, while she uncertain whether she is already caught, escaping his bite, spurts from the muzzle touching her. So the virgin and the god: he driven by desire, she by fear (trans. Kline, 2000)].

The muzzle of the hound is extended, outstretched (*extento rostro*) and about to bite, constraining the victim's every step. The latter, not knowing whether she has already been caught or not, escapes in extremis from the bites (*morsibus*) of this mouth that is already touching her (*tangentiaque ora*). The sentence *tangentiaque ora relinquit* shows the prey leaving behing (*relinquere*) the touching mouths (*tangentia ora*), where mouth is an accusative plural. The act of predation multiplies the organ of capture in a temporality where the tempo and speed of the aggression are vividly enhanced. Such an emphasis on the predator's wounding jaws in the extensive simile that describes the chase must be kept in mind. For the god will indeed enforce his mouth onto Daphne after her metamorphosis.

Daphne's strength is soon exhausted, and she begs her father, the river-god Peneus, to rescue her from Phoebus by ridding her of the figure that pleased the god too well, *qua nimium placui, mutando perde figuram* (*Met.* 1.547). The immediate impact of her prayer is her metamorphosis, whereby she is deprived not so much of her attractiveness as of her mobility.

> *uix prece finita torpor grauis occupat artus;*
> *mollia cinguntur tenui praecordia libro;*
> *in frondem crines, in ramos bracchia crescunt;*
> *pes modo tam uelox pigris radicibus haeret;*
> *ora cacumen habet; remanet nitor unus in illa* (*Met.* 1.548–552).
> [Her prayer was scarcely done when a heavy numbness seized her limbs, thin bark closed over her breast, her hair turned into leaves, her arms into branches, her feet so swift a moment ago stuck fast in slow-growing roots, her face was lost in the canopy. Only her shining beauty was left (trans. Kline, 2000)].

After a first shift in momentum during the race, a second one occurs when Daphne is abruptly transformed into a laurel tree. The speed of the metamorphosis is meant to defeat the speed of the god's haptic greed, separating the exact timing of transformation from the timing of contact. While Daphne desperately tries to escape from the sexual predator's clutch, his avid breath hanging over her neck and scattered hair (*et crinem sparsum ceruicibus adflat*, *Met.* 1.542), her call for help results in an immediate and utter loss of autonomous motricity. She is suddenly paralyzed and trapped within the bark and wood of a

tree, her rooted feet planted within the ground, her arms growing (*crescunt*) into lifted branches, leaving her trunk exposed to the god's grasp and mouth. In terms of kinaesthetic sensations, this metamorphosis is catastrophic. It evokes the trauma experienced by victims of rape who find themselves paralyzed with terror.

When Phoebus reaches Daphne, her hardened envelope supposedly protects her from penetration. This is the reason why Daphne is generally seen as saved from rape. The idea that she is not raped because bark precludes penetration is in and of itself a sensorimotor inference elicited by a perceptual simulation. But, while rape is anyway not limited to vaginal penetration, an explicit reference to penetration is absent from other scenes of rape in Ovid's *Metamorphoses*. Here, Phoebus touches Daphne, and she recoils from within her bark. This is a horrifying moment, which interconnects kinesis, kinaesthesia, and haptics: the sexual predator touches his victim's body despite her reluctance and her hardened wooden envelope, and he enforces upon her a constrained contact that she is prevented from warding off. It is noteworthy that, in the first line of the following quotation, the use of the word *amare* denotes the predator's sexual actions.

> *hanc quoque Phoebus amat, positaque in stipite dextra*
> *sentit adhuc trepidare nouo sub cortice pectus,*
> *complexusque suis ramos, ut membra, lacertis*
> *oscula dat ligno; refugit tamen oscula lignum.*
> *cui deus "at quoniam coniunx mea non potes esse,*
> *arbor eris certe" dixit "mea."* (*Met*. 1.553-558).
> [Even like this Phoebus loved her and, placing his hand against the trunk, he felt her heart still quivering under the new bark. He clasped the branches as if they were parts of human arms, and kissed the wood. But even the wood shrank from his kisses, and the god said "Since you cannot be my bride, you must be my tree!" (trans. Kline, 2000)].

"The wood shrank (*refugit*) from his kisses." The Latin verb *refugit*, from *refugere* "to flee back, to run away, to escape," is formed on *fugere* "to flee" and the prefix *re-* which suggest a backward movement and/or iteration, thus intensifying the meaning of the verb and the idea of a strenuous and repeated attempt at escaping from a threat in order to find *refuge* elsewhere—and elsewhere for Daphne means farther within her trapped, embodied self. The wood (*lignum*) still (*tamen*) fled back from (*refugit*) the kisses (*oscula*). To fully understand this line, we need to actively use our kinesic imagination and kinaesthetic knowledge. Trapped in her flesh which has become wood, deprived of all autonomous motricity, Daphne is still desperately trying to escape from the coercive mouth of her aggressor. The deeply embodied impossibility of her flight makes her powerless effort even more sensorially vivid and horrifying.

The extreme violence of the aggression is conveyed by the timing of the two sudden shifts in momentum, leading to a sense of utter repulsion in haptic constraint, highlighting the suffocating horror of rape. Wood recoiling as flesh would is strikingly expressive of the extreme act of violence which Ovid narrates in this story of rape. To bypass this key aspect and turn this narrative into a "love story" in which "fun" is palpable is to miss a crucial point, adding more violence to the violence of rape.

Sensorimotricity is the register in which metamorphoses take place in Ovid's work, inducing the possibility of a felt understanding in readers. Readers of any century and of any gender are *a priori* cognitively equipped to perceptually simulate and experience the temporal qualities of an increasing momentum abruptly halted by a radical loss of motricity, triggering specific kinaesthetic sensations. The latter may potentially convey the haptic horror of an unwanted contact that paralyzes the victim. Ovid's narrative style provides an augmented access to kinaesthetic sensations inflected temporally via shifts in tempo (in the act of running), timing (in the moments of transformation and contact), and momentum (in the chase). Time as flowing motion is an experience conveyed by his style and narrative art, which elicit the possible awareness in readers of a deeply embodied and traumatic metamorphosis.

However, the rape of Daphne has been recycled into cultural capital and institutional domination. In his translation, A. S. Kline chose for lines 553 to 567 the heading "Phoebus honors Daphne." Daphne, a victim of rape, is "honored" when her rapist touches and kisses her by force even though he can feel that her flesh-turned-wood still tries to escape, recoiling from his hands and mouth despite her paralysis. She has literally been reduced to the silence of plants by the intervention of her own father. Apollo can now decide that she belongs to him once and for all: *"arbor eris certe" dixit "mea"* (*Met*. 1.558), "you will be, he said, *my* tree!" The syntactic position of *mea*, separated from the rest of the sentence by *dixit*, puts an emphasis on the fact that the predator declares that he owns his victim.

Daphne turned laurel becomes another attribute of the god, beside his lyre and quiver. Apollo announces that her leaves will crown his forehead and serve as trophy for victorious Roman generals, acclaimed in processions through Rome after returning from their imperial conquests. She will also have to stand outside Augustus's doorposts, decorating the entrance to the emperor's palace. To read this after the violence of her transfiguring rape and decide that all is well, her supposed honor compensating for her loss of self and agency, is highly problematic.

Ovid's final line is striking: *factis modo laurea ramis / adnuit utque caput uisa est agitasse cacumen* (*Met*. 1.566-567), "the laurel bowed her newly made branches and seemed to shake her leafy crown like a head giving consent" (trans. Kline, 2000). J. D. Reed (2018, p. 408) rightly points out that "The ambivalence in that 'seemed' with which the episode concludes is endemic to this poem's representation of identity and change". Daphne has been silenced and deprived of autonomous movements. She can be read as anyone may wish to read her, deciding what the plant is bound to mean in submissive approbation. A person turned into a thing can only comply. In kinesic terms, she has been reduced to kinetics, the laws of physics whereby some breeze can make her branches move and supposedly approve, she who was able to run as fast as the wind. Her body turned into wood is now limited by new kinematic constraints, her feet rooted deep and her arms perpetually lifted. Once her terrified heart has recoiled within her new wooden flesh, her kinaesthetic sensations are blocked out and become impossible to infer. Her voice is irremediably silenced, as her face and mouth are lost in the canopy, precluding kinesic communication and intersubjective interactions. She is

now just a symbol, a token of Apollo's power, and her ability to make meaning is forever torn away from her self-agency. She is left approving in the way a tree bows in the wind. Her kinesis and power to interact have been reduced to kinematic mechanisms prompted by the action of external forces (e.g., the wind) and the will of others (e.g., that of her "owner"). Her kinesic agency has been reduced to kinetic laws and reified kinematics.

Ovid's attention to sensorimotricity conveys the sense of trauma caused by the act of torture which rape is, transposing into the realm of deities (a bold move in itself) what could not be said of human authorities. For J. D. Reed, the *Metamorphoses*

> is a study in the exercise of power, and rape (in Latin, such violations could have fallen under the legal category of *stuprum*) is one version of power over a person. The gods largely behave as absolutely…powerful humans might be expected to behave, without moral constraint, to satisfy their desires (remember that this poem offers no clear account of where these gods came from and why they deserve their power). Implicit in these personal interactions are questions of coercion and consent; episodes such as that of Daphne pose these questions in the realm of sex and gender (Reed, 2018, p. 407).

It is noteworthy that Ovid refers to Augustus as a reaching point in the Phoebus and Daphne episode. Putnam (2004, p. 71) suggests that "Ovid offers on several level at once an intense critique of contemporary Rome". Referring to the laurel as a symbol of victory, he writes,

> Between the simile [the laurel meaning victory] and Augustan reality lies, of course, the metamorphosis of Daphne, the raison d'être for the episode itself. Daphne's prayer for, and moment of, mutation both break up the epic continuum from Apollo as hunter-hound to Augustus in glory, and serve as extraordinary commentary upon it. […] In terms of hierarchies of power, Daphne is not only the "enemy" that Apollo is drawn to pursue but his, and Rome's, victim as well. She is the defeated without whom victory cannot take place, the loser who puts into relief the winner's celebration (Putnam, 2004, p. 81–82).

Daphne turned into the laurel tree is a "symbol of Apollo's public image and of Rome's pretensions to imperial power" (Putnam, 2004, p. 84). What is more, Octavian, once become Augustus, is known to have gradually taken on "the role of protégé of Apollo" (Zanker, 1988/1990, p. 48). His residence was emphatically close to Apollo's temple on the Palatine (Zanker, 1988/1990, p. 51), and the emperor's intense propaganda "reached the stage of blending his own image with that of the god" (Zanker, 1988/1990, p. 55). It is thus conceivable that Ovid's representation of Apollo as a rapist and compared to a drooling dog in Book 1 of the *Metamorphoses* is symptomatic of the reasons why the emperor decided to exile the poet. The exact reason of Ovid's exile is to this day unclear, but his *Metamorphoses* convey a representation of power that does not flatter authorities smoothly enough. The refinement of his style should not blind readers to the fact that, in Enterline's (2004, p. 1) words, "at the center of Ovid's *Metamorphoses* lie violated bodies". In his work, gods acting like humans—suggesting humans acting as if they were gods—have a strong and systematic tendency to abuse their power. To grasp this dimension of Ovid's masterpiece, it matters that we pay attention to his poetics of sensorimotricity and activate our kinesic imagination and kinaesthetic knowledge consistently and reflectively. One immediate benefit would be to have Classicists and academics in general reconsider calling Apollo's rape of Daphne an "erotic" and "passionate" "love story".

5. CONCLUSION

Kinesic imagination and kinaesthetic knowledge are fundamental cognitive and sensorial faculties shared by humans of any culture and historical period. They are manifest in artifacts such as literary texts and visual representations, which activate these faculties in acts of reception. The second section of the article illustrates this fact with visual examples taken from medieval illuminated manuscripts and with literary examples borrowed from authors of various periods (Antiquity, the Renaissance, and Modernity), using different languages (Latin, English, and French). The analysis of the selected drawings and quotations applies the 4K distinctions with a focus on kinaesthesia.

The 4Ks are associated with the second set of distinctions (momentum, tempo, and timing) in Sections 3 and 4. In Section 3, the focus is on visual artworks and the kinesic intelligence with which such artists as Bosch and Bruegel communicated visually about dynamic movement-based meanings relative to gravity and the myth-related action of falling. In Section 4, the focus is on literature and Ovid's masterpiece, in which time and movement constitute a conceptual unit. A kinesic analysis of the Apollo and Daphne episode in the *Metamorphoses* suggests that readers' kinesic imagination and kinaesthetic knowledge are instrumental to an understanding of the text. Kinesic intelligence in literature implies paying full attention to the ways in which another human created movement-based meanings, wherever and whenever this human lived. The added value of the two sets of distinctions discussed in the article is that they provide complementary means not only to describe movements but also, and most fundamentally, to perceive them at all. It is often the case that movement-based meanings are overlooked, even by specialists of a given field of research, when this type of analytical tools is missing, precluding the level of attention needed to consider such aspects fully.

This being the case, the two sets of distinctions discussed in the article are tools, no more no less. They afford the possibility of more focused acts of perception, thus allowing for more detailed analyses and descriptions. It must be stressed that they do not correspond to interpretive grids. To better perceive movements is the opposite of imposing preestablished meanings onto them. In Proust, the simile that compares the Duchess of Guermantes to a tree does not imply a loss of agency and intersubjectivity, whereas in Ovid, Daphne's transformation into a tree involves such a radical loss.

The ethical responsibility of artists and writers needs to be met by that of readers and viewers, thanks to their shared kinaesthetic ability to imagine how a gesture may potentially feel. While a movement-based meaning must unquestionably be situated in its historical and cultural context, kinesic imagination and kinaesthetic knowledge may not only help us delve deeper into an artwork, but also find in it the source of novel and more discerning relations with our own sensorimotor and interpersonal reality. For instance, they may possibly shed light on the difference between a story of rape and an erotic love story.

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/s.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Temporal procedures of mutual alignment and synchronization in collaborative meaning-making activities in a dance rehearsal

Maximilian Krug*

Institute for Communication Studies, University of Duisburg-Essen, Essen, Germany

Synchrony is a members' interactional solution for dealing with multiple relevant interactional tasks simultaneously when working on two or more separate, perceptual, and equally relevant projects, e. g., when dancing while pointing out a feature of the ongoing dance. This paper focuses on moments in which participants engage in joint meaning-making to identify, negotiate, and implement displayed multimodal gestalts of the choreography. Three temporal procedures of mutual alignment and synchronization were identified through a conversation analytical approach in combination with marker-less motion tracking movement analysis of a dance rehearsal: delays, accelerations, and accentuations. The analyses revealed that synchrony requires constant coordination in order to establish, maintain, and dissolve alignment between participants and their multimodal resources.

KEYWORDS

synchrony, alignment, multimodality, multiactivity, coordination, movement analysis, conversation analysis, dance

Introduction

Temporality is an essential feature of social interaction (Deppermann and Günthner, 2015). In the field of linguistic interaction research (e.g., Couper-Kuhlen and Selting, 2018), the temporality of spoken language has been conceptualized as online syntax (Auer, 2007) and studied in terms of incrementality and emergence of spoken language (Günthner, 2011). Most recently, the shift toward multimodality in the study of conversation analysis (cf. Mondada, 2019) has led to a focus on temporality in multimodal interactions. As such, the temporal logics of different processes (e.g., speaking and dancing, Keevallik, 2015), the prospectivity of deictic projections (Stukenbrock, 2018), and the retrospectivity of delayed completions (Oloff, 2018) have come into focus. Following Deppermann and Streeck (2018, p. 4), there are three factors involved in the temporality of interactions:

(a) temporality as duration: e.g., pauses in speech, stretched syllables, phases of movement within a gesture, and entire sequences of actions as "time-objects"

(b) temporality as frame of reference: e.g., the retrospective and prospective perspectives of participants on interactional events

(c) temporality as timing: e.g., temporal coordination of different phenomena, such as the linking of gestures and speech

This paper draws on all three by focusing on both the anticipation of verbal courses of action and movement trajectory estimations as basic requirements for synchronization in interactional situations like collective dance activities. Recent research on synchrony in interactions (e.g., Pfänder and Couper-Kuhlen, 2019) suggests that synchrony is used by participants for communicative purposes in narratives (see Section Mutual alignment and synchronization in social interaction for a literature review). Yet, the communicative function synchronization may have outside storytelling sequences (e.g., for collaborative activities) remains largely unexplored. Therefore, this paper investigates how and for what purpose interactants synchronize with each other in collaborative situations. Which alignment procedures do we find for verbal and bodily synchronization practices? Furthermore, what is the function of the similarity of multimodal gestalts (i.e., symmetry) for these synchronization practices?

Dances are appropriate for investigating these research questions because various processes can be regularly observed in dances in which participants resonate and synchronize with each other. These include alignment with the beat of the music, bodily synchronization with dance partners, and the integration of verbal sense-making activities (e.g., instructions, explanations, or inquiries) into the dance movements.

Alongside advances in multimodal interaction research, the collaborative, interactive production of dance is increasingly becoming a research focus in conversation analysis (Bassetti, 2014; Albert, 2015). Most relevant studies have focused on the interactions between dance teachers and students (Keevallik, 2015), between two dancers (e.g., the legitimacy of a dance hold as examined by Keevallik, 2021), or the coordination of a simultaneous movement start (Broth and Keevallik, 2014). However, until now, there has been no systematic description of the temporal procedures of these interactional alignment practices in dance rehearsals through which dancers establish synchronization of movement.

Therefore, this article aims to explore the temporal procedures (including delays, accelerations, and accentuations) that dancers use to establish alignment and synchronize with one another in terms of intensity, speed, and multimodal gestalt (Mondada, 2014). Thus, this article both connects to current research on personal and intercorporeal coordination in face-to-face interactions (Deppermann, 2014; Meyer and Wedelstaedt, 2017) and offers insights into the interactional and temporal practices of mutual alignment in a complex communicative project like a dance rehearsal.

Background

Temporal organization in interpersonal communication

In social interaction research, the simultaneous presence of different expressive resources is called multimodality. Recent studies on interactional multimodality have shown that all modalities can be equally relevant for interactants, meaning that none should be treated as automatically superior unless explicitly displayed by the participants. Modalities do not occur individually, nor are they perceived separately by interactants. The totality of all perceivable multimodal resources of a given participant in a given situation is referred to as a gestalt; this concept is in line with the holistic perspective on multimodality in interaction research (Koffka, 1928, 2013 [1935]). The central principle of gestalt theory is supersummativity, the idea that the perceived whole is more than the sum of its individual parts. Utilizing this principle for multimodal investigations allows for the definition of interactional displays as multimodal gestalts of simultaneously relevant resources that result from the situational actions of the participants. To date, the gestalt concept has only been applied to isolated resources, such as prosody (Couper-Kuhlen, 2009) or gestures (Streeck, 1993), due to interaction research's focus on linguistic features. Krafft and Dausendschön-Gay (2003) extend this perspective with their holistic concept of communicative gestalts, indicating that participants treat individual utterances as multimodal units due to their gestalt-like nature. Mondada (2014, p. 136) takes this idea further by describing all interactional contributions as "complex multimodal gestalts." According to this, pointing gestures should be described not only as arm and hand movements, but as movements of the whole body that use all multimodal resources (including posture, gaze, facial expressions, etc.) in their sequential environments.

With a multimodal perspective on social interaction, the organization of multimodal resources as interpersonal and intrapersonal coordination processes (Deppermann, 2014) moves into the research focus. Interpersonal coordination encompasses those multimodal behaviors through which interactants interactively coordinate with each other. This includes all sequential procedures, which are usually the foci of conversation analysts: Who acts in what ways in relation to whom? How do interactants indicate their understanding of previous interactional contributions? Intrapersonal coordination, then, describes the self-organization of multimodal expressive modalities: When does a gesture reach its climax? How do interactants establish simultaneity of their multimodal resources? The concept of coordination allows for the analysis of the reciprocal processes of both multimodal self-organization and the organization of multiple activities with other interactants. One particular form of coordination discussed in detail in the following Section Mutual alignment

and synchronization in social interaction is synchronization. In this paper, synchronization of multimodal resources is relevant as the rehearsal participants utilize it to align with each other and with the dance rhythm in order to engage in collaborative meaning making.

Closely linked to synchronization is the phenomenon of the simultaneous relevance of multiple activities; this is known as multiactivity (Haddington et al., 2014). To date, this term has subsumed all interaction analyses that examine the simultaneity (of whatever kind) of multiple activities in interactions (e.g., Nishizaka, 2014; Hoey, 2018; Kamunen, 2020). The phenomenon of multiactivity encompasses the coordination practices of complex activity packages in which participants must maintain their involvement in and the co-relevance of multiple courses of actions (Haddington et al., 2014, p. 3). In doing so, multiactivities follow their own temporal logics, which need to be aligned by participants to enable simultaneous coordination (Mondada, 2008). With the help of simultaneous coordination practices, interactants combine two or more courses of action (=activities) into one interactional unit (=multiactivity) (Mondada, 2011) until the same resources are needed for different activities (Ticca, 2014). Multiactivities increase the complexity of face-to-face interactions because participants use different multimodal resources in different orders for different courses of actions (Mondada, 2014) and pose particular demands for all participants in interactions. Multiactivities occur when interactants have two or more separate, perceptual, and equally relevant projects (Licoppe and Tuncer, 2014) to work on, e.g., performing a dance while discussing a feature of that dance. Multiactivities are not randomly occurring, inference-rich phenomena that interactants must deal with. Instead, they are both a "collective, collaborative, and intersubjective" (Haddington et al., 2014, p. 6) manufacturing effort of an entire interactional ensemble *in situ* and an interactional solution for dealing with multiple simultaneously relevant interactional tasks.

Mutual alignment and synchronization in social interaction

Interactional alignment is one of the basic requirements for face-to-face social interactions (Stivers, 2008). As interactants mutually orient themselves to each other, a social resonance is created that enables participants to, among other things, produce complex communicative projects (Luckmann, 1995; Linell, 2009) like dance rehearsals. Thus, reciprocal alignment is a prerequisite for synchronization in interaction. Synchronization as the "dynamic and reciprocal adaptation of the temporal structure of behaviors between interactive partners" (Delaherche et al., 2012, p. 351) encompasses processes through which interactants' multimodal resources are

aligned in terms of speed, intensity, and form of realization. As research on interactional overlap suggests, participants purposefully vary the tempo of their speech in order to obtain the right to talk (Jefferson, 1973, 1986; Schegloff, 2000). Conversely, participants can also align with the speed of a turn to synchronize with another speaker's turn. This can be accomplished such that the multimodal resources that are "attuned" to each other are performed synchronously, e.g., when interactants finish sentences in unison (Pfänder and Couper-Kuhlen, 2019) (=simultaneous synchronization) or when other interactants practice gestural matching (Lerner, 2002; Sidnell, 2006) (=post-simultaneous synchronization).

Thus, if simultaneity describes the moment of temporal relation in which two or more (communicative) units (resources, practices, actions, activities, etc.) relate to each other, synchrony instead refers to the similarities between aligned communicative units. As Condon and Ogston (1966) showed using film recordings of an isolated utterance at 48 frames per second, synchrony in communicative situations occurs when so-called "patterns of change" (Condon and Ogston, 1966, p. 338) can be observed in kinesthetic behavior with respect to the immediate temporal antecedent. These patterns of change can be divided into self-synchrony (congruence of speech and body movement) and interactional synchrony (changes in body configuration by listeners in relation to speakers; cf. Condon, 1970). Thus, synchrony in interactions, as a special type of personal coordination, exhibits the same distinction between intrapersonal and interpersonal synchrony as coordination (cf. Deppermann, 2014). It is important to note that every (interactional) synchronization requires both intra- and interpersonal coordination, but not every intra- and interpersonal coordination results in synchrony. In situations like a dance rehearsal, the synchrony of simultaneous activities is made possible by the fact that interactants have established a common focus of attention that is maintained for the duration of the synchronization if not longer (cf. Chetouani et al., 2017). Furthermore, routinizations (Streeck and Jordan, 2009) or preparation markers that project specific activities (Auer, 2005), also allow participants to respond to actions before they are even performed. Synchronizing simultaneous actions can mean that participants simultaneously perform actions others are already engaged in (so-called symmetrical synchronization, Kim, 2015), e.g., in choral speaking (Lerner, 2002), mirroring the postures of co-participants (Kendon, 1970), or in this paper, moving to music in the same way as other participants. In asymmetrical synchronization, however, participants synchronize different simultaneous actions with ongoing actions by other participants. Examples include nodding in relation to speech (Whitehead, 2011) or, in this paper, placing footsteps to the rhythm of music.

Synchronization is not only observable in activities like a partner dance, but also in everyday settings like job applications (Delaherche et al., 2012), couples therapy (Tschacher and Ramseyer, 2017), and triadic situations of shared storytelling

(Zima, 2017). One explanation for synchrony in social interactions is positive relational work, which is the idea that the more synchronized a relationship is, the more positive (Kim, 2015). Synchrony is an interactional state or process that occurs when participants have coordinated their multimodal resources for both form and timing (McDowall, 1978). Pfänder and Couper-Kuhlen (2019, p. 25) describe the synchrony of speech and non-verbal behavior of two participants as "choral performance," thus (re)integrating verbal modality into the corporal synchrony concept, making the study of synchrony possible within the field of multimodal conversation analytics. When examined with this perspective, interactants establish synchrony when they align their gestalts, e.g., when dancers adopt the choreographer's posture, as illustrated in this paper. As synchrony involves similar forms, intensities, frequencies, and paces of actions, interactors use different temporal relation procedures, such as pauses, delays, or accelerations of individual movement trajectories, to synchronize. Furthermore, in the context of multiple activities, synchronization enables the simultaneous processing of multiple local interaction tasks, and thus complex communicative projects like dance rehearsals. With the help of various synchronization procedures, interactants combine their practices when participating in a multiactivity such that functionally divergent interactional tasks can occur simultaneously. A prerequisite for this is the structural compatibility of the multimodal resources of the co-relevant activities. Thus, while intra- and interpersonal coordination involve the organization of the activities that are part of every face-to-face interaction, synchronization focuses on the relationship between those activities. If activities are similar in terms of shape and function, they are considered synchronous (Pfänder et al., 2017). In the following, the synchronization concept developed based on monoactivity interactions will be transferred to simultaneous coordination processes of multiple activities. The focus here is on both synchronization for the purpose of communicative projects and the practices through which interactants adapt to structurally compatible multiactivities in terms of form, intensity, and speed. In sum, this study shows how dancers must align their multimodal gestalts to successfully collaborate on a dance rehearsal.

Dance in social interaction research

According to Goffman (1974, p. 66), a dance instruction is "an activity taken out of its usual functional context in order to allow someone who is not the performer to obtain a close picture of the doing of the activity." Dancing requires participants to focus on both the inter- and intrapersonal coordination of multimodal resources. However, unlike activities such as instructions, dancing is an activity that requires synchronization (Pfänder et al., 2017), much like choral singing or joint piano playing (Reed, 2015). While dance was rarely considered in

the field of interactional analysis before the 2000s (Levy, 1987 is an exception), the collaborative, interactive production of a dance has increasingly become a research focus with the rise of multimodal studies in interactional research. Recent studies on dance in interaction focus on creating intersubjectivity in partner dances (Bassetti, 2014; Bassetti and Bottazzi, 2015), the use of bodily resources for adjusting elements in dance lessons (Keevallik, 2010, 2013, 2015), and the interactional work partners conduct to count into a dance (Broth and Keevallik, 2014). Most recently, Ehmer's (2021) study on the multimodal synchronization practices of demonstrations in dances reveals that synchronization can be either emergent (i.e., when bodily alignment can be performed at any time) or orchestrated (i.e., when bodily alignment is required). These studies indicate the vital importance of the intercorporeal coordination of the dancers. In a pair dance, the two dancers act as one body: the movement of one is followed by the other, which, in turn, makes its own movement perceptible to the other. When dance partners are synchronized intercorporeally (Meyer and Wedelstaedt, 2017; cf. Goodwin, 2017), they are able to continue the logic of dance; two bodies are performing complementary, synchronized actions at very small distances, or even with direct body contact, within the same rhythmic-temporal temporality (cf. Keevallik, 2015).

All of these studies indicate the importance of intercorporal coordination in synchronized dance activities. However, temporal alignment practices have not been specifically addressed until now. One exception is Albert's (2015) study on the rhythmic coordination of performers and audiences in partner dance, which utilized beats as units of temporal alignment. While this hints at temporal synchronization, the synchronization practices of multimodal gestalts in terms of form, intensity, and speed cannot be described by temporal dimensions alone. To address this research gap, this paper aims to combine conversation analytical methodology and marker-less motion tracking of dance movements as described in the following section.

Data and methodology

The audiovisual data basis for this paper is a 36-min sequence in which participants in a German theater production work with a choreographer on the play's opening waltz. Since neither the actors nor the director had in-depth dance experience, the choreographer had to primarily use her body, and those of the participants, to suggest, instruct, and correct dance steps and figures. Therefore, our analysis focuses on sequences in which the participants engaged in joint meaning-making in order to identify, negotiate, and implement the displayed multimodal gestalts of the dance elements.

The data is presented in transcripts that follow GAT2 conventions (Couper-Kuhlen and Barth-Weingarten, 2011).

For multimodal annotations, Mondada's (2018) conventions were used. The analytical approach of the paper is within the framework of multimodal conversation analysis (Goodwin, 2018; Mondada, 2019), this involves a data-driven, subject-based perspective on the mutually synchronizing interactants.

In addition to audiovisual data, marker-less motion tracking (Pfeiffer, 2013) was used to analyze alignment practices regarding the dynamic position work in space and the distances between the dancers. Tracking was done using Adobe After Effects' built-in tracking tool. First, the single pixels of the dancer's left foot (unless stated otherwise) were tracked in 2d space. This data was then copied onto a shape layer where a line was drawn using the tracked coordinates. The lines were then normalized using the RotoBézier function, slightly adjusted for perspective distortions, drawn onto a white background, and visually analyzed in the context of the unfolding sequence. In the graphs, movement trajectories always start at the top of the image and move down; in that sense, the y-axis represents dance distance and x-axis represents movements to the left or right from the dancer's point of view. Excerpts 4 and 5 also contain time aligned spectrogram information that was extracted *via* PRAAT (Boersma and Weenink, 2022).

Temporal procedures of mutual alignment and synchronization in dance rehearsals

This section presents five cases in which participants engage in collaborative meaning-making sequences within a dance rehearsal. In all cases, a choreographer (CHO) guides an actress (ACF) and an actor (ACM) through a dance by simultaneously demonstrating dance elements and taking part in the dance itself. Thus, all cases involve multiactivity organizations of at least two co-relevant activities. The cases are part of a larger sequence in which the participants are working on the figure of the turn in a waltz. Both actors, according to their own statements, have experience with dance; the actor had mastered the basics of folk dances and waltzes while the actress had knowledge of ballet and jazz. Therefore, both actors understood that the male dancer must assist the female dancer during a turn. In this example, however, a turn needed to be defined for a dance that does not actually provide for a (single) turn of the female dancer. Therefore, developing a turn in a waltz specifically, as well as the entire choreography, more broadly, was new to all participants. Accordingly, the participants utilized the temporal procedures of mutual alignment and synchronization for collaborative meaning-making.

Each of the five cases represent one type of synchronization practice as follows: verbal (excerpt 1) and bodily (excerpt 2) delays, verbal (excerpt 3) and bodily (excerpt 4) accelerations, and multimodal accentuations (excerpt 5).

Verbal and bodily delays

The first case involves three verbal delaying practices (pause, lengthening, and verbal recycling) through which the participants establish synchrony between the verbal instruction and the bodily dance. Before the start of the excerpt, the actress asked the choreographer if she could teach a way to turn in a classic waltz. The choreographer initially refused because there are no single turns in waltzes. However, when the actress insisted, the choreographer complied as shown below.

Excerpt 1: Verbal Delaying Practices as a Synchronization Device

```
018   CHO    ähm-
             uhm
019   ACF    also wenn das PASST wenn das passt;
             so if that works if that works
020          wenn nicht (unverständlich)
             if no (unintelligible)
022   CHO    wir können das so MACHen,
             we can do it like this|
023          *(---)#
      cho    * approaches ACF & ACM-->
      fig         #fig.1.1
024   CHO    äh: *wenn man dann zum BEIspiel,
             uh when you then for example
      cho    --->*takes ACM's hand--------->
025   CHO    *wenn man (.) HIER ist,#  *
              when you are here
      cho    *moves into dance position*
      fig                      #fig.1.2
026   CHO    *dass man EINfach nur-*
              that you just
      cho    *moves into ACM's arms*
027   ACF    geNAU; (-)
             exactly
028          das is [SCHÖN];
             that is nice
029   DIR           [JA:  ] (.) das is schön;
                    yes, that is nice
```

This excerpt begins with the choreographer complying with the actress's request ("we can do it like this," line 022). She walks onstage (Figure 1.1) and approaches the actor and actress silently (line 023). The verbal pause between the projection (line 022) and the following sentence (line 024), during which she complies with the request, allows the choreographer to put the activity *explaining a turn in a waltz* on hold for a short time until the resources of her second activity, *dancing*, have been mobilized, i.e., standing next to the actor, assuming a dancer's posture. The pause as a verbal delaying practice thus enables the following synchronization of participants.

The choreographer then grabs the actor's hand (line 024), acquiring him as another intercorporeal resource for her dancing activity. She begins her explanation activity before she has fully grasped his hand; to bridge this gap of her not yet fully mobilized dance figure, she resorts to another delaying practice. She performs a particle ("äh," line 024) that she stretches until her hand has grasped his (Figure 1.2). Thus, in addition to the pause, the stretching serves to prepare for the synchronization of the participants' intercorporeal-kinesthetic coordination.
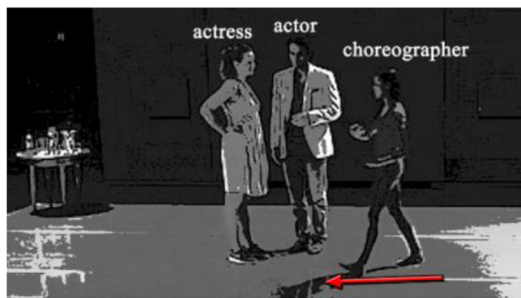
FIGURE 1. 1
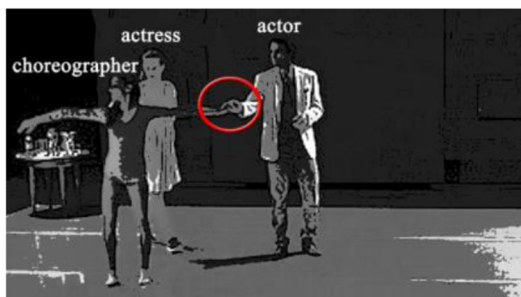CHO walks toward ACF and ACM.

FIGURE 1. 2
CHO takes dancing posture.

The choreographer has now acquired the intercorporeal resource of the couple, but still must establish her dance posture. She interrupts her own verbal participation in her explanation, meaning that her utterance "uh when you then for example" (line 024) remains syntactically incomplete. While she then adopts her dancing posture, she restarts her explanation by recycling speech material from her previous utterance ("when you are here," line 025). In this way, she once again buys herself time to adopt the necessary starting posture for the multiactivity *dance explanation*. Furthermore, she again delays the explanation in favor of her still-incomplete dance gestalt by utilizing a micro-pause (line 025) to synchronize her two activities, namely explaining and dancing. She synchronizes her two activities in such a way that the focal action phases (cf. Hoey, 2018) of both activities can be realized at the same moment ("here," line 025). Thus, the multiactivity becomes possible with the next utterance (line 026) as a synchronized syntactic-bodily gestalt (Keevallik, 2015). Simply put, she explains what she dances and dances what she explains.

Both the actress (lines 027–28) and the director (line 029) respond positively to her performance, thus displaying their understanding of the multiactivity as a collective sense-making device. This occurs at the moment that the choreographer

has synchronized her dancing and explanation activities and realized them simultaneously. The actress and the director indicate that the multiactivity is only ratable when the choreographer has synchronized her multimodal resources and formed a dance-explanation gestalt. The director and the actress clearly do not treat the synchronized activities as separate, but rather as one combined activity (a multiactivity). Therefore, it is not possible to distinguish which of the activities their visual and verbal actions are referring to. This is due to the close alignment of the activities, which are interdependent and mutually refer to each other. Thus, the choreographer achieves self-synchronization by using the delay practice of stretched particles, phases of verbal abstinence, and speech material recycling to slow down the verbal explanation in favor of the speech-free dance activity.

Delaying practices can also be observed in bodily activities, as shown in the following excerpt in which the choreographer slows down her kinesthetic actions until the actress reaches a certain moment in the choreography (turning around). In this way, the choreographer allows the actress to synchronize her actions with those of both the choreographer and the actor.

Excerpt 2: Movement Delaying Practices as a Synchronization Device

```
031 CHO  GEnau;
         exactly
032      =[ei]ns zwei DREI?
           one two three
033 ACM  [hm]
034 CHO  und dann vielleicht *drehst +du DICH* um?
         and then maybe you turn around
    cho                      *turns around---*
    acf                              +turns----->
035 SCW  ja;+#
         yes
    acf  -->+
    fig      #fig.2.1
036      * (---)
    cho  *changes dance hand grip-->
037 CHO  und gehst +so (-)* in die HAND,
         and you go into the hand like this
    cho                -->*
    acf        +mirrors cho's dance hand posture-->
038 CHO  und dann *+(5.0)#
         and then
    cho          *dances-->>
    acf           +dances-->>
    fig              #fig.2.2
```

The choreographer counts the ¾-beat of the waltz while leading the actor by the hand; the actress dances alone. The choreographer's recipient design addresses the instructions to the actress as it is she who must carry out the instructions. Thus, the choreographer must ensure that the actress can synchronize her multimodal resources with the multiactivity while simultaneously leading the actor by the hand and demonstrating the dance to him. The choreographer achieves this by first transferring her beat counting into an announcement "and then maybe you turn around" (lines 034) and then implementing the described figure (the turn) herself. However, instead of immediately following the next step in the choreography (changing hand postures), the choreographer

remains in this position with the actor holding her hand. In this way, she delays her dance, both intercorporeally indicating a pause to the actor and giving the actress the opportunity to perform the turn herself. This enables the actress to align with the progress of the multiactivity and synchronize her multimodal resources with those of the choreographer. The choreographer continues the dance only after the actress has turned and ratified the turn through a verbal feedback particle ("yes," line 035). This particle, in combination with the established eye contact (Figure 2.1), acts as a synchrony marker, indicating to the choreographer that the actress has synchronized with the multiactivity and the choreographer's gestalt. Having established synchrony between participants, the choreographer can continue her instruction.

With eye contact between the actress and the choreographer established, the latter changes the positioning of her hand (line 036), offering description of the movement shortly before the completion of the action ("and you go into the hand like this," line 037). Even before the target object of the action (hand) is introduced by the choreographer, the actress begins to imitate the shown but not yet described action with her imagined dance partner. The actress performs the imitation by physically mirroring the choreographer as the gestalt-giver while simultaneously continuing to orient herself so that she can

monitor the choreographer's further movements (Figure 2.2). This makes it clear that the actress is not only orienting herself to the verbal action of the instruction but also to the gestural-proxemic action of the dance. In this way both parts of the multiactivity contribute to the communicative project of the dance instruction. The choreographer also organizes her actions in such a way that she can monitor the progress of the actress, allowing the choreographer to wait for the actress's hand to change before announcing the next step in the choreography ("and then," line 038). This announcement is again defined as a verbally incomplete syntactic-bodily gestalt that all three participants perform simultaneously, thereby indicating symmetrical synchronization. The choreographer enables the actress to synchronize with the ensemble multiactivity by pausing her kinesthetic participation, as opposed to her verbal participation. In contrast to the previous excerpt, the delays here occur as part of a stop-and-go procedure; the choreographer performs a step of the choreography and then pauses her gestalt until the actress has also performed it. Thus, it is both the actress who synchronizes with the choreographer's action and the choreographer who aligns her participation in the ensemble multiactivity with that of the actress while intercorporeally coordinating with the actor. Synchronization status can be observed using a movement analysis, as shown Figure 2.3 below.

The movement analysis reveals three things. First, it shows the different levels at which the participants are synchronized with each other. When looking at the choreographer's movements, a regular pattern of one step forward on one followed by a movement to the side on two and three emerges. The actress also follows this pattern, but her movements take much more space than the choreographer's. When the dance sequence finishes, the actress's alignment converges even more such that when the choreographer ends the dance with a
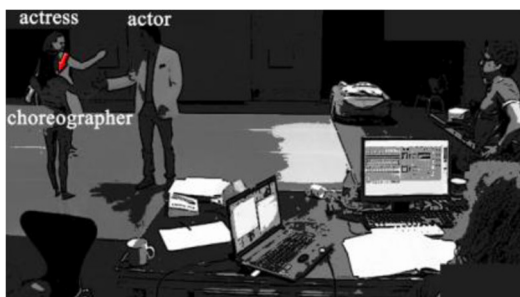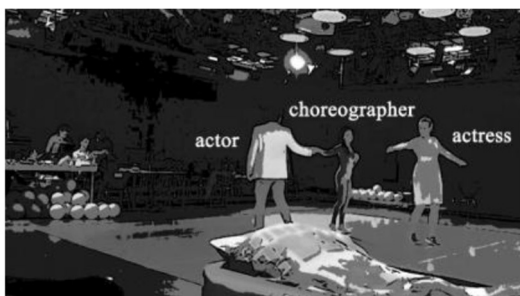

FIGURE 2. 1
ACF turns around.

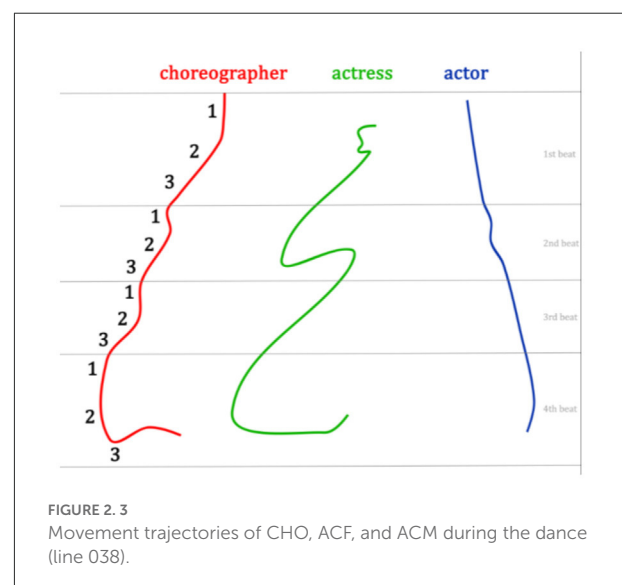FIGURE 2. 2
CHO, ACF, and ACM dance together.

FIGURE 2. 3
Movement trajectories of CHO, ACF, and ACM during the dance (line 038).

variation, the actress can duplicate this gestalt (see the large arc at the end of the graph). The actor's sideways movements show little variation, indicating a reduced dance style with a lack of effort. However, the 2nd and 4th beats particularly reveal his synchrony with the choreographer; he performs inversions of her sideways movements. Second, the analysis illustrates the different times at which the participants join the collective activity. Unsurprisingly, the choreographer starts her dancing self-synchronized with her imagined beat. The actor, still connected to the choreographer *via* intercorporeal handholding, starts to move just a short time later. This is different for the actress, who joins the collective dance last. The discrepancy of starting times can be explained by the lack of a projected go-time (cf. Broth and Keevallik, 2014). The choreographer's "and then" (line 038) indicates that a joint dance is imminent, but the precise starting time is unclear to the actor and actress. At the end of the dance, however, this changes; having established synchrony, the participants can interpolate the moment when the last "three" of the imagined, though commonly oriented to the beat, movements will take place. This is visible in the graph; all three participants end the dance almost at the same time. Third, the movement analysis shows actress's struggles to obtain synchrony. Not only is she delayed in her dance participation, but her footwork in the 1st beat suggests her working to match the choreographer's foot position.

Verbal and bodily accelerations

Synchronization involves practices not only of delay but also of acceleration; these practices become possible when participants can anticipate ongoing interactional projects. According to Streeck and Jordan (2009, p. 94), such anticipation arises through routinization, which makes a projection of the next steps and thereby a synchronization, possible: "specific types of interaction episodes—in fact, formalization and

routinization alone—serve to make interaction predictable to some extent." In the following two excerpts, the participations utilize the routinized nature of a dance as a pre-agreed sequence of steps in order to re-align with ongoing dance activities. The first excerpt shows the choreographer's coordinative work to re-establish her counting after the actor has asked a question. It demonstrates how the choreographer resorts to a synchronization practice of acceleration while intercorporeally coordinating with the actor and simultaneously coordinating a request from him without dissolving the synchrony of the multiactivity.

Excerpt 3: Verbal Acceleration Practices as a Synchronization Device

```
029 CHO  wenn man (-)°h dies:es
         when you are doing this
030      *EINS zwei drei EINS +[zwei drei EINS zwei drei-  ]
         one two three one two three one two three
    cho  *dances-->>
    acm                        +dances-->>
031 ACM                       [wenn wir hier @VORn +sind,@+]#
    cho                        when we are here in front
                                            @gaze to ACM@
                                                  +nods--+
    fig                                                    #fig.3.1
032 CHO  GEnau;#
         exactly
    fig        #fig.3.2
033      =[ei]ns zwei DREI? |
         one two three
034 ACM  [hm]
```

At the beginning of the excerpt, the choreographer synchronizes her rhythmic action and her counting/describing action by moving her feet in synchrony with her counting (excerpt 5 will focus on this phenomenon in greater detail). Both the actress and actor, whom the choreographer still leads by the hand, synchronize as gestalt-takers with the choreographer as gestalt-giver. Being synchronized with the collective dance instruction activity, the actor establishes another activity by means of a question (line 030). The choreographer reacts to this new coordinative demand in such a way that, while continuing to count the beat and to move her feet in time, she first establishes eye contact with the actor (Figure 3.1), nods in response to his question, and additionally verbalizes her confirmation ("exactly," line 031). While this validates the conditional relevance of the actor's question, it also poses a new coordinative problem regarding the synchronization of the ongoing multiactivity.

The choreographer's two-syllable feedback particle "GEnau" ("exactly," line 031) occurs in the moment of the one-count within the dance instruction. At this point, a synchronization problem arises for the choreographer; by answering the question, she is now one beat behind. She solves this problem with two practices. First, she maintains her speed, thereby also maintaining alignment with the collective dance. Second, she uses a quick verbal connection that latches her answer to her counting (line 032). By skipping half a beat, she restores the synchrony of her kinesthetic movement practices and her counting action. In the course of her re-alignment, she breaks eye contact with the actor (Figure 3.2) and subsequently continues the counting activity. In this way,
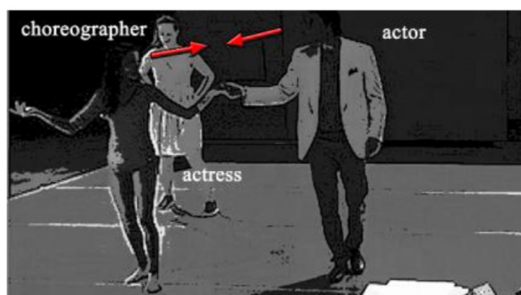

FIGURE 3. 1
CHO's and ACM's mutual gaze.

the choreographer can re-synchronize her instruction with the dance activity to which the other two participants also orient themselves.

In the following excerpt, the actor resorts to a practice of acceleration, skipping a dance step in order to synchronize with his dance partner (in this case, the actress). The choreographer then acts as beat giver by providing a regular rhythm to which the actors orient.

Excerpt 4: Movement Acceleration Practices as a Synchronization Device

```
060    CHO    und dann,
              and then
061           (---)
062    CHO    *+CHA cha cha,
       acf    *dances-->
       acm     +dances-->
063           CHA# cha *cha*,
       acf              *intermediate step*
       fig      #fig.4.1
064    CHO    #CHA,*+
       acf      -->*
       acm      -->+
       fig    #fig.4.2
065           (--)
066    CHO    und dann drehst du dich wieder UM,
              and then you turn around again
```

In this excerpt, the choreographer sets the ¾-beat of the waltz by vocalizing each beat with a "cha" sound, emphasizing every first count ("CHA cha cha," line 062). The actress has aligned, and thus synchronized, her dancing with this rhythmic instruction consisting of non-lexical vocalizations (Keevallik, 2018). The actor's interpersonal alignment with the choreographer's verbal rhythm, as well as his intercorporal alignment with his dance partner, become clear when the actress improvises an intermediate step (line 063), changing her foot position. Instead of copying this intermediate step and thus risking asynchrony with the multiactivity, the actor skips this step and, in this way, accelerates a small part of his choreography. He does this by placing his right foot, which he had already placed behind him during previous

regular step (Figure 4.1), even farther back (Figure 4.2), becoming re-synchronized with both his dance partner and the choreographer's rhythm.

By skipping a dance step, thereby "fast-forwarding" his part of the choreography, the actor synchronizes with the collective multiactivity. This is possible in this situation because the next steps in the choreography are predetermined and projected from the previous step. Hence, the actor can anticipate where the actress will be on the next beat with the help of the rhythm encoded in the choreographer's instruction. The routinization of the dance movement synchronized with the choreographer's counting enables the actor to predict where the actress will put her foot on the next beat so he can act accordingly. Thus, both parts of the multiactivity contribute to the actor's ability to use the acceleration practice. While the instruction provides the rhythm, and thus the temporal frame, of the expected actions, the dance provides information regarding the concrete realization of the kinesthetic action. Therefore, the actor synchronizes both with respect to the speed given by the verbal action and the form given by the kinesthetic participation.

The movement analysis of the dance segment (Figure 4.3) suggests that both actors are aligned with the choreographer's counting. As in the choreographer's dance pattern in Figure 2.3, both actors take one step forward on one (here: emphasized CHA), followed by a movement to the side on two and three (here: cha cha). As compared to their movement patterns in Figure 2.3, where the actress displayed spacious (larger steps) and the actor reduced footwork (smaller steps), both use similar dance trajectories here. As this excerpt occurred several dance iterations after the previous one, it documents the actors' learning of the waltz. This implies the presence of a form of routinization, which the actor draws on when the actress initiates the improvised intermediate step on the 2nd beat. The spectrogram suggests that this step occurs before the third cha of this beat, meaning that the actor has little to no reaction time. Consequently, his movement trajectory shows no sign of attempting this new dance figure himself, which would sacrifice
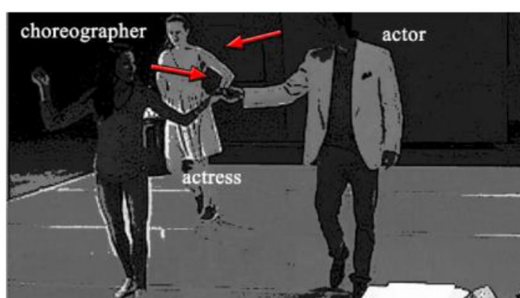

FIGURE 3. 2
CHO gazes past ACM.

FIGURE 4. 1
ACF realizes an intermediate step.

FIGURE 4. 2
ACM regains synchrony.

FIGURE 4. 3
Movement trajectories of ACF and ACM during the dance (lines 062–064).

FIGURE 5
Movement trajectories of CHO during the dance (line 029).

synchrony. The fact that he is reacting to the improvisation by accelerating his footwork becomes clear when he is able to end on the last CHA with his dance partner. If he had maintained his speed, his movement graph line would have been longer. This becomes apparent when analyzing the beginning of the respective graphs; while the actress starts dancing in synchrony with the first count of the choreographer, the actor starts relatively late. To establish synchrony, he must accelerate his dance participation.

Verbal and bodily accentuations

The remainder of this paper focuses on the verbal and bodily self-synchronization of the choreographer, which she uses to establish a regular rhythm for the actors to orient to within their collective dance instruction multiactivity. The following excerpt is taken from the beginning of excerpt 3, in which the choreographer holds the actor's hand while the

actress is dancing alone behind them. This illustrates the fine-grained interwovenness of verbal resources, movement, and (foot) posture.

Excerpt 5: Verbal and Bodily Synchronization Device for Accentuation purposes

```
029 CHO  wenn man (-) °h die:ses *EINS zwei drei EINS zwei drei EINS zwei drei
         when you are doing this one two three one two three one two three
    cho                          *dances---------------------->>
```

As described in excerpt 3, the choreographer first needs to get into position to start the dance; she does this by utilizing the verbal delaying practices described in excerpt 1 (pause and lengthening). She organizes her verbal construction "when you are doing x" as a syntactic-bodily gestalt. The choreographer first projects an imminent movement and then redeems the projection, not by explicating the movement, but by producing it herself. Interestingly, this change is also observable in her turn design. As soon as she starts to dance, the verbal modality is no longer needed for projection purposes; it is instead used as a method to establish a rhythm, a resource for the actors as they synchronize their actions with the choreographer. The following movement analysis (Figure 5) illustrates the choreographer's symmetrical self-synchronization and its communicative function.

The choreographer dances together with the actor, while describing her own movement in terms of rhythm and speed by counting, which the actress and the actor understand as an instruction to imitate these movements. In the context of the choreographer's utterance "when you are doing this one two three one two three" (line 029), she synchronizes her activities in such a way that she moves her feet with the accented counting beats and simultaneously counts at the speed of her dance. The close alignment between counting and dancing become apparent in the movement trajectories of her left foot. Before the start of the dance, she first gets into position *via*

a slight back and forth movement (Figure 5.1). Analyzing that movement's pattern reveals that every number is connected to a specific movement: On one, there is a movement to (her) right that is repeated at the beginning of each beat (compare Figures 5.2, 5.5). On two, it is primarily her right foot that moves, resulting in a small shift to each side (Figure 5.3). Finally, on three, she performs a movement to her left (Figure 5.4). While dancing, her coordination of the steps and her words differs from the temporal offset of the gestural peak and the speech-affiliate usually observed in speech-accompanying gestures (Schegloff, 1984). In face-to-face interactions, speech-affiliates are usually realized only when the peak of a gesture has already turned into a retraction (Streeck, 1993). Here, the choreographer establishes the synchronization practice of accentuation *via* the close alignment of the verbal counting and the accompanying footwork. Her accentuation thereby spans both parts of the dance instruction multiactivity; she stresses the beginning of each beat with her voice, imitating a typical waltz rhythm, and emphasizes every first step of the dance sequence with her footwork. The coinciding of the two emphasized actions here establishes the synchronization of the instructing and the dancing.

This synchronization is not only a temporal process, it also solves a communicative purpose; by describing the waltz rhythm by counting while dancing, the choreographer provides the same information *via* both her counting and her dancing. The actress and actor can then identify the direction of the movement and its rhythm, in addition to the dance posture, using her dance gestalt. Her verbal modality also provides information about the rhythm of the dance *via* acoustic references for the accented beats. This functional similarity, however, is not mere redundancy; it rather increases the interactional value of the multiactivity. Thus, the actor, who does not imitate the choreographer's dance posture (see excerpt 3), primarily uses the acoustic reference to help him perform his steps in rhythm so that he puts one foot forward per accented beat count. He cannot synchronize with the choreographer's dance posture because of his side-by-side perspective. Instead, he presumably uses the intercorporeal relationship of his hand with the choreographer's as a synchronization cue for both his dance posture and the direction of the dance. The verbal emphasis of beginning of the beat, which here coincides with a certain foot position, is thus a means of self-synchronization of the activities dancing and instructing within the collective multiactivity. It also makes the progress of the multiactivity anticipatable, thereby enabling the actors to synchronize the temporal relations of their actions with those of the choreographer in form, frequency, and speed. This synchronization of actions and activities enables a gestalt convergence of the parts of the multiactivity such that actions align. In this way, participants produce synchronized activities that allow them to work on multiple interaction tasks simultaneously.

Discussion

The paper examines the communicative purpose and practices by which participants in a dance rehearsal synchronize with each other. The participants in the data engage in the collective, collaborative, and intersubjective task of rehearsing a dance, meaning that they are constantly involved in joint meaning-making to identify, negotiate, and implement displayed multimodal gestalts. The rehearsal is organized in such a way that the dance could be performed while instruction was occurring, as opposed to instruction occurring prior to performance. As such, the participants have two or more separate, perceptual, and equally relevant projects to work on. Their interactional method for being able to deal with these multiple simultaneously relevant interactional tasks was based on achieving synchrony. With the help of various synchronization procedures, the interactants combined their practices while participating in an emerging multiactivity so that the different activities could be carried out and the functionally divergent interaction tasks could be mastered simultaneously.

Previous research suggests that interactants synchronize their multimodal resources in terms of speed, intensity, and form of realization. These aspects differ regarding their symmetry. In symmetrical synchronization, participants perform simultaneous actions that other participants are already engaged in. It is essential for those involved in a communicative project like a dance rehearsal to align themselves with the multimodal gestalts of their co-interactors; interactants establish symmetrical synchrony by aligning their gestalts with these of their co-participants. In terms of this study, this phenomenon can be observed when the actors aligned with the choreographer's dance posture in order to perform the instructed dance figure themselves. Here, speed, intensity, and form converge. This differs from asymmetrical synchronization, in which participants synchronize different simultaneous actions. This can occur when different modalities are aligned with each other, e.g., when dancers place their feet in a counted beat. While symmetrical synchronization allows participants to establish a collective, time-aligned activity, asymmetrical synchronization allows for complex interactional tasks, such as the explanation of a dance that occurs while that dance is performed, while also serving as a (symmetrical) synchronization device for the co-participants (excerpt 5).

To achieve synchronization, all necessary multimodal resources must be present at the same time. With the help of various synchronization procedures, interactants combine their practices so that the different activities can be carried out and functionally divergent interaction tasks can be mastered simultaneously. As synchrony involves similar forms, intensities, frequencies, and paces of actions, interactors must use different temporal relation procedures, such as pauses,

delays, and accelerations of individual movement trajectories, to synchronize. Verbal delaying practices, such as pauses, lengthening, and verbal recycling, allowed the participants to establish synchrony between a verbal instruction and a bodily dance (excerpt 1). Bodily delaying occurs when participants either slow down their movements or pause their kinesthetic participation (excerpt 2). Interestingly, this delay can be performed in either a smooth, emergent way or as part of a stop-and-go procedure. When participants can anticipate ongoing interactional projects and their trajectories, synchronization practices of acceleration can be used. These range from verbal practices, such as latching (excerpt 3), to bodily accelerations like skipping a dance step (excerpt 4). The analyses reveal that the nature of symmetrical synchrony can be corresponding rather than mutual exclusive; the actors regularly synchronized with respect to both the speed given by the verbal action (asymmetrical synchrony) and the kinesthetic form given by the choreographer and their dance partner (symmetrical synchrony). Therefore, synchrony involves constant coordination to establish, maintain, and dissolve alignment between participants and their multimodal resources when they are engaged in a collective meaning making activity like a dance rehearsal.

In conclusion, an important communicative function of synchronization in a dance rehearsal as a sense-making activity is to enable the performance of a complex multiactivity such as dance instruction. For dance instructions to work, the participants must synchronize in terms of speed, direction, and gestalt of movements. These coordination procedures are organized in a multimodal way and are found at both verbal and corporeal levels. They involve delays, accelerations, and accentuations of multimodal resources and occur in asymmetrical and symmetrical synchronization.

For the most part, this paper focuses on the participants' methods for establishing alignment and synchrony *in situ*. However, as indicated in the comparison between excerpts 2 and 4, movement analysis also suggests a longitudinal alignment. In that sense, movement analysis might be a useful method for documenting the learning of movements. This application is not limited to dances; it could be utilized in different settings where movements are taught to be performed independently later by participants, e.g., in sports or medical settings. To achieve more precision, the 2d marker-less motion tracking presented here could be expanded to include 3d space. This would also allow for the tracking of more than one point per participant as the trajectories could be related to each other. 3d tracking would also overcome one major limitation of this paper, which is the fact that, though the presented method enables trajectory comparisons, little information is available on the dynamics involved in gaining or losing momentum.

Despite this limitation, this paper manages to illustrate the multimodal delaying, acceleration, and accentuation practices

interactants employ when aligning their multimodal resources in terms of speed, intensity, and form of realization to reach an intersubjective understanding of an ongoing activity, such as a dance rehearsal.

Data availability statement

The datasets presented in this article are not readily available because of the data protection regulations regarding the consent forms of the study participants. However, it is possible to review the data on-site together with the author. Requests to access the datasets should be directed to MK, maximilian.krug@uni-due.de.

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. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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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Making a mark: Transforming everyday work of city arborists into dance

Matthew Bruce Ingram[1]* and Ian Mitchell Wallace[2]

[1]Dakota State University, Madison, SD, United States, [2]Independent Scholar, San Francisco Art Institute, San Francisco, CA, United States

This article expands on previous scholarship on the choreographic practice of marking by studying two disparate communities—community-based dance makers and arborists—who collaborate to create a large-scale, public dance performance. With the dance company's goal being to bring public awareness to the embodied skillfulness of the city's urban forestry department and the impacts these city workers have on the community green spaces they service, the dancers for the performance are the foresters themselves who enact dancerly versions of their professional movements. We analyzed 21 h of videotaped data of dance rehearsals, proffering up an interaction-based approach to the study of marking, analyzing the moment-to-moment way, both groups mark out dance phrases for a sub-section of the final performance: the brush truck routine. In doing so, we develop the term *marking together* to denote how dance ideas are built, transformed, and enacted through group idea formation and revision. Ultimately, we provide insights into how to study dance marking in its full, interactional complexity.

KEYWORDS

embodied interaction, community-based dancemaking, dance rehearsal, marking, marking together, collaborative idea construction, collaborative imagining, gestural depiction

Introduction

The dance creation process is a creative, co-constructed endeavor between the choreographer(s) and dancers that requires a great deal of bodily semiosis. Although dance creation, depending on the genre of dance, the studio/company, and the individuals involved, may shape the idiosyncrasies during the process, the choreographer-dancer interaction is typically one of mutually shared intelligibility of dance vocabulary. There, however, are instances where dance practitioners partner with communities in a collaborative form of dancemaking, often involving people from the respective community they work with who do not necessarily identify as dancers. One instance of this, known more broadly as community-based art, is a form of collaborative artmaking (see Cohen-Cruz, 2005 for history and varieties) that seeks to feature personal stories and lived experiences that are intertwined with the said community; the community knowledge, skills, and competencies are invaluable and unique sources of site-specific meaning-making that are often addressing local concerns. When choreographers create a large-scale performance involving community members

who are not trained in dance vocabulary, the artistic vision is necessarily driven and shaped by the confines of their locality and community knowledge. This has immediate consequences for dancemaking: shared intelligibility regarding crafting and interpreting the dance being created requires creative communication and negotiation to reach an understanding and appreciation without any shared referential history.

In this article, we looked at just that: the dance creation process and practices between two disparate groups, the dance company Forklift Danceworks focused on community-based artmaking and arborists of Austin's Urban Forestry Division. The two groups, together with the neighborhood and community partners, created a story tethered to the local community (the Govalle-Johnston Terrace neighborhood in Austin, Texas) within a public park setting involving and recognizing the importance of municipal park maintenance, titled (Forklift Danceworks, 2015). They simultaneously fulfilled a symbolic and functional role by incorporating the arborists as the dancers (or *worker-actors*) to perform regular work tasks in organized dance form.

The arborists, being skilled workers who specialize in aspects of environmental science, horticulture, and urban forestry, make dance creation possible; they bring their entrained and enacted professionalized vision (Goodwin, 1994, 2017) and bodily intuition (Harper, 1992) to bear on whether the dance creation process adheres to safety and logistical concerns, reaching creative compromises with the choreographers. Through ethnographic methods, the choreographers learn about the day-to-day tasks of preserving urban green spaces and the technical knowledge needed to maintain such standards. Shadowing the workdays of the arborists enables the choreographers to start thinking about their movements, competencies, and environments in artistic ways, such as their utility in dance phrase creation that holds a fair amount of creative potential and logistic stability. Over time, featuring deeply engrained professionalized knowledge, skills, and intuition and fitting these forms of expertise to artistic needs requires the arborists and choreographers to develop makeshift terminology within and through communication, talk, and gesture playing a vital role.

In working with the choreographers and their artistic vision, the arborists become partially socialized into dancerly ways of thinking and organizing their bodies and tools. On the flip side, the artists partially become socialized into the professional habits and ways of seeing the world as an arborist. The back-and-forth between these two communities helps them progress in the shared goal of creating an informative and aesthetically pleasing performance for their community audience. However, the different form of knowledge and experience means that the two communities need to establish a choreographic arena that lends itself to the dance creation process and encourages the shaping of artistic ideas while circumventing some limitations they face. *How do the choreographers and arborists navigate such contingencies?*

In studying the choreographer-arborist interactions, we observed that, for these two groups, an appropriate place and time to manage many of these contingencies is during rehearsal session interactions. These face-to-face meetings allow the choreographers and arborists to develop a workable conceptual space for enacting, visualizing, and experiencing routines (as the choreographers generated these routines from past actions of the arborists) and modifying, subtracting, or adding to a dance phrase in its entirety. Talk and gesture are rich depictive communication resources (Clark, 2016, 2019) for helping foster a workable or shareable image, bridging the divide between a subjective and, perhaps, specialized vision to objective and perceivable public image. To make a dance idea tangible enough to both parties, it needs to be publicly augmentable (we mean this both in the sense of one's mental simulation and the physical material surrounding in sight) despite having differing relations and knowledge of what arborists do and how it affects urban green spaces. To create movement phrases (rhythmic, spatialized oriented, and timed choreographic structures)–especially when it involves machine and tool use of the arborists (chainsaws, brush trucks, and pole saws) and intimate knowledge of plant ecologies–they need to resolve emergent choreographic problems. Problems, such as whether two brush trucks can actually work together in a coordinated manner (synchronization) or how much time felling a tree in real-time would take vs. its choreographed rendition, raise coordination, feasibility, and cohesion concerns. The rehearsals go through many iterations. The choreographers pare down a dance phrase and the routine into what is essential and most expressive, not only for their own sake but also clearly understandable for onlookers. Eventually, the problems become more manageable while simultaneously tightening or solidifying the routine. Rehearsals become more fluid, and the two groups are quick to fix all these issues and move on to committing things to memory with repetition and practice with the actual forestry equipment and machinery.

This choreographic situation draws our scholarly attention because it is where dance creation and *gesturing-for-dance* are made perceivable *in situ*. When the choreographers and arborists work together to solve and foresee problems, further pre-existing dance routines, or create new suggestions entirely, they do so *via* a specific mode of depictive communication that art practitioners and scholars refer to as *marking* (see Kirsh, 2011). "When dancers mark," Kirsh writes from a cognitive ethnographic account of dance, "they execute a dance phrase in a simplified, schematic or abstracted form… When marking, dancers use their body-in-motion to represent some aspect of the full-out phrase they are thinking about. Their stated reason for marking is that it saves energy and avoids strenuous movement, such as jumps. Sometimes, it facilitates the review of specific aspects of a phrase, such as tempo, movement sequence, or intention, all without the mental and physical complexity involved in creating a phrase full-out. It facilitates

real-time reflection" (p. 179). Across several studies, (Kirsh et al., 2009; Kirsh, 2010a,b, 2011, 2012) demonstrate that the act of abbreviating already established dance movements is for efficiency, to reserve energy, and summarize or altogether bypass specific steps (usually inconsequential to the point trying to convey and therefore more easily mastered) until reaching a point where more complex marking needs to be slowed down to emphasize organizational issues.

Likewise, dance scholar Warburton (2011, 2014, 2017), Warburton et al. (2013) has advocated exploring the many cognitive and kinesthetic benefits of marking as *dance enaction*. Warburton (2011) writes, "The activity of dance marking not only allows for subjectivity to be accessible through the perceptual appearance of physical body 'movement reductions,' but it also can account for the workings of both on-line and off-line cognitive (and emotional) processes simultaneously. The marking dancer is moving and thinking explicitly in real time, at the same time using small hand gestures and her implicit memory to prime in correct sequence a 'turning' motor program by taking it off-line. But ultimately, marking is 'for' expression, not faster information processing" (p. 77). For Warburton (2014), marking is a form of *notation-in-action*: dancers make these scaffolded notations publicly available and transform them in real-time (also see Warburton et al., 2013; Warburton, 2017).

It is evident in dance-oriented scholarship that marking is not unidimensional. First, marking is a form of gesturing-for-dance where dance phrase movements are externalized and brought into the realm of public semiosis; either one marks solo or in groups (Kirsh, 2011; Warburton, 2017). Second, the heterogenous *marking practices* are carried out to accomplish various socio-cognitive aims, serving as a mode of recalling, reflecting, remembering, theorizing, showing, spatializing, emulating, and coordinating dance phrases (see Muntanyola-Saura and Kirsh, 2010). Third, *mark-making* is, to borrow Clark and Gerrig's (1990) notion regarding demonstrations, a selective depiction that illustrates varying dimensional qualities and their interactions in a dance phrase, such as duration, emphasis, tempo, time, rhythm, synchronicity, and sequentiality. Finally, marking involves varying degrees of semiotic complexity (Bressem et al., 2018), ranging from using only hand gestures to fully embodied: choreographers and dancers in our data, for instance, can use their hands, head, and body to emulate distinct movements or actions of the arborists, including felling a tree with a chainsaw or picking up brush with trucks.
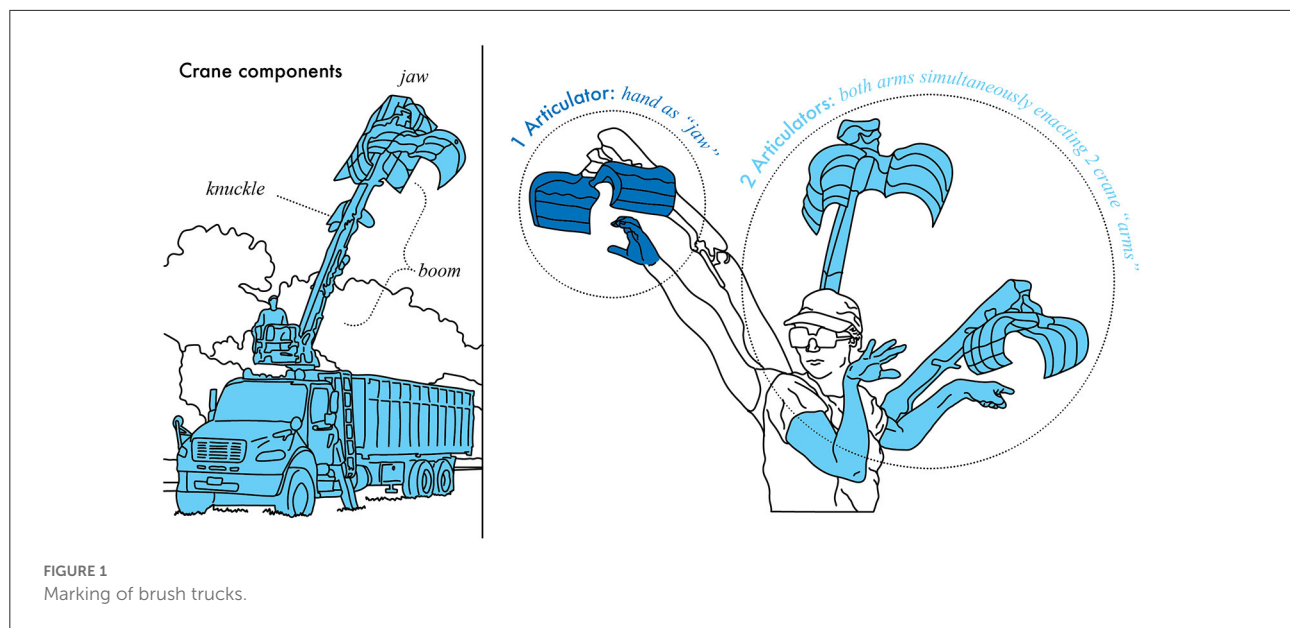
Our focus, then, is on a relatively overlooked type of mark-making, what Kirsh (2011) refers to as "When marking is used as a tool for *communication*" (p. 180) that involves clearly depictive gesturing. We elaborate on this idea by seeing marking communication that involves multiple actors, multiple bodies, and elaborate scaffolded ideas with accompanying visual and kinesthetic imagery: *marking together*. In group choreography, the purpose of marking is to mark with *dancers*. It is a performative action not in conjunction *with* a

group but proposed *for* the group to provide an "abstracted structure" (Kirsh, 2011, p. 190) or generalized example of a particular movement or demonstration of a problem that needs refinement. The abstracted structure makes it possible to imprint some speculative projection (an externalized image or version) that becomes, as Kirsh (2010a,b, 2011) argues, augmented reality for shared imagery. With these scholars' ideas in mind, we will demonstrate how marking for timing, spatial orientation, synchronization, and audience visualization, among other qualities, is a form of co-speech gesturing-for-dance creation.

Taking up a micro-interactional approach (see Materials and Methods) to the marking practice of mark-making, we explore the moment-to-moment analysis of marking as it unfolds, not in one gesture but a series of multisensory acts across interactional sequences and collaborative moments of dance co-creation made perceptible in gesturing-for-dance. Specifically, we trace examples of marking together across one routine: a dance using brush trucks. The marking moments we analyze in this article involve the choreographers and arborists physically emulating the movement qualities of the brush trucks (or grapple trucks): movements of the mechanical jaw/claw, positioning of the truck body and dump box, and extensions of the knuckle boom crane (see Figure 1). Central to this complex interaction is the ability to imagine [borrowing Murphy (2004, 2005) notion of imagination made visible in public discourse] a routine in the here-and-now discourse moment, even if that routine is not being practiced with the actual machines or tools that will be included later but not at that moment; instead, the two groups' bodies serve as an abstracted, mediated channel of communication for makeshift augmentation in a virtual space (a space created for art symbolization and perception) artistically rendered (Langer, 1953; Kirsh, 2011). In our analysis, we will use the term *brush truck* to reflect the term used by the choreographers and foresters.

Cognition-centered accounts are apt at attending to why choreographers and dancers mark, explaining how cognitive operations such as projection, imagination, and perception (See Kirsh, 2010a,b, 2011) are intertwined. We, however, want to expand those works by illustrating what an interaction-based account can add to the scholarship, especially when we look at a markedly different context: two groups, choreographers and arborist-dancers, trying to bridge cultural and expertise gaps in embodied knowledge. It is also a context where, as we plan to show, marking takes on an interactional role that is highly collaborative and essential to any progress in the dance creation process. And in the process of our analysis, we will weave together notions of gestural depiction, publicly available imagination, and multisensory semiosis as they are relevant *via* mark-making during dance rehearsal sessions. Our article, therefore, unfolds in the following way:

1. First, we provide a detailed narrative that describes our data, methods, and materials. In this section, we

FIGURE 1
Marking of brush trucks.

carefully trace our inductive, interaction-based methods for studying marking and the iterative stages in the research process.

2. Second, analyze several interactional snippets (shown in detailed multimodal transcripts) involving the community-based dancers and the arborists marking out aspects of one routine involving the brush trucks. Our analyses in this section detail an account of the various ways marking-making can be used to communicate knowledge between these groups. In turn, we develop a notion called *marking together*.

3. Finally, we address how this inductive analysis of videotaped data, as informed by microethnography (detailed in the section below), expands contemporary scholarship on marking and the analytic purchase of our notion of *marking together* as it creates new trajectories for research.

Materials and methods

Data

For this micro-ethnographic project, the principal investigator (one author of this article) recorded and participated in interactions between two groups: a dance company, Forklift Danceworks, and Austin, Texas' Urban Forestry employees. The culmination of the collaboration between the two groups resulted in a large-scale performance piece: (Forklift Danceworks, 2015).

Community-based dancemakers, Allison Orr, the Founder and Director of Forklift Danceworks, and Krissie Marty, Associate Artistic Director and Community Collaborations

Director, in conjunction with other team members, shadowed the arborists in their day-to-day work, solicited personal stories, interviewed members of the Urban Forestry Division, and derived artistic potentialities from the movement vocabularies made evident in these ethnographic, iterative steps. The premise of the performance using previously untrained dancers on park grounds and operating workday machines is to maintain the authenticity of their professional skill sets and knowledge while telling a narrative about how these workers affect their community's green areas. Alternatively, those artistic concepts examine the customary societal valuation of art and municipal work present in the arborist dances to propose an alternative viewpoint for the unification of understanding of how these cultivated spaces affect the city's citizens. The dance phrases for the performance exemplify several skills and actions of the foresters and their specialized knowledge of using different machines for maintenance. They are crafted only through back-and-forth collaboration and learning from one another. While formulating the order of the performance, the choreographers investigated commonly used forestry equipment and tools. For this article, we focus only on the brush truck routine.

Video recordings for this dataset occurred over a year and a half and comprised 21 hours of footage. The dataset includes videos of:

- the choreographers recorded as they observed the everyday work activities of the foresters.
- the choreographers scouting out actions and practicing dance phrases.
- the principal investigator attending the rehearsal and practice sessions across the entire dance performance

videos. This also includes videos of the choreographers working with other organizations and their music, stage, and safety/logistics team.

- the public performances.
- post-performance interviews.

The principal investigator recorded video and audio using the following equipment: Canon XF105 HD Professional Camcorder, Zoom Q8 Handy Video Recorder, two Sennheiser EW G3 Wireless Lavalier microphones, a Sennheiser MKE 400 camera-mount shotgun microphone, and a monopod. Recordings occur in various settings, including urban parks, a music studio, the dance company headquarters, and the urban forestry division workspaces. The choreographers and foresters all attended an introductory session detailing the principal investigator's role as a researcher and the data to be collected. The principal investigator provided consent forms to participants, and only those who consented were recorded. For this study, participants were allowed to anonymize their names to protect their identities. We requested and were given permission to openly reference Forklift Danceworks and include the actual names of the choreographers. However, as stipulated in my consent forms, we kept the city workers-performers names anonymized, as their relation to public life differs from that of the publicly available dance company. You can learn more about Forklift Danceworks, the Urban Forestry Department, and their co-partnerships at (Forklift Danceworks, 2015). The Institutional Review Board approved the study at the University of Texas at Austin, IRB Number: 2014-09-0120.

Microethnographic analysis of marking

Interactional approaches to the study of social life go by various related names, modes of analysis (microanalysis, conversation analysis, microethnography, among others), and interconnected traditions that share a common aim to study social interaction as it is documented in recordings. Though these, often qualitative, approaches may differ in the scale and level of detail in how moment-to-moment interactions are analyzed, for our purposes, we will refer to our approach as a *microethnographic investigation* (See Streeck and Mehus, 2004): the systematic study of talk and bodily action in their consequential structures and patterned trajectories as informed by ethnographic interactions with the communities involved. The work of applied linguist heavily inspires our project, Goodwin (2017), who spent his lustrous career integrating micro-interactional perspectives with ethnographic methods to understand how communities develop and enact profession-specific knowledge in interpreting social contexts and use of communicative resources. In our analysis, we will use Goodwin's (2013, 2017) notions of co-operative action and semiosis to refer

to the ways action is accumulatively built and transformed in interaction.

In this vein, our study takes a microscopic, interaction-based approach to the study of dance rehearsal sessions, focusing on the dance practice of marking. The way we collected, organized, analyzed, and displayed our information was drawn from several qualitative, social interaction research guides on conversation analysis, interactional linguistics, and video-based studies (Bavelas, 1987; Heath et al., 2010; Reed, 2010; Hepburn and Potter, 2021). Below, we sketch out our research trajectory and processes, breaking these iterative phases into stages:

Preparation

Engaging with the choreographers and arborists, the data collection involved gathering as much videotaped data as possible and shadowing the groups working together. This led to recordings revolving around rehearsal sessions with various specialized forestry equipment: brush trucks, water trucks, chainsaws, pole saws, loader trucks, and other maintenance tools. Video recordings were time-stamped for dates, times, and locations and then organized by the type of rehearsal activity, whether it involved chainsaws, brush trucks, or combinations. Initial viewings of the recordings led to observations that the choreographers and arborists needed to establish a shared understanding and intelligibility to create a production out of the arborists' professional movement vocabulary, machine use, and community maintenance.

Discovery

Together, we watched the entire dataset, noting observable patterns across the different rehearsal sessions; the differences varied between the size of participants, types of machinery, locales, and the goals they hoped to achieve in each session. Of these patterns, one theme emerged consistently; the choreographers lacked specialized knowledge of the foresters, and the foresters, who lacked technical knowledge of choreographic or artistic practice, needed to collaborate to learn from one another. The process involved generating choreography derived from the local movement vocabularies of the arborists and transforming them–somewhat improvisationally–into verb-like actions that can be easily shared between parties (see Orr, 1998 for the earlier articulation of her typical choreographic process). This had to be negotiated collaboratively to solve potential problems or emerging contingencies. As we watched and re-watched these rehearsal interactions, we noticed the choreographers resorted to bodily *marking* in the early stages of dance routine creation (Kirsh, 2011). Marking is a choreography practice that involves abstracting qualities or characteristics of dance phases and formulating them through the body in a particular, abbreviated form. In the earliest stages of dance rehearsals, we established a

baseline intuition that marking is necessary when first launching the dance routines within the confines of mechanistic capability. We also had an inclination that this was a communicative tool for translating experience and understanding between the two groups.

Classify

Establishing that *marking* appeared to be a widespread phenomenon for problem-solving between the two groups, we created a collection of "marking moments" across the entire dataset. We observed similar uses of hand marking across routines; however, what was abstracted and the degree of the abstraction with the hands depended on the type of machinery or actions being done. Whereas the choreographers could easily abstract the handsaws, there was little potential or necessity to schematize more detailed hand movements as the routine became streamlined or required more minute changes. Zeroing in on one routine, in this case, the brush trucks, was helpful in our analysis for several reasons:

- The routine involved substantive problem-solving between the two groups.
- There is a good deal of semiotic complexity (Bressem et al., 2018) and mechanical elaborateness (the arm and human body can easily be imagined as if they were parts of the truck).
- And in the recordings, we could observe the gamut of changes to the dance routine and the spectrum of dance creation to the actual practicing of the performance.

Analyze

After creating and analyzing our collection of "marking moments," we transcribed selected segments of these instances to engage in a deeper analysis. Although transcription methods vary, we adopted standard conversation analytic conventions for talk (Jefferson, 2004; Reed, 2010) and bodily action (Goodwin, 1990) to understand collaborative marking practices' sequentiality, positioning, and unfolding nature. In conversation-analytic scholarship, a good deal of consistency in transcription conventions for talk, the temporal and spatial coordination of gestural actions can be represented in various manners to fit the analytic concerns and the contextual details.

To grasp how we transcribed the segments analyzed in this paper, we provide an illustrated guide to our transcription conventions and explain each symbol alongside its purpose (see Figure 2).

The empirical analysis process in interaction-based studies requires testing and confirming the investigator's analyses of these snapshots of social life. Therefore, throughout the entire process, we tested our interpretations with formal and informal data sessions (see Hepburn and Potter,

2021, p. 19; Heath et al., 2010, pp. 102–103 and 156–157 for resources and tips on data sessions) conferences to confirm, expand, and solidify those hypotheses with others who study spontaneous social interactions (fields such as embodied communication, interactional linguistics, linguistic anthropology, and gesture studies).

Results

In this section, we lay out several interactional snippets in chronological order because it exemplifies the cumulative stages of dance creation (see Kirsh et al., 2009 on novel dance creation) to the performance. Reviewing examples across time in the development of dance phrases draws out the accumulative, co-operative power of human action (cf. Goodwin, 2013, 2017); the choreographers and arborists establish a rich form of semiosis, that is, a form of *gesturing-for-dancing* and a movement vocabulary that helps them conceptualize dance phrases and rework them in conversation. Dance phrases for the final public performance required the two groups to bridge gaps in knowledge and overcome certain contingencies.

- The choreographers wanted the arborists to enact their own embodied knowledge, intuition, and skilled repertoires as foresters. Still, there were expressive limitations since the arborists are learning to think in a dancerly mindset, and the machines are being repurposed for artistic expression. The arborists learn *in-situ* how to think in a choreographic fashion, consider new ways of organizing their machines and their bodily skill sets, and even anticipate and suggest artistic potential.
- The arborists faced limitations and constraints in several capacities regarding their participation. Their availability was particularly limited because they worked early morning hours and had to be onsite; therefore, there was a substantial amount of day-to-day, week-to-week negotiation with the urban forestry department. The choreographers worked carefully with the Urban Forestry Department to secure approval and follow machine operation protocol and safety guidelines.
- The dance company's goal is to highlight the value of this municipal work as it is embedded in an urban community; hence, limitations in time or ability to get specialized certifications by the choreographers were left to the arborists to fulfill. The choreographic process and ultimate product, the public performance, required the choreographers to be highly mindful of the dance routine timing, ensure proper alignment of routines to music, and follow regulatory guidelines for safe audience engagement. They could do so through ethnographic observations and participation with the arborists. These processes demonstrate how contingencies and epistemic gaps shape

Transcription Conventions

Transcription conventions are adapted from interactional approaches to embodied communication, including:

• Goodwin, C. (2017, pp. 17-18)
• Goodwin, M. H. (1990, pp. 25-26)
• Jefferson, Sacks, Schegloff (1974, pp. 731-733)
• Reed (2010, pp. 236-237)

The presentation of the data and transcription convention descriptions is modeled most closely after Goodwin (1990) due to its ease of readability and text-image intuitiveness. We established our own way of illustrating gestural actions and combine them with transcripts.

1. **Carats:** Indicate the variability of speaking rate. *Carats* facing inward towards the word indicate that the rate is increasing and outward carats indicate the rate is decreasing.
2. **Cut-Off:** A *dash* between words indicates that there is an abrupt cut-off of the current sound.
3. **Capitalizing:** Indicates that the speaker places emphasis or stress on the talk, this is often marked via changes in pitch and/or amplitude.
4. **Overlap Bracket:** *Left brackets* connecting talk indicate a point where two or more utterances between speakers overlap each other.
5. **Lengthening:** *Colons* indicate that speakers noticeably lengthen the preceding sounds.
6. **Latching:** The *equal sign*, referred to as *"latching,"* indicates no gap between the end of a prior utterance and the start of the next piece of talk.
7. **In-breath/Out-breath:** A series of *h's* preceded by a period mark when a speaker breathes in, and a series of h's without the period indicate when the speaker breathes out.
8. **Breathiness/Laughter:** If occurring within a word, *h's* signal a type of breathiness and/or laughter, it is contained within parentheses.
9. **Aspiration:** *Superscript h's* indicate that the pronunciation is noticeably aspirated.
10. **Comments:** *Double parenthesis* describes embodied communication behaviors that mark how the quality or characteristics of how something is said or the actions taken in the moment of interaction.
11. **Silence/Pauses:** *Numbers enclosed in parenthesis* mark meaningful silences and pauses measured in seconds and tenths of a second. Durations are aligned with the talk when silence/pausing is part of the speaker's turn-at-talk. When the speakership role is relinquished or open to the other interactants, silence/pause is aligned left.
12. **Problematic Hearing:** *Talk enclosed in a single parenthesis* indicates that the transcriber cannot discern what is said with absolute certainty. Single parenthesis with no words indicates it is impossible to tell what is said, whereas a phrase or utterance in parenthesis is the transcriber's educated guess. If ambient sound or discernable to some degree, italics is used.
13. **Intonation:** *Punctuation symbols* mark intonational changes in a speaker's utterance instead of grammatical characters.
    • A *period* marks a falling contour.
    • A *question mark* implies a rising contour.
    • A *dash* indicates that the pitch contour stays relatively the same.
    • A *semi-colon* marks going from high to mid contour.
    • An *arrow up* indicates a noticeable jump up in pitch.
    • An *arrow down* indicates a noticeable jump down in pitch.
14. **Crescendo and Diminuendo:** Contained between carats, the talk is preceded by *<crec>* or *<dim>*, indicating a slow steady increase or decrease for that section relative to the beginning volume.
15. **Accelerando:** Contained between carats, the talk is preceded by *<acc>*, indicating an increase or quickening in speed for that section relative to a slower preceding tempo.

FIGURE 2
Transcript conventions.

dance phrase creation, maintenance, or alteration. One primary way these groups interacted and accomplished establishing dance phrases for their routines is through the one joint space that was easy to create: the abstracted, interactive, and imaginative spaces made possible with their bodily gestures and talk. *Marking together*, a term we develop in the interaction examples below, provides insight into how two seemingly disparate professional communities can co-construct, revise, and enact dance ideas (Yasui, 2013) in real-time with and through bodily thinking and *collaborative imagining* (cf. Murphy, 2004, 2005).

Marking together as a form of professionally informed artistic idea creation

The dance routine, at this stage, is relatively new. The dance company's Founder and Artistic Director, Allison, worked with the arborists by herself to establish the routine. In our first set of examples (Transcripts 1.1–1.3), the Associate Artistic Director, Krissie, works with two arborists, Antonio and Roy, to refine a previously rehearsed routine. In this segment, we observe an earlier stage of the routine-creation process: the choreographers and arborists develop a catalog of movement and coordinated dance possibilities. Brush truck mechanical jaw and crane motions are posited from a choreographic viewpoint to be accepted and added to a list of options or adjusted based upon arborists' logistical set of limiting parameters.

During this stage of the dance phrase creation process, the choreographers and arborists exchange professionally informed ideas to negotiate a routine's efficacy and artistry. They must establish a curated set of embodied vocabulary, where the arborists edit the proposed ideas from the choreographers before enacting legitimized ideas. This context differs significantly from a typical choreographer-dancer interaction; the two groups use their own bodies in place of the brush truck components to negotiate these dance phrases and intermittently practice with the actual machinery. They mark dance phrases by acting as symbolic stand-ins for the brush trucks. When marking, the two groups have a different kinesthetic relation, and appreciation for how the actual moves gestured through the body will translate to full-out practice with the machines. The brush truck booms, knuckle, and jaw are likened to the human arm, elbow, and hand. Mimetic enactments, as many scholars who have studied it concerning the gesturing body (see Calbris, 1990, 2011; Donald, 1991, 2001; Streeck, 2008, 2009; Müller, 2014) have found, involve our ability to imaginatively (re)-produce actions or model our perceptional experiences in an objectified form that is imaginable and perceivable to others.

Days prior, Allison (not in this interaction) established some basis for a brush truck routine with the arborist. In Transcript 1.1, the brush truck routine is at a point of being a work-in-progress; the arborists alternate between operating the actual brush trucks and negotiating possible changes to the dance version of their work with their bodies and the choreographer. Krissie, who was not present, has access to a video of the rehearsal and notes; therefore, she runs through the routine with the arborists to fully grasp the elements of dance phrases. As she's talking through each step of the dance phrase, she tries to describe and illustrate by marking a specific positioning of the boom and the claw. The marking activity in this interaction is very much a confirmation-seeking one for Krissie; it serves as a embodied reminder of the artistic ideas being developed (see Figure 3).

In Transcript 1.1, Krissie discerns a particular position of the crane boom; however, she is not generating fitting terminology, so she turns to the arborists for elaboration. Krissie uses three distinct arm/boom extensions pitched to the arborists so that they can co-articulate the specific actions she's trying to name. Her differentiating gestures–gestures that show the height of the crane extended and claw position–and co-occurring level pitch intonations work synchronously to contextualize the goal of the activity to secure feedback and confirmation from the arborists. One of those insights immediately gleaned from this part of the exchange is that there is a more technical vocabulary for describing the position Krissie is trying to articulate, one that, Antonio reminds her, is a "locked" position (Lns. 6 and 8). Reminiscence of a word-search activity (Goodwin and Goodwin, 1986), Krissie brings forward a three-part contrast seeking feedback: "And that was-it was kind like not fully-extended, not fully-middle," or a "weird locked elbow-bent place" (Lns. 1–7). As she is enacting this three-part illustration, Krissie carefully looks between Roy and Antonio for elaboration and definition of her suggestion. Antonio takes his turn as Krissie's role as arena-maker is relinquished to her satisfaction. When Krissie says "weird [locked] elbow-bent place" (Lns. 4–5 and 7), Antonio nods, looks at Roy, back to Krissie, and then presents his understanding in the form of a verbalized concept of the truck *locked* and then pivoting his arm/boom from the center to the right. What is first a somewhat generalized projection of the brush truck's orientation is given further movement specificity as Antonio co-operatively elaborates on her gestures. Antonio directs the "locked it" motion to Roy as he gazes in his direction, seeking confirmation. Roy nods during Antonio's gesturing and confirms with "yeah" and a simplified, static locked jaw gesture. In doing so, Roy informs Krissie that "that's the easiest place to operate it," further characterized by Antonio as the "safest (Lns. 9–10 and 12)."

As we will demonstrate throughout these transcribed interactions, marking is *gesturing-for-dance*. The notating of specific actions of the crane boom and jaw are given specificity and meaning *in* interaction, as Krissie observes how the

```
 1   K:   And THAT was-it was ↑kInda like;          8   A:            [Locked it]
 2        not fULLy extE:NDE:D-                      9   R:   Yeah h.
 3        ↓Not totally mI:ddL:e-                    10        And thAt's the easiest place to Operate it.
 4        It was kInd of in THA:T. (0.2)            11   (0.5)
 5        weird-                                    12   A:   ((Safest))
 6   A:   Locked                                    13        For me?
 7   K:   elbow bent [place-
```
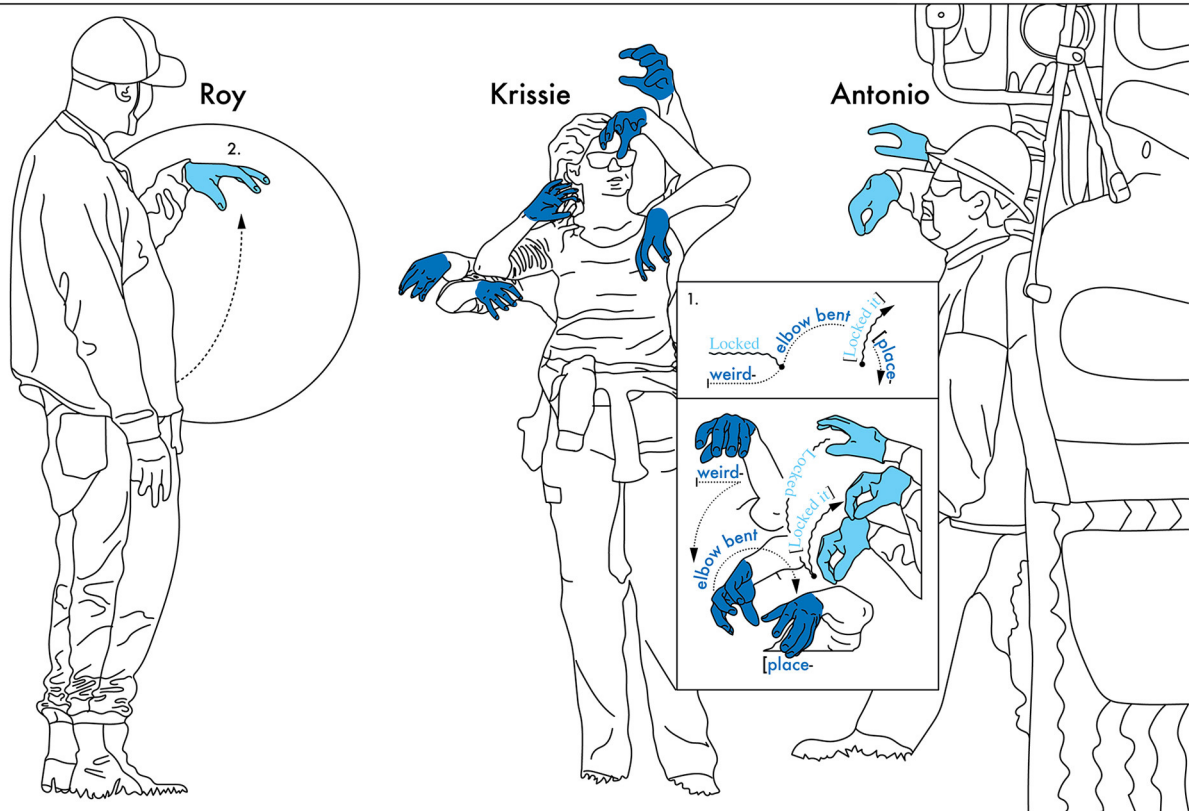
FIGURE 3
Transcript 1.1.

arborists discuss the mechanics and movements. Through their talk and gestures, the arborists proffer their intuitive and kinesthetic knowledge (their professional vision as arborists to reference Goodwin, 1994) of how the crane operates, its optimal performance, and its mechanical limits. The co-operative semiosis that takes place here–the continuation and re-specificity of Krissie's original gestures as the crane–is insightful and necessary for her ability to transform their work into artistic ideas and is done so accumulatively. According to conventional crane operation, Krissie is taught–albeit on a micro-scale the arborists in this virtual space to "think" and "see" the work from their vantage point. With the establishment of this common understanding, Krissie can now integrate more artistic boundaries into the conventional boundaries (see Figure 4).

With Krissie's newly informed understanding of the dance routine and phrase(s) in mind, Antonio and Roy adapt the proposed vision of the brush truck routine in real-time. In

Transcript 1.1, Antonio and Roy relay safety concerns and best practices when operating the brush truck crane in a locked position (referring to the knuckle of the crane bent) vs. having the crane fully-extended. With these concerns voiced, Krissie has to determine the implications of the truck's limitations on the artistic idea they've been crafting, asking, "Is it locked, the elbow?" (Ln. 15) as she completely extends her arm and forms a semi-opened claw hand shape. With Krissie's gesture, she takes the orginal meaning of "locked" that the arborists used to describe the knuckle of the crane's boom bent to now refer to the boom being fully-extended. She turns to Antonio when presenting the marking gesture, harkening back to his original "locked" term he attributed to her "weird elbow bent place."

While the choreographers have an artistic vision of how to have the arborists act using their unique embodied movements, knowledge, and machinery, they have to do so by unpacking the arborists' intuition to bridge the expertise that is not shared

```
14  (0.3)                        18  K:   Mmhmm
15  K:   Is it lO:CKed? the elbow  19  R:   That's when the trUck wobbles.=
16  R:   When it-when it ↑lOck?    20  A:    =Yeah
17  (0.3)                          21  K:   A:::h
```
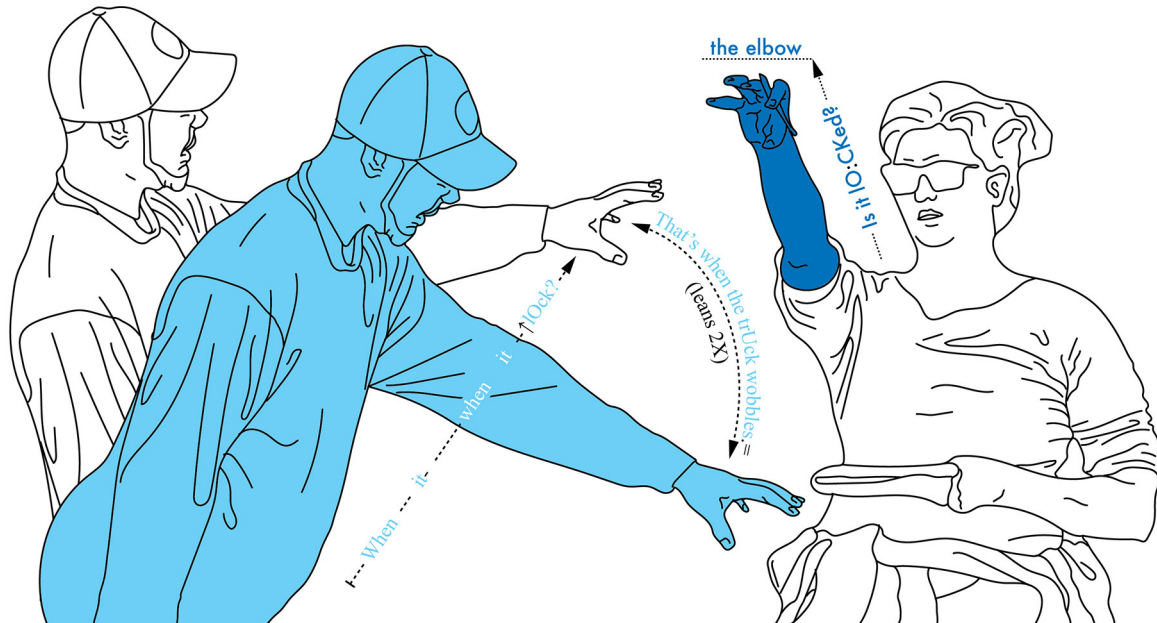

FIGURE 4
Transcript 1.2a.

between the two groups. This emergent vocabulary (mostly verbalized actions) speaks to the truck being talked about in uncertain terms because it was not designed for dance. Marking what the truck does requires a particular type of mimetic translation: the crane is couched in everyday language, and analogical links are made between the arm and elbow of the human body to the crane base, booms, and jaw. This is not all too surprising move since the boom on this knuckle boom truck is not entirely straight; it has a main and outer boom that enables it to bend, and many manuals on these trucks liken it to the human fingers' ability to bend at the knuckle. However, the ability to use hands as abstract analogical links (comparing the parts of the human arm and hands to the crane parts; Calbris, 1990, 2011) makes for smooth translations when the two groups converse and devise dance phrases.

Roy points out a safety concern regarding the brush truck that emerges when the crane boom is extended out fully: "that's when the truck wobbles" (Ln. 19). The utterance is multimodally packaged, a co-occurring ensemble of talk, bodily enactment, and the dance phrase being adjusted to conjure up a depictive scene. Roy, acting as the crane, extends his arm and tilts his body forward to illustrate the truck losing balance, and his intonation falls; therefore, mutually intertwined semiosis is achieved to demonstrate the feeling of falling or tilting

downward and the undesirability of this outcome during the routine. The felt appearance of the body/truck tilting, coming off a stable axis, is made visible in the interaction. Krissie's marking gesture is elaborated upon; the crane booms and claw extended become problematized in the context of the added weight of the crane and base when Roy enacts beginning to "wobble" (Lns. 16 and 19). The marking together takes place in this context, not so much concerning marking for time, duration, intensity, or synchronization; they are marking out what potential pitfalls may occur, emulating the problem to guide Krissie to a more refined and functional alternative. Roy, in part, takes up the supervisory role while making a point for Krissie before proceeding to the next movement. He emphasizes the problem by repeating the wobbling motion twice and bobbing his head as the arm/crane "hits" its lowest point with a jerk. Krissie's understanding of the crane's limitations when locked is clarified, as evident by her "Ahhh" vocalization. To add to this understanding, Roy elaborates on the safety and feasibility of this maneuver (see Figure 5).

The "bent position" has implications for the synchronization and timing of the brush trucks, and Roy helps make this apparent, noting that "So when you gotta kinda bent, that's-that's when it smooth" (Lns. 22–23). There is overlap between the two, as Roy slightly marks the smooth movement quality of the crane

```
22   R:   So when you gotta kinda bE::nt          27       two
23        that's-that's when [it smoo::th          28       ↓three.
24   K:                       [it's the eh smOO:thest   29       .hhh
25        Okay.                                     30   (5.0)
26        .hhh One                                  31       .hh
```


FIGURE 5
Transcript 1.2b.

in "bend position," and Krissie overlaps with a partial repeat of his talk and gesture. The mutual elaboration of one another's gestures and talk illustrates that marking together depends upon co-operation and collaboration; they reconstitute each other's marked actions to transform them into new pathways for dance phrase creation and, in turn, establish a shared understanding. Learning from the arborists' expertise engender Krissie to revise the dance phrase in her notepad (Lns. 26–31), and this illustrates the transformative project at hand:

- The arborists' expertise informs and drives the dance creation process.
- The dance practitioners re-envision the practices and skills in an artistic light.
- The dialogue between the two ensures these artistic possibilities come to fruition by navigating the contingencies imposed on the process.

The artistic idea creation process and brainstorming described above are referenced in other studies of creative imagining. For instance, Murphy (2004, 2005) reminds us, in studies of architects brainstorming building plans, that the act of imagining, or at least one type of imagining made publicly visible, can be observed in social life *via* the talk, gestural actions, and ways people maneuver their material surrounds. Likewise, in Yasui (2013), studying students brainstorming a short film project, she observed how the repetition of gestures across different speakers and their respective turns-at-talk demonstrates how ideas (or particular aspects of them) can be accepted and rejected, modified, and even contested in interaction.

Marking together is a means of communicating depictively, enabling these two communities to build a shared vocabulary, imagery, and ways of making expertise publicly accessible. For Krissie, at least, from social interaction and ethnographic observations, the spirit of the dance company's work involves different levels of completion and interactivity. The dance practitioners must imagine cohesive dance phrases that are keenly aware of symbolic artistry. The interaction between artistic potential and logistical possibilities creates new forms of

thinking about the dance phrases as they are under negotiation. In Transcript 1.3, the final transcript in this sub-section, Krissie explores the application of the "locked" position to another part of the dance phrase: the seesaw (see Figure 6).

The work of the brush truck is being reconceptualized from its day-to-day utilitarian use to fit more artistic endeavors. When Allison originally envisioned a dance for the brush trucks a few days earlier, the two trucks alternated, bringing the hydraulic arms to their highest peak with the jaw open. Synchronization emerges as a problem as the trucks move at varying speeds, depending on the machine's age and wear. With the newfound understanding of the implications of the crane boom being "locked," Krissie must consider the safety concerns as the brush trucks up against artistic potentiality and aesthetics. "There's just one question. On the seesaws, can you do it locked?" Krissie asks in lines 32–33. Whereas *locked* in the previous excerpt refers to the crane jaw being positioned almost ninety degrees (the main boom extended with the outer boom bent) with a bend, Krissie uses "locked" again to refer to the crane arm (jaw included) fully-extended out (Ln. 15). She follows up with a reformulated question, "Can you stay locked when you do the seesaw thing or is it better to have a little bend for your safety?" (Lns. 35–36). In this second question reformulation, Krissie marks two potentials: a crane fully-extended (in a locked position) and a crane bent at the knuckle. Although a loud plane flies overhead, Krissie's confirmation-seeking activity is met with an affirmative nod from Antonio. Both then look to Roy, who assures Krissie they "can do it locked" (Ln. 37). Working between the demand of artistic thinking and practical logistics, Krissie provides the arborists with an account of why one of the two marked potentials is valued over the others: "Cuz it looks better" (Ln. 40) aesthetically to have the booms extended and alternating in tandem.
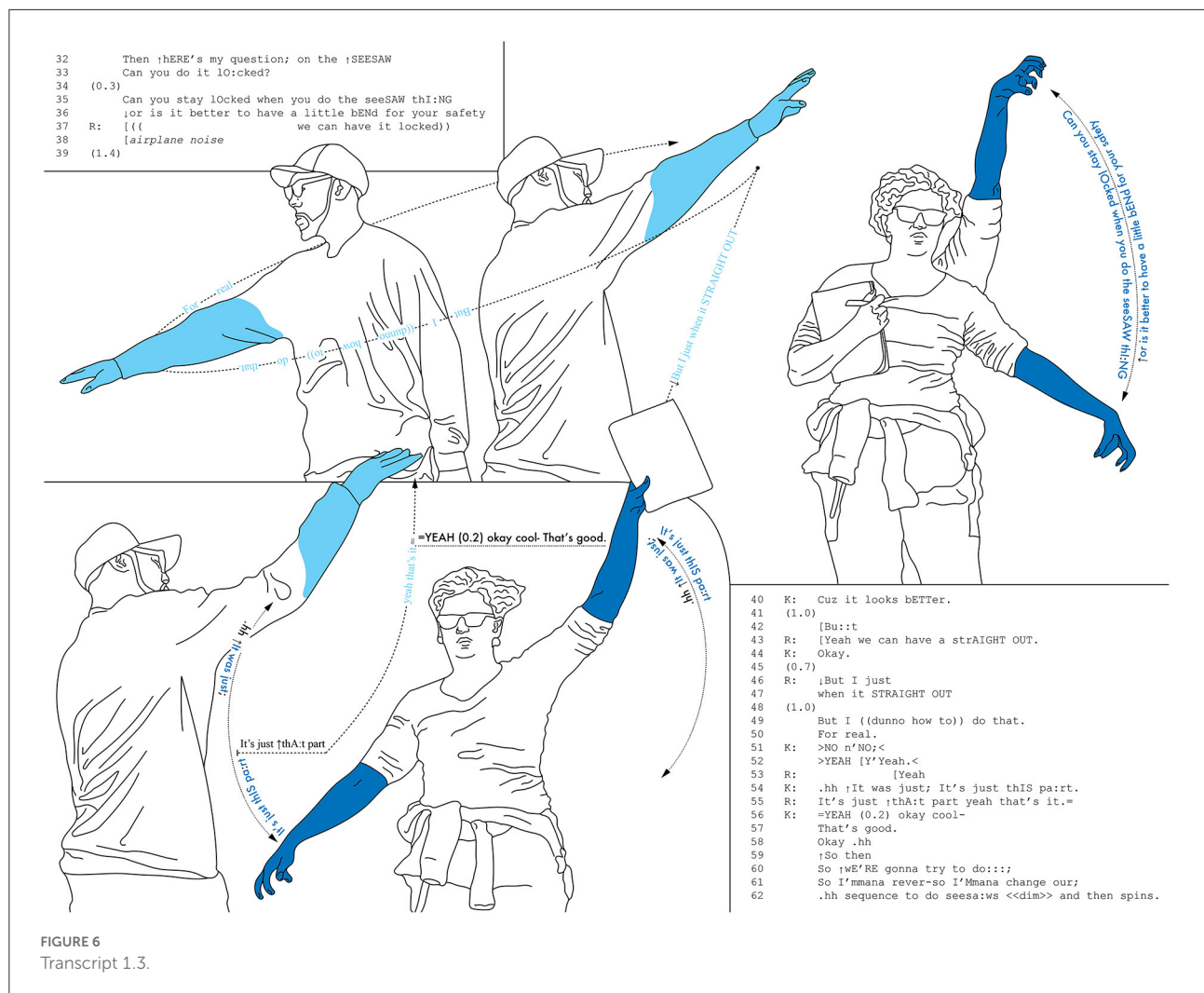
Krissie does not immediately secure uptake, though; when she turns to Antonio, he nods; she then looks to Roy, where he too nods, remarking, "Yeah, we can have it straight out" (Ln. 43). Also, Krissie begins to document the changes in her notepad. The surrounding noise (an airplane flying above) makes it challenging to discern what Roy says in line 49, though, it is clear that he projects a possible disagreement or anticipation of an issue when he utters, "But I." In succession, the crane booms are straight out, and the arborists rotate the cranes diagonally full circle. Having the main and outer booms and the crane claw fully-extended while moving in a diagonal motion proves challenging, as it is an atypical maneuver. It is safer and easier to manage when the outer boom is bent at the "knuckle." In lines 47–50, Roy motions with his hands, rotating his body around once in a circle stating, "But I just, when it's straight out, but I (dunno how to) do that" (Lns. 46–50). A discrepancy emerges between what is desirable for artistic production and what is logistically feasible or comfortably tenable for the truck operators. The imaginative work needed to envision and rework the routine is appreciated through gestures and talk. Krissie

looks up from her notetaking as Roy marks out the next part of the phrase and immediately clarifies that she is not referring to the crane being fully-extended when they enact the circular motion; instead, she only would like to see the crane extended fully during the seesaw portion (Lns. 51–54).

What emerges is a prime example of what Goodwin (2017) discusses as the layering of co-operative action. Therefore, to clarify the moment she's thinking, she marks out the alternating movements of the two trucks in "seesaw" positions and looks at each of the arborists respectively with the gestures. Roy recycles parts of Krissie's talk and gesture, and the dialogic parallels and resonance (Du Bois, 2014) between their utterances and marking gestures convey subtle nuances in the now agreed-upon idea. When Roy marks out his version of extending and lowering the crane arm fully-extended, he only does so with one arm; he articulates his vantage point as a worker-actor, and his kinesthetic relationship as a skilled machine operator is fundamentally different from that of Krissie's. And vice versa, Krissie never presents herself as an operator, knowing more than what could be gleaned from the expertise of the arborists. Therefore, Roy repeating Krissie's marking gestures is not only a gestural repetition (Yasui, 2013) of the general trajectory and pacing of the crane; his actions and experience are layered onto her actions and understanding. To borrow Goodwin (2017) terms, the semiotic layering of these co-operatively assessed actions results in a shared agreement on how the dance phrase should progress. The collaboration between Krissie and Roy leads to a modification in the sequencing of the routine. In lines 58–62, she reverses the order of the "spins" with the "seesaws" to address the very problems Roy and Antonio propose from the logistical standpoint.

Marking together to communicate, as we've seen is a form of distributed physical thinking (Kirsh, 2011). We can add to this, noting that it is a method of *gesturing-for-dance* or dance notation of choreographed ideas (Warburton, 2014). Transcripts 1.1–1.3 illustrate how marking together with the hands can be as simple as an upward motion or as complex as taking on several features of an object or activity: the crane booms, the upper and lower jaw, and the truck base simultaneously. In due time, however, such semiotic complexity increases as dance phrases near completion, actors become accustomed to the rehearsal format, and the language of navigating these dance phrases and vocabulary becomes more accessible and integrated.

Dance phrases take on new meanings and change the co-constructed collaboration and co-operative transformation. This imaginative playground for the two groups helps them address expertise, logistics, and feasibility issues. Marking together is not a product of one person's innovative capacities; it is the depictive ensemble where the interactants involved re-create the appearances of dancerly actions. As fleeting as these appearances may seem in space to spectators, they are interactionally lasting and salient in the embodied conceptual remainders manifested in the subsequent actions and reactions

FIGURE 6
Transcript 1.3.

to others' talk and gestures. Marking together creates a gestural flow of (virtual) actions of the brush trucks in which one person's bodily marking is contingent upon and only made possible by the immediately preceding gestures; they become part of the same flow for the more considerable dance creation activity. Repetition of gestural actions, albeit enacting the same dance moves, (re-)enacts an established movement within a marking practice (rehearsal) that enables the arborists to habituate the dance phrases with their own bodies, (re-)experience the phrases, and create space for nuanced revisions. There is, of course, a translation of sorts in this case since the arborists must then translate that to operating the brush truck controls after practicing it through their own bodies. With each repetition of a marked action, the repeated abstractive actions afforded by hands and arms (Streeck, 2009) open up new possibilities, stylizations, and alterations with new interpretability (Noland, 2009) and artistic rendering.

Marking together as idea scaffolding toward routine realization

In Transcripts 1.1–1.3, we illustrated how artistic ideas for the dance phrases are negotiated amongst the participants to bridge epistemic gaps and overcome potential disconnects between the artistic intent and logistical futility. In Transcripts 2.1–2.4–all part of the same videotaped moment and sequence–we break down the complex idea scaffolding as complex cognitive mappings occur and externalizations are pitched to different audiences. The transcript segments below appear after previously discussed to illustrate how marking together attends to various contingencies as the routine progresses. At this stage, the brush truck routine has advanced significantly and now involves a third operator and truck.

Transcript 2.1, which starts the series, involves a situation where the Artistic Director, Allison, and the Associate Artistic Director, Krissie, whom we discussed previously, walk through

several dance phrases with the three brush truck operators: Antonio, Mateo, and Roy. As Allison runs through the brush truck routine with the arborists, Krissie checks and assesses the brush truck performance for accuracy and artistry. The back-and-forth, understanding checks, suggestions, and proposed revisions, become markedly visible. Allison can adjust and maneuver the arborists' positionality and ask them to enact parts of the dance phrase alongside her. This is possible because Allison, Krissie, Antonio, and Roy have previously taken part in the brush truck routine creation and rehearsal processes during an improvisational session. In contrast, Mateo is a relatively recent addition to this dance section. Also, in Transcript 1, a moment that took place days earlier, the routine only included two brush trucks; in this scene, they are preparing for a performance that entails three brush trucks and hence, three operators (see Figure 7).

With the addition of the third truck into the brush truck routine, Allison and Krissie face new choreographic tasks related to the sequencing and timing of the trucks. Transcripts 1.1–1.3 show that the dance phrase involves the brush truck cranes extending out in patterned sequences. Although the movements are established, there are variations upon the assigned order that can create different aesthetic effects. Rehearsal sessions, especially in the later development of a routine, involve careful mutual monitoring (Goodwin and Goodwin, 1980) of the movements (whether marked out or actually performed). The choreographers solicit advice from each other, and the arborists as needed. And in this interaction, they align themselves in rows: Krissie is in the front-facing, Allison, who is in the middle facing Krissie, and the arborists, in the furthest back row, face Allison and Krissie. As we will see, this formation becomes significant for the conceptual work accomplished in marking together.

As they've been incrementally working through the brush truck routine, Krissie foreshadows a marking out of the phrase concerning the extension of the crane arms. While, at first, in lines 1–2, Krissie projects a specific ordered sequence of the crane movements she has in mind; however, she quickly switches from a definitive statement to the modal, advice-giving *should*: "So we're gonna go, so we should go." As she articulates the routine, Allison becomes a placeholder, assuming a general crane position by leaning her body forward with her right hand and articulating the knuckle bend crane with a claw hand shape. We can speculate several reasons for her assuming this position. For example, she may take on the general crane position predicting her participation will be requested. It is equally likely that Allison's crane position simply is a reminder of the blueprint and routine created thus far.
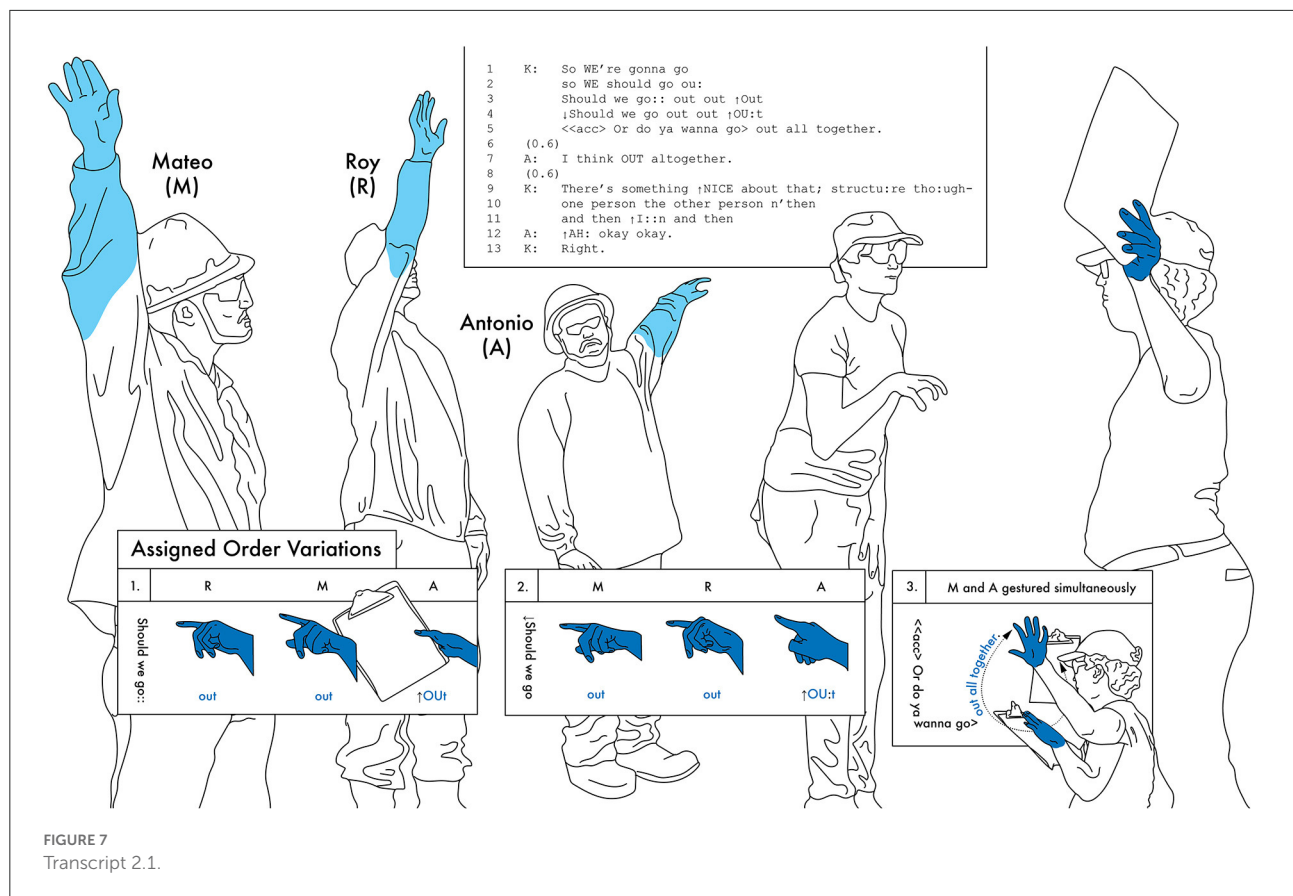
Krissie simulates three-movement possibilities the dance phrase can take, uttering "out, out, out." Each "out" utterance is timed, emphasized, and aligned with a pointing vector (See Assigned Order Variations within Figure 7). For this reason, Krissie can use Allison's held crane position to accomplish some conceptual work.

1. Krissie points with her left hand to Roy and Antonio and then her right hand with the clipboard to Mateo (Ln. 3).
2. Krissie points with her left hand to Mateo, Roy, and Antonio (Ln. 4).
3. Krissie emulates all three trucks, stating, "Or do ya wanna go out altogether," as she puts her arms upward fully on both sides of her body (Ln. 5).

The semiotic landscape in the here-and-now discourse is transformed. Through pointing, Krissie externalizes a complex set of timed sequences and movement patterns that will require precise coordination in the performance's full realization. When Krissie proposes the last combination of all the trucks moving synchronously (referred to as "out altogether" in Ln. 5), her speaking rate increases gradually. As she points "out" the options, she is, as Kirsh (2011) distinguishes, mentally simulating *via* imagining the movement order of the routine. However, we take imagination in our context to not refer to localized or simply individualized internalized imagery; in fact, aspects of imagining can be laid bare in interaction through collaborative imagining (Murphy, 2004, 2005) or collaborative idea construction (Yasui, 2013). The arborists act as the trucks and therefore are conceptual surrogates (Liddell, 2000), this is useful for Krissie who can simply point to the arborists to conjure up or simulate a movement order. Only in the last part of the enactment, when she acts as all three trucks, does she truly mark the actions.

We encounter, here, "*perceiving in the hypothetical mode*" (cf. Murphy, 2004, pp. 269–270): the negotiation sets out a course of imagined possibilities as they see the marked phrases imagined as-if they were the actual trucks moving, thus, seeing what potential the routine *could* take. The goal is for Krissie to secure quick confirmation from Allison on which of the interpretations would be most aesthetically appropriate. The back-and-forth is a means of identifying what needs improvement and the best way to carry out the routine with the most straightforward and concise artistic message. In the end, Krissie marks the sequence only in the final iteration, when she needs to conjure up the image of all three trucks moving in arrangement, which does not lend itself to the embodied resource of pointing, since she'd have to not only index all three trucks but also, move them up at the same time.

Allison, in line 7, proposes they stick to "out altogether." However, Allison's suggestion is not quite the preferred option for Krissie, who responds after a pause: "there's something nice about that structure, though" (Ln 9–11). To aid Allison in seeing the aesthetic import of the structure, Krissie marks out the staggered, alternating crane extensions of the trucks. As she utters, "one person, then the other person, n' then" (Ln. 10), Krissie extends her right arm and then her left arm. As she finishes that utterance, Roy contributes to her marking, lifting his right hand as a stand-in for the third truck Krissie cannot illustrate due to the gestural affordances of her two arms/hands.
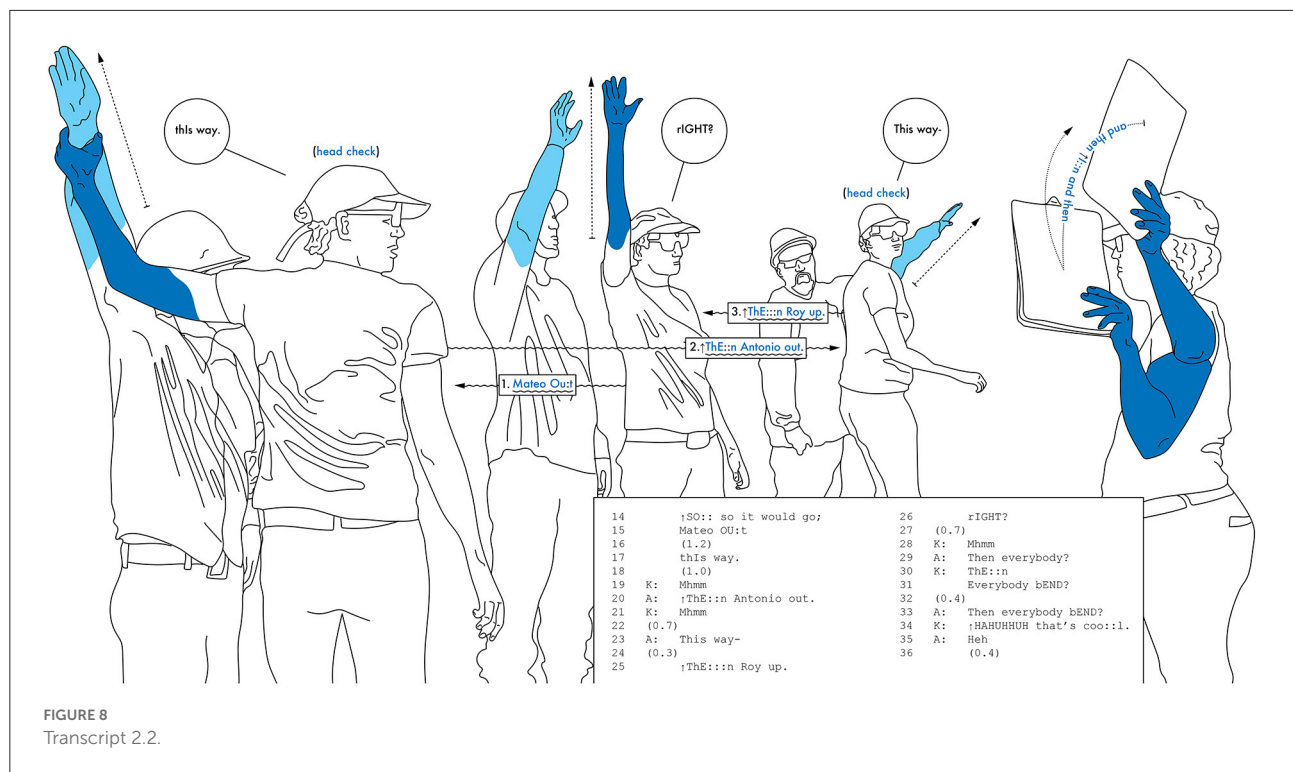
```
 1    K:    So WE're gonna go
 2          so WE should go ou:
 3          Should we go:: out out ↑Out
 4          ↓Should we go out out ↑OU:t
 5          <<acc> Or do ya wanna go> out all together.
 6    (0.6)
 7    A:    I think OUT altogether.
 8    (0.6)
 9    K:    There's something ↑NICE about that; structu:re tho:ugh-
10          one person the other person n'then
11          and then ↑I::n and then
12    A:    ↑AH: okay okay.
13    K:    Right.
```

FIGURE 7

Transcript 2.1.

Krissie and Roy's actions, taken together, form the three-truck-formation marked together. Allison, at this moment, though facing Krissie, pivots to see Roy, positioned slightly to her right. Although Krissie is marking for Allison, she is also enacting it with her own body. It is possible that marking, at this moment, is done for mutual assuredness (marking-for-self and marking-for-others, a distinction Kirsh, 2010a, 2011 makes): Krissie can appreciate the alternating, rhythmic patterning within her own body while illustrating it for Allison.

The three iterations are enacted in quick succession, enabling all parties to compare and contrast the dance phrase possibilities, the final of the three being marked by Krissie with Roy's accompaniment. The focus of this activity concerns not feasibility but artistic potential; therefore, the pointed variation and marked movements are directed from Krissie to Allison regarding the arborists behind them. Although the arborists in this segment do not contribute verbally, they play a significant role in meaning-making. Mateo, Roy, and Antonio are aligned in their assigned positions as the brush truck operators in the furthest back row. Allison, meanwhile, is holding a brush truck crane pose. The contextual configuration (Goodwin, 2017) encourages certain types of communicative potential: Krissie can map Allison's brush truck pose onto the arborists behind her who serve as stand-ins for the trucks, as they are the machine operators. These conceptual layers involve deictic points, talk, and marking to envision what *could* hold more aesthetic potential in quick succession. Although communication from the arborists is welcomed at this stage, it is unnecessary unless it will affect how the choreographers realize the dance phrases in the performance. Marking is only resorted to at the end of this sequence to show Allison why she prefers to have the brush trucks moving in a staggered manner vs. one joint action synchronously: "There's something nice about that structure though" (Ln. 9). Nearing the end of Transcript 2.1, Krissie marks out the "preferred" structure so Allison can evaluate the artistic form. In line 12, Allison confirms her appreciation of the preferred format of the phrase: "Ah, okay, okay" and, in a continuation of the segment in Transcription 2.2, marks out the phrase for Krissie. The conceptual groundwork established between the two choreographers will now be implemented. Krissie marked out the actions so Allison could experience the artistic value of the cranes extending one by one; now, Allison turns to the arborists to mark together the sequence more elaborately (see Figure 8).

At the start of Transcript 2.2, Allison models Krissie's proposal we analyzed in Transcript 2.1: having the brush truck cranes move in an alternating sequential order as they raise up. Using the quotative "go," she utters, "So, so it would go" (Ln. 14)

FIGURE 8

Transcript 2.2.

and projects a forthcoming demonstration (cf. Clark, 1996, 2016, 2019) of how the cranes proceed:

1. First, Allison walks toward Mateo and utters, "Mateo out (1.2) this way," and he extends his arm slightly toward the center of his body (Lns. 15–17). Allison grasps Mateo's wrist and curves it to his right side. Krissie confirms that adjustment with "Mhmm" (Ln. 19).

2. Second, Allison walks past Roy in the middle (he accidentally raises his arm) and utters, "Then Antonio out (1.2)," taps Antonio's arm, and extends it out (Ln. 20); Krissie again confirms the phrase with "Mhmm" (Ln. 21). And Allison taps his arm.

3. Third, Allison, moving to the middle in front of Roy, utters, "Then Roy up, right?" (Ln. 25) as she extends her right arm. Roy, shortly afterward, follows suit, raising his right arm as well. Krissie, once again, confirms the ordering and the marked version with an "Mmhm" token (Ln. 28).

4. Finally, as Krissie vocalizes her appreciation with consecutive "mhmm's, "Allison tries to remember the next part, "Then everybody?" (Ln. 29). Krissie, consulting her notes, steps in and provides the next movement. As she does so, she co-opts Allison's language, stating, "Then everybody bend" (Ln. 31). Allison repeats Krissie's words, "Then everybody bend," (Ln. 33) and, as she does this, bends her elbow and the arm back (the crane knuckle between the booms and the jaw/claw joint). All three arborists do the same movements in tandem.

Much like the previous examples, this moment starts with one person confirming the choreographic idea pitched briefly before and guides that idea step-by-step as it progresses through cumulative stages. Allison marks so Krissie perceives the idea she proposed in visuo-kinesthetic form; she does this by marking out the movements with her own hands while enabling Krissie to see a larger-scale version *via* the arborists who simultaneously enact the brush truck movements behind them. The elaborate marking together is done with both talk and gesture complimenting each other at each stage. As she states the verbal actions aloud, she also starts each utterance (an act for each truck to accomplish) by raising intonation, and she extends her arms and the arborists.' The semiotic layering of hand gestures, talk, intonation, and movement (Mendoza-Denton and Jannedy, 2011) conjures a vivid model of the dance phrase that Krissie can examine as a spectator/reviewer. After Allison and the arborists model the dance phrase, it results in an "aha moment." Krissie says, "HAHUHHUH, that's cool" (Ln. 34), with a noticeable pitch step-up and roaring laughter, and Allison also laughs (Ln. 35).

Transcript 2.1 begins with Krissie (mentally) simulating with pointing gestures and then partially marking the brush truck crane formation. Allison maneuvers her body to each of the arborists in the order in which the crane arms should extend and co-augments them to mark and maintain the alternating extensions. She guides the arborists through grasps, touch, and instructions, all of which work together to produce a marked ensemble that is now made perceivable to Krissie.

Marking together takes on a new set of relational dimensions, whereby multiple actors jointly mark in real-time for Krissie to see the phrase played out. Allison serves as an orchestrator, cueing the arborists when to mark by following or anticipating her example. A rhythm is established with each marked action, as the cranes all extend in relative time and meet their spatial designations, reaching the phrase's end and symbolic potential at the height of its artistic symbolization (Langer, 1953): the choreographers see the coordination play out, with actions presented and what they will accomplish when the arborists make the trucks dance for an audience.

Now that the brush trucks have undergone several iterations, the choreographers can clarify the dance phrases and corresponding culmination of movements, leading to a remembering session. In Transcript 2.3, each person who has been present in the different iterations of the routine can contribute to completing and refining the vision. Each participant, having differing epistemic access and embodied relations to the performance (because of their availability and addition to the dance routine), contributes to the small-scale, scaffolded modeling of the phrase (see Figure 9).

Although Krissie and Allison agree with the phrase they just mapped out, they forgot about the "shaking" and "pivoting" of the crane jaw; hence, they jointly remember the phrase sequencing. Allison looks to Roy to confirm if her memory is correct because he had been present at all the rehearsals: "But, but what it was Krissie, it was bend and it-it was pivot, right?" (Lns. 37–40). Roy promptly, as directed, corrects the proposal, noting that the sequence was that they bent the crane arms and then shook them (Lns. 41–44). Even this correction is very much a marking together activity. Roy emulates jaw shaking while pivoting the crane (Ln. 41–43). Since part of Roy's utterance "It was bend, and then we shook" (Ln. 41–42) is met with a pause, a possible point to transition between speakers, and Allison, thus, overlaps with Roy. She repeats Roy's action verbs "bend and shook" while reusing his marking of the shaking jaw and rotating crane (Ln. 45). Her repetition of Roy's hand marking amplifies his production, and she proffers it to Krissie. Krissie overlaps with Allison, making slight movements with her hands and showing certain actions of the crane (Ln. 46). The audio overlap makes it impossible to discern what she says accurately.

Roy points out a problem with the previous rendition: it involves one fewer truck than required (Ln. 47). After a slight pause, Allison recognizes Roy's concern (Lns. 49–50); the additional truck adds a layer of complexity. Eventually, Roy proposes a solution to retain an aesthetic consistency of appeal, synchronization, and balance. Before that impetus, his proposition is initiated by Antonio breaking the silence, "I think that we should meet everybody like" (Ln. 50). As he says this, Antonio laughs and marks the truck moving to the center (not illustrated in the transcript), his arm/the crane. The arborists still maintain their respective positions as worker-actors/operators. His short injection ends with a fist-bump gesture into Roy's

shoulder (Lns. 50–54). Allison engages with a sweeping proposal because it articulates something they are trying to work toward: all the brush trucks (fully-extended) bringing their jaws together. Right after Antonio taps Roy on the shoulder, Allison and Roy raise their arms, marking out (if we consider Antonio's arm) the three cranes acting in unison and coming together with the jaws touching at the peak (Ln. 52–53). There is a continuity of the dance phrase idea, as each arborist holds their hands/the crane extended, enabling Allison and Roy to try and revise the phrase in real-time. They've arrived at a shared point where revisions are necessary, and ideas are encouraged. Marking together, in the way it is enacted here, involves a scaffolding of complex movement ideas as they are fitted to emerging contingencies.

The addition of the third truck raises several questions: *What direction does each crane face? When do the cranes shake or bend? How does the movement pattern integrate with a third truck?* Allison attempts to articulate one of those possibilities as she's thinking it through, though she struggles to do so, uttering "What if it-it's, what if it's" it's (Ln. 55–56) and motions to her right with the raised arm. Roy co-operatively builds on and finishes what Allison starts by stepping in where she leaves off, "What if they still do that and I just stand here and just shake" (Lns. 57–59). As he utters this, his two hands mark (the left crane and the right crane jaws, respectively) shaking, and then he drops his left hand to centralize his right hand, illustrating the third/middle truck, "And I just stand here and just shake." Allison shows enthusiasm for Roy's modification, uttering, "yeah," as she torques her body, offering a momentary involvement (Schegloff, 1998) with Krissie to seek her confirmation (Ln. 60).
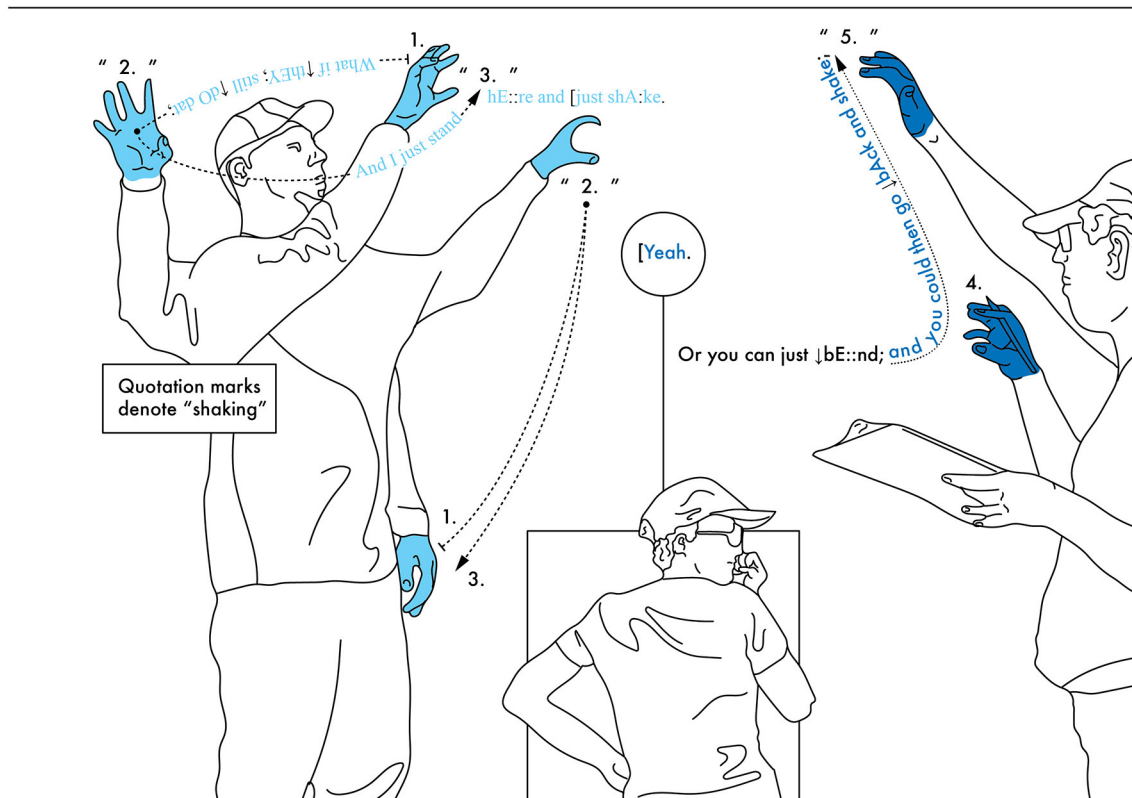
A complication arises in whether the cranes are to meet or touch, when they are extended and what the middle truck (Roy in this case) should do before the trucks on the side turn to the middle. Krissie proposes a slight alteration to when Roy/the truck shakes, which occurs only after extending, instead of him staying fixed in one position: "Or you can just bend, and you could then go back and shake" (Lns. 62–63). This leads to a back-and-forth negotiation of the phrase (see Figure 10).

Krissie attempts to secure confirmation of whether her alteration changes the ideas Roy proposes or simply modifies it: "Yeah? That's-is that the same thing?" (Ln. 64). As Krissie is asking Roy this question, Allison points to Roy and her point transitions to a marked-out proposal (see Figure 10). Roy indicates that the two ideas differ, and to help Krissie comprehend the implications of these two variations: he re-marks the movement sequence. In the first iteration, Roy is presented as marking for time, shaking in the center. In the second iteration, his readiness transitions into the next part of the dance phrase as all trucks converge while shaking (Ln. 65).

Roy completes his multimodal action with a gesture, in what linguists Hsu et al. (2021) refer to as a moment where the gesture

```
37        BU::tʰ
38        Bu::t what it wA::s Krissie
39        it was bE:::nd
40        and it-it was ↑pI:;vot right?
41   R:   It was bE::nd
42        n'then we shoo:k
43   (0.8)
44        [to the middle
45   A:   [bE:::nd [and ↑shOOk
46   K:            [and we ((verb)) INto the [((noun))
47   R:                                      [But it was jUST TWO trucks.
48   (0.7)
49   A:   Right.
50   An:  I think [that we should meet everybody li(h)ke=t
```
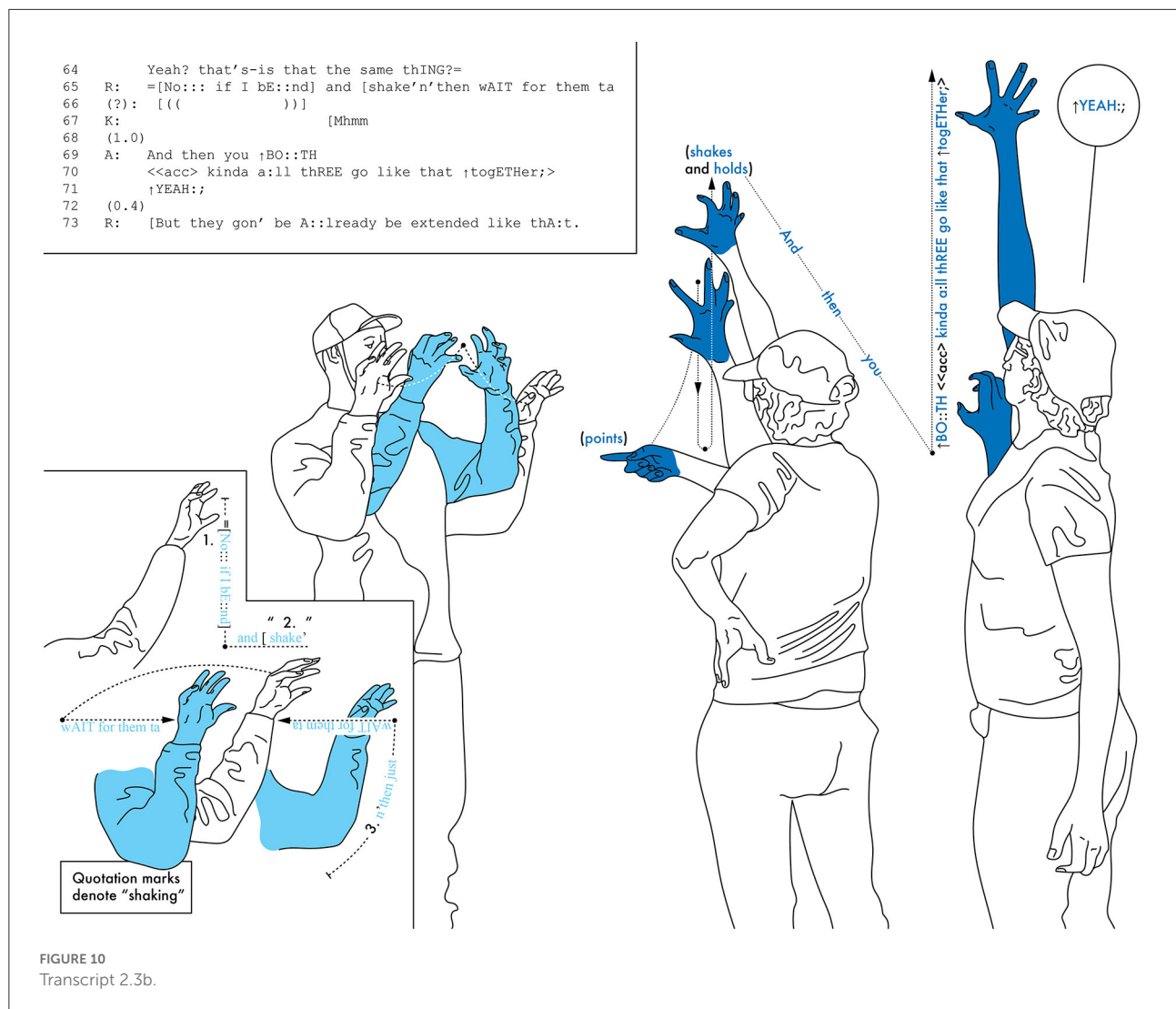

" 2. "   " 1. "   What if ↓thEY; still ↓dO dat;   " 3. "   hE::re and [just shA:ke.

And I just stand.

" 2. "

[Yeah.

Quotation marks denote "shaking"

" 5. "   and you could then go ↑bAck and shake;

Or you can just ↓bE::nd; and

1.   3.   4.

```
51   A:                                [So::
52        ↑Ri::gh[t well that's what we were ↑sAY::ing;
53   P:          [Hhhhihihuh: .h
54   R:     ((Mhmm?))
55   A:   So ↑whA:T if it's:;
56        What if it's
57   R:   What if ↑thEY; still ↑dO dat;
58   (0.5)
59        And I just stand hE::re and[     just shA:ke.
60   A:                              [Yeah.
61   (0.4)
62   K:   Or you can just ↑bE::nd;
63        and you could then go ↑bAck and shake;
```

FIGURE 9
Transcript 2.3a.

"takes over." Roy marks (and thus depicts) the action of the two cranes rotating and facing each other instead of verbalizing this part of the dance phrase. Roy is marking out the movements of the left and right brush trucks, while Allison has her right hand extended fully, held in position, and shaking, marking the time of the third, middle truck.

```
64        Yeah? that's-is that the same thING?=
65    R:   =[No::: if I bE::nd] and [shake'n'then wAIT for them ta
66   (?):   [((          ))]
67    K:                   [Mhmm
68   (1.0)
69    A:   And then you ↑BO::TH
70         <<acc> kinda a:ll thREE go like that ↑togETHer;>
71         ↑YEAH:;
72   (0.4)
73    R:   [But they gon' be A::lready be extended like thA:t.
```

FIGURE 10
Transcript 2.3b.

The marked actions—the ideas being verbalized and depicted focus on different selective aspects of the cranes (timing, position, and movement)—integrate conceptually into one clear image. Allison tries to unify all of these ideas to feature the most productive potential for the dance phrase. "And then you both, you kinda all three go like that together," she utters, extending her arm slowly, clapping, and then pointing to Roy with an emphatic "Yeah" (Lns. 69–71). It remains clear that all of these ideas marked out need to be playout out in full, as Roy expresses that there are still potential issues with their modeled phrase: "But they gon' be already be extended like that" (Ln. 73).

As we will see in our last segment, hypothetical imagining of a routine involving the third truck leads to various considerations when the arborists try to think practically and logistically. Allison is now prepared to present a summary of these ideas. As small-scale, layered marking actions are laminated onto one another, the dance phrase, and the interactant's abilities to keep these temporary products in mind, become increasingly challenging. To find out the point of
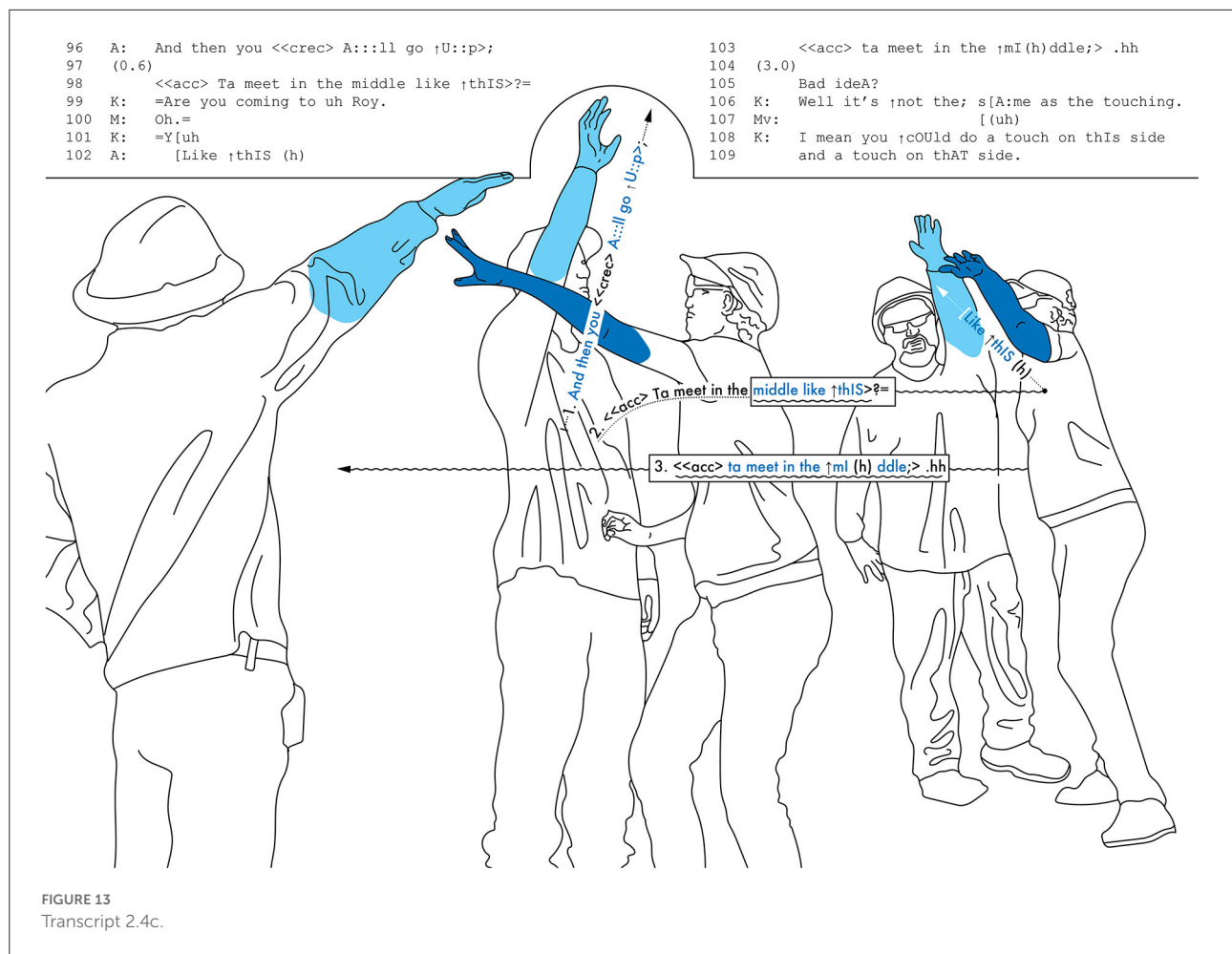
disagreement and clarify what the choreographers have in mind regarding Roy's suggestion and understanding, Allison resorts to a more elaborate form of marking together that we observed earlier where she serves, functioning as the artistic director and orchestrator, augments the bodies of the arborists standing in for the trucks. Ultimately, one iteration must be taken up and enacted.

Gearing up for practice, she prepares all parties: "Okay this. No, no, no this right? This, so, so, okay" (Lns. 74–76). There is intertextuality between Krissie's original simulation of three movement possibilities in Transcript 2.1, which uses points and verbalizes "out[s]" to map a conceptual framework, and Allison's three-part re-iteration (see Figures 11–13):

Transcript 2.4a

1. In lines 77–79, Allison utters, "You go out," demonstrating while pointing with her right arm for Mateo to extend his arm (the crane). Krissie then notes Mateo's name.

FIGURE 11
Transcript 2.4a.

FIGURE 12
Transcript 2.4b.

```
96    A:   And then you <<crec> A:::ll go ↑U::p>;       103        <<acc> ta meet in the ↑mI(h)ddle;> .hh
97    (0.6)                                            104   (3.0)
98         <<acc> Ta meet in the middle like ↑thIS>?=  105        Bad ideA?
99    K:   =Are you coming to uh Roy.                  106   K:   Well it's ↑not the; s[A:me as the touching.
100   M:   Oh.=                                        107   Mv:                      [(uh)
101   K:   =Y[uh                                       108   K:   I mean you ↑cOUld do a touch on thIs side
102   A:     [Like ↑thIS (h)                           109        and a touch on thAT side.
```

FIGURE 13
Transcript 2.4c.

2. In lines 80–81, Allison utters, "You go out," a second time, demonstrating while pointing with her left arm. Krissie then notes Antonio's name.

3. In lines 82–84, Allison utters, "You go up," in the last iteration of the three-part series, demonstrating while pointing and looking over her shoulder at Roy. Roy extends his right arm up in front of his torso; it parallels Allison's arm. Krissie, once again, notes Roy's name.

    Transcript 2.4b

4. In lines 85–86, Allison utters: "Everybody bend in." Everyone follows Allison in bending their respective arms.

5. In lines 87–91, Allison looks to Antonio and then to Mateo for their attention, then makes a curved pointing gesture with her left hand at Antonio to illustrate the rotation. The pointing, eye contact, and naming mutually reinforce one another. Allison maintains her position as the third and middle crane, holding her left hand extended while her point indexes the need for the cranes to rotate; her head movements and visual command to each respective part guide the directionality of action as both Antonio and Roy need to turn toward the center: "You two rotate toward the center, eh Mateo and Antonio, right? Right, and then you." Krissie confirms the movement sequence up to that point at the rotations: "Oh yeah," (Lns. 87–91).

6. In lines 92–95, Allison has slight difficulty recalling the next part of the dance phrase, "And then sh-shake, I am sorry." For instance, in line 93, Mateo looks at Allison, has his right arm/crane extended forward, resets his crane/arm, and then rotates from his right to the center. At this moment, the arborists adjust accordingly, attempting to watch Allison and maintain their positions.

    Transcript 2.4c

7. In lines 96–98, Allison directs: "And then you all go up to meet in the middle like this," marking out the synchronization and coordination of the trucks; her voice crescendos to emphasize the *up* descriptor and gestures, mutually reinforcing the multimodal image. In one motion, Krissie reminds the group that Antonio and Mateo will rotate toward Roy: "Are you coming toward Roy." She then points and instructs Mateo. Based upon the accelerated reaction by Allison to correct first Antonio, then Mateo, to turn toward the center, two interpretations come to mind:

Allison, when she directed the arborists, was expecting them to do what Krissie noted by rotating toward the center truck. Or, Allison was staggering these movement phrases and waiting until everyone was at the same understanding and coordination. Either way, Allison instructs all parties in a multisensory way: she positions Antonio to the center, verbalizing the instructions and touching and rotating his extended arm "to meet in the middle" (Lns. 100–104).

As we've argued, the conceptual work illustrated in Transcript 2.1–2.4 takes shape in a complex series of stages continuously refined in scope. As the segment begins, the choreographers, working amongst themselves, attempt to lay bare a brief schematic of the dance routine to the present moment. This starts with Krissie, simulating the sequential order of the brush truck crane extensions (pointing to arborists who are aligned and serving as placeholders for the trucks). As they develop the routine, a much more refined physical form of thinking and visualizing is needed. Marking together becomes a moment-to-moment negotiation in an imagined space (Murphy, 2004, 2005); they move from larger-scale marking moments that include the choreographers guiding the bodies of the arborists to a highly fine-grained analysis of how one movement of the crane is to be performed and its artistic accomplishment(s) valued within the sequence's broader context.

As with the goal of community-based artmaking, marking is a gesturing-for-dance crafted from insight gleaned from both parties' knowledge contributions and negotiations. The layering of marked action through these diverse embodied enactments contributes to an accumulated understanding of the potentialities. To work through contingencies, such as how to involve a third truck or whether a crane should bend and shake, is so much easier in the virtual space where modification is efficient when tied to the body and not the truck it represents. When they arrive at the conclusion of the sequence, it is mainly made salient that although many parties were involved, it is challenging to attribute ownership to any part of the resulting dance phrase. Marking together is just that, a production in which the contributions of all parties, in the form of layered, incremental actions, test those potentialities and arrive at the most artistically, prudent, and feasible idea.

Discussion

In this article, we laid out an interactional approach to the empirical study of marking practices as they unfolded in rehearsal interaction between community-based dance practitioners and city arborists. When the dancerly materials

for artmaking are derived from the stories, techniques, pieces of knowledge, and lived experiences of a local community as forged through the interaction between two disparate communities (trained dancers and performers who do not identify as dancers), a mode of communication must be constructed to bridge gaps in knowledge, as the dancers learn to think like arborists and the arborists learn to think like a dancer. The choreographers needed to observe and, to a point, participate in the arborists' day-to-day work. The arborists must participate and become receptive to the dancemaking process, which entails thinking about their professionalized skills and tools in new ways. The choreographic process can become challenging, for instance, when actual chainsaws, brush trucks, and pole saws are being operated in the performance. As we've shown, marking is critical for establishing mutually intelligible and relatively consistent communication between these two groups.

Most cognitive ethnography or psychology of dance scholarship on marking devices (Kirsh, 2010a,b, 2011, 2012; Muntanyola-Saura and Kirsh, 2010; Warburton, 2011, 2014, 2017; Kirsh et al., 2012; Warburton et al., 2013), turn their readers' attention to the visuo-kinesthetic forms of (distributed) cognition. A micro-interactional approach to studying marking practices reinforces these ideas; however, it, in addition, sheds more light on how mark-making is used to communicate through contingencies, lead to complex semiotic transformations, and perhaps, most importantly, when something is marked-for-dance in these community-based artmaking contexts, at least, it is hardly ever the product of one individual. Hence, we put forth the notion of *marking together*, or perhaps more aptly put *together-marking*, because the *togetherness* captures the interactional reality that takes shape in its multiplicity of meanings.

Togetherness between the community-based dancers and the arborists takes place through combined action and mutual elaboration; the arborists inform the choreographers of their own lived experiences and movement vocabularies; the choreographers re-envision those movement vocabularies into dancerly ideas; and the two, in on-going negotiations, shape an artistic performance only made possible together. *Togetherness* reflects the unifying potential mark-making from and for the body fosters because different relational associations and understandings that cannot be easily inhabited by each other are forged, whether it opens up an account about the mechanical limitations of the brush truck, the safety concerns of a particular action, or even the artistic potentiality not usually driving the trucks day-to-day operations. For example, when marking the crane boom extending, the choreographers learn that when fully-extended and moving in a specific directionality, balance is thrown off, and the truck can tip. And it is *the togetherness* that perfectly characterizes the co-operative action (Goodwin, 2017) or notation-in-action (Warburton, 2014) involved in marking in this group context. Multiple lines of creative direction or tempering may be suspended while tending to

the main course of the interaction, allowing for the group to discuss the "wobbling" aspect of truck balance in consequence of shaping the seesaw movement-coordinated phrase. Mark-doing together, hence, can be sequential, one person building on another person's depicted gestures, just as mark-doing together can be an activity done simultaneously across multiple actors to model the phrase on a broader scale. At the very least, togetherness is a productive avenue for thinking about gesturing-for-dance in its multisensory and relational aspects.

Finally, our research opens up a few new avenues for theorizing and analyzing marking as it is situated in its respective context of deployment. As we argued earlier, marking is a set of practices aimed at different interactional purposes, composed of other intertwined methods of depictive communication (gestural in both the physical and the sonic), taking place in a collaboratively imagined space (Murphy, 2004, 2005) and thus, resulting in the establishment of common ground (Clark, 1996) that enable interpretability, interactivity, and iterativity. Our goal has not been to foreclose on one definitional understanding; instead, we've aimed to capture marking *in-situ* in its full complexity. At times, this approach has its limitations in trying, at least in part, to shore up how to connect these different meaningful threads involved in the social, cognitive, and artistic capacities of marking. However, at the same time, this level of empirical rigor and attention to interactional details shows the fecundity of possible research trajectories as scholars could focus on the aims, types, devices, and communicative activities involved in marking. These new pathways will hopefully, in turn, inform us about artistic expression in social life, specifically, drawing our attention to symbolic transformations and projections of human experience made perceivable via presentational abstractions (cf. Langer, 1930, 1951, 1953, 1957, 1967) in creative arenas like dancemaking.

Data availability statement

The datasets presented in this article are not readily available because of ethical and privacy restrictions. Requests to access the datasets should be directed to MI, matthew.ingram@dsu.edu.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board approved the study at the University of Texas at Austin, IRB Number: 2014-09-0120. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

MI was the principal investigator who collected the data, completed the IRB process, and communicated with all parties involved. MI and IW worked together to write, organize, and revise this submitted paper. IW created all images for the paper and discussed them with MI. Both parties worked on and established the transcriptions. Both 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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Forms of professional interkinesthesia in nurses' body work: A case study of an infant's stepping

Julia Katila[1]* and Johanne S. Philipsen[2]

[1]Faculty of Social Sciences, Tampere University, Tampere, Finland, [2]Department of Language and Communication, University of Southern Denmark, Odense, Denmark

Moving their bodies in knowledgeable and professional ways in order to handle and connect affectively with infants entails a large part of child health care nurses' work. We deploy a phenomenological approach to videoanalysis of interaction to analyze an episode of a 1-month-old infant visiting the child health care clinic with their caregiver to have their body assessed for a neonatal stepping. Focusing on the co-movement of the baby and the nurse, we ask: how do various ways of moving as a co-embodied entity allow and corporeally prompt the baby's age-appropriate bodily ability to emerge? We develop the notion of *professional interkinesthesia* to indicate specific forms of body work of nurses which in this case entails moving together with the baby to make her successfully perform a specific health care task—the stepping. Building on Charles Goodwin's concept of professional vision, we uncover how the nurse moves and touches the infant's body in ways relevant to the institutional task. The study shows that accomplishing "normally" developed neonatal stepping is not work accomplished by the baby alone but requires that the bodies of the baby and the professional move in unison. While neonatal stepping is but one specific type of health care task, we propose that nurses' work entails numerous forms of professional touch and interkinesthesia that make it possible to successfully perform different types of health care operations.

Introduction

Previous interaction research has shown that embodied interaction plays a crucial role in health care encounters (Heath, 1986). Drawing on the phenomenological approach to videoanalysis of movement and kinesthesia in interaction (Wedelstaedt and Meyer, 2017; e.g., Meyer et al., 2017; Philipsen and Katila, 2021), we develop the notion of professional interkinesthesia to analyze the interkinesthetic body work of nurses. Specifically, we focus on the work of child health care nurses, who conduct health checks for infants soon after their birth. Furthermore, in our analysis, we build on Goodwin's (1994, 2018) concept of professional vision, which refers to socially organized

ways of seeing, understanding, and acting to make sense of the world in occupation- or institution-specific ways. Building on Goodwin's work, scholars have shown that not only vision but also touch can be part of such institutionalized professional practices (Nishizaka, 2007; Kuroshima, 2020). Child health care nurse's hands, for instance, are knowledgeable about sensing and palpating developmentally "normal" and "abnormal" features in the baby's body and bringing them into the baby's and other co-present participants' awareness.

Building on this body of research investigating professional multimodal practices, we explore some of the embodied styles in which a nurse utilizes the interkinesthetic body to highlight and bring forth relevant features in a baby's body that are central to carrying out the institutional task. According to Behnke (2008, p. 144), interkinesthesia refers specifically to kinesthetic modes of inter-bodily relationality or intercorporeality (Merleau-Ponty, 1962, 1964, 1968). Interkinesthetic moments enable human beings to connect with each other intercorporeally through moving together (Behnke, 2008; Meyer and Wedelstaedt, 2017).

As one example of such interkinesthetic moments in child health care clinics, we selected the case of an authentic interaction between a nurse and a 4-week-old infant who is being examined for neonatal stepping. Also known as the walking reflex or response[1], a baby up until 2 months of age should start stepping when held in an upright position with her or his feet touching a surface (Thelen and Fisher, 1982; e.g., Barbu-Roth et al., 2009).

As a standard procedure, babies are being examined in various ways after their birth in order to determine if they are healthy and their bodies have developed normally. The first health care examinations may thus be directly consequential for the baby and the baby's caregiver(s). Given that embodied interaction has an impact on how the health care examinations emerge, it is of great importance how the practitioner moves and interacts with the patient during these encounters.

As introduced above, we approach the baby's embodied movements, including stepping, as actions brought forth by the nurse's skilled, professional body work. Furthermore, we view the occurrence of stepping as a result of an interkinesthetic choreography in which the nurse and the baby participate together. Focusing on the co-movement of the baby and the nurse, we ask: how do these ways of moving as a co-embodied entity allow and corporeally prompt the baby's age-appropriate bodily ability to emerge? To answer this question, we utilize multimodal videoanalysis of the interaction (Streeck et al., 2011). Multimodal videoanalysis of interaction enables uncovering in detail how tasks such as testing the neonatal stepping are being achieved through moment-by-moment embodied interaction moves of the participants.

In the case study analysis, we show how the specific kinesthetic skills of the baby that are being tested become visible through the nurse's interkinesthetic highlighting and how the nurse—deploying her body, voice, eyes, and hands—provides a scaffold for the baby to move in a way that is recognizable as accomplishing the "neonatal stepping." In doing so, we highlight how accomplishing neonatal stepping is but one example of the various institutionalized abilities of a nurse's body skilled at handling and connecting with patients in various ways.

Professional vision and professional touch

Moving their bodies, especially their hands, in knowledgeable ways is central to nurses' work. The bodies of the child health care nurses working with infants are especially shaped by different forms of body work (Twigg et al., 2011), such as touching, empathetic attunement, and moving together with the babies, in ways relevant to the institutional task at hand. Skilled in the "art of touching" (Van Dongen and Elema, 2001), the practitioners know the ways of both "instrumental" and "expressive" forms of touch (Watson, 1975; Routasalo, 1999) crucial in conducting their institutional tasks. This embodied ability enables conducting health care tasks such as palpating, diagnosing, and investigating (Nishizaka, 2007), moving or making the patient's body move (Guo et al., 2020; Raudaskoski, 2020), showing empathy (Mononen, 2019; Raia et al., 2020), and healing (Paterson, 2005). Previous studies have uncovered the health care practitioner's "professional touch" through which they palpate, investigate, and support (Nishizaka, 2007; Merlino, 2020; e.g., Kuroshima, 2020) the patient's body in ways that highlight (Goodwin, 1994, 2018) areas relevant to health care tasks, such as diagnosing illness.

Such practices are similar to other embodied, institutionalized ways of "seeing" or making visible specific aspects of the world that are important for carrying out different tasks. For example, archaeologists uncover traces of ancient human artifacts by tracing out color changes in dirt (Goodwin, 1994, 2018), food professionals touch cheese in a gourmet shop to determine qualities in them (Mondada, 2020), or auto-shop owners touch parts of a car in ways that enable diagnosis of problems (Streeck, 2013; Cuffari and Streeck, 2017). Other studies have shown how vision (Goodwin, 1994), gestural practices of pointing, tracing, and reenacting (Goodwin, 1994, 2018; Philipsen and Trasmundi, 2019; Philipsen and Katila, 2021), and touch (Nishizaka, 2007; Kuroshima, 2020; Merlino, 2020) are important for carrying out as well as teaching these different professional practices.

In this study, we show how not only touch and vision but also interkinesthetic actions of moving a patient's body and moving together with a patient can be employed in similar ways

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1   The researchers are not in agreement if the stepping response can be called a reflex or not (see e.g. Barbu-Roth et al., 2009).

to highlight bodily (dys)functions and abilities relevant for the professional task-at-hand.

Interkinesthesia, touch, and the haptic system

Human beings are born mobile (Sheets-Johnstone, 2011), and this inborn sensemaking of the world through body movement is closely intertwined with the sense of touch and the whole haptic system. As such, early communication between infants and caregivers often unfolds as interkinesthetic. Enabled by direct intercorporeal connections between bodies, in interkinesthetically coordinated movement, single bodies connect through movement and move meaningfully together. By attuning to and anticipating the subtle body movements of the other and emerging as a co-mobile unit, bodies are able to perform movement trajectories from spontaneous co-gestures to complex and well-practiced choreographies of team sports (Behnke, 2008; Stuart, 2012; Meyer and Wedelstaedt, 2017; Philipsen and Katila, 2021).

Similarly, when infants are being tested in the health care clinic, the newborn and the nurse must attune to each other's moving bodies *via* the language of the body. Due to this inherently intercorporeal and interkinesthetic nature of the interaction among caregivers and babies, we do not simply analyze the nurse's touch in health care clinics. Instead, we approach the nurse's body work as an engagement of the whole "haptic system" (Gibson, 1966). Including forms of touch as well kinesthesia (Gibson, 1966; Sheets-Johnstone, 2011; Katila, 2018), the haptic system refers to "an apparatus by which the individual gets information about both the environment and his body" (Gibson, 1966, p. 97). Enabling perceiving messages both from the "inside" and "outside" of the body, the haptic system is the simultaneous sensibility of an individual toward the world and their body through bodily actions.

By focusing on the haptic system instead of mere touch, it is possible to reflect on how the bodies simultaneously feel both themselves and the world around them, including other living bodies. In their reflection on Merleau-Ponty's theory on human embodiment and affectivity, Roald et al. (2018, p. 208) describe how the perception of the world is always synonymous with a perception of one's own body, or, in authors' words, "external perception and the perception of one's own body are two facets of the same act.". In touching, for instance, the body senses that which is being touched, as well as one's own body touching (Merleau-Ponty, 1968). Moreover, when touching other living bodies, one's body is inevitably touched by other bodies and the world. Indeed, as pointed out by Van Dongen and Elema (2001, p. 150), a nurse's body work and touch evoke feelings not only in the patients but also in the nurses themselves. The nurse connects her own feelings of being touched to those of her patient and is simultaneously affecting and affected by them

(i.e., interaffectivity, Fuchs, 2017). This two-way dimension of touch (touching and being touched), combined with its both "inward" and "outward" dimension (kinesthesia/proprioception and sense of touch), indicates that the child health care nurses cannot simply unidirectionally move and touch the patients—they inevitably move with the patients and are also being touched by them. In a way, when we touch other people, our bodies and their sensorial fields spread to the world around us and the things we grasp, manipulate, and feel.

Kinesthesia also cuts across perceptual systems (Gibson, 1966, p. 111). Just as we never lack tactile experience, we also never lack kinesthetic experience of ourselves in the world, even if we do not pay attention to it most of the time. However, as Sheets-Johnstone (2002, p. 138) expresses, "Any time we care to pay attention to ourselves, there we are—kinesthetically, tactilely." Each sensorial and perceptual action has a kinesthetic aspect in it: it is feeling the moving "I" in reaching out to the world. In terms of touching and being touched, the kinesthetic sensation is different. Feeling the "I" moving the body in touching, and feeling the "I" when being moved and touched by somebody else are distinct feelings, even if these sensations are ultimately intertwined. Due to these multi- and "inter-sensorial" (Howes 2005, p. 7) aspects of co-embodied relationality in the encounters between the nurse and the baby, we focus on uncovering forms of professional interkinesthesia. This enables us to view bodies and their multisensorial features in connection to the bodies they touch and by which they are simultaneously being touched.

Infant stepping as a context-specific action

As one example of interkinesthetic action, in this paper, we analyze how neonatal stepping is being examined in child health care clinic. Neonatal stepping refers to the tendency of a baby to start stepping when held in an upright position with her or his feet touching a surface (e.g., Forssberg, 1985). According to previous research, stepping is expected to last until about 2 months after birth (Thelen and Fisher, 1982; Barbu-Roth et al., 2009). The relationship between infant stepping and walking has been discussed to an extent. Although infant stepping disappears during the course of development, some scholars believe the response does not disappear but is only temporarily suppressed by the weight of the infant's leg (Thelen and Fisher, 1982; Cautilli and Dziewolska, 2006). It has been suggested that mature walking may evolve from infant stepping patterns (Thelen and Cooke, 1987), and that practicing infant stepping can lead to accelerated walking (Ulrich et al., 2001).

In the context of health care encounters, stepping is being evoked in the baby as part of testing if their body is developing according to age-appropriate expectations. Thus, the moments of testing can be highly meaningful and directly

consequential for the baby and their caregiver, as the baby's development is being evaluated within these encounters. For the babies themselves, responding to a certain stimulus by moving their legs one after another on the ground indicates a spontaneous pre-reflective expression and body movement. However, in the institutional context of health care, through the development of the child health care occupation and developmental psychology research, it has come to mean "neonatal stepping" or "stepping reflex."

In a sense, neonatal stepping is thus a product of the health care institution and developmental psychology research, and its occurrence is entirely context-dependent. It not only requires a nurse with a specific professional vision to conduct the task, but the special institutional environment and physical background (examination table) must be present and involved in specific ways, in order for the action to be identified as a successful occurrence of neonatal development. Moreover, the most distinctive aspect of stepping or walking is often thought of as the movement of the legs. However, walking is a body technique (Mauss, 1973) developed in humans through the evolution toward an upright posture. To state the obvious: an infant conducting the stepping reflex can move their feet, but not to hold their body upright or to walk. Thus, it is only through co-participated embodiment with the nurse that the baby momentarily becomes a walking body.

Materials and methods

Video data

The research data consist of video recordings of authentic interactions in a Finnish child health care clinic. The data collection followed the Finnish National Board of Integrity's ethical guidelines for collecting and handling data. The data include information gathered from child patients accompanied by their parents, and written informed consent was obtained from the parents (Ruusuvuori et al., 2008; Ijäs-Kallio et al., 2011; see Homanen, 2013). To illustrate our finding—the form of nurse's body work we call professional interkinesthesia—we have chosen one exemplary case of a four-week-old baby's visit to health care that we will present, analyze, and discuss in detail. We will exemplify how the professional and the baby interact with each other using their whole bodies during physical examinations in the postnatal clinic.

Methodological approach

We adopt multimodal videoanalysis of interaction as a method to analyze the health care encounter. This microanalytic approach stems from a wide field of qualitative studies focused on the intercorporeal, multimodal, multisensorial,

and other semiotic aspects of naturally occurring face-to-face interactions (Streeck et al., 2011; Meyer et al., 2017; Goodwin, 2018; Goodwin and Cekaite, 2018; Katila, 2018). Our co-operative and intercorporeal perspective on microanalysis draws on embodied and experienced understandings of human action, and it is especially helpful for the study of embodied resources, such as affect, touch and interkinesthetic sociality (see Katila and Philipsen, 2019; Katila and Raudaskoski, 2020; Katila and Turja, 2021; Philipsen and Katila, 2021). With videoanalysis, it is possible to analyze embodied, communicative aspects of interaction, and to determine how these aspects are manufactured together by the participants through their mutually elaborating body movements and orientations. Moreover, by drawing on an inherently social and intercorporeal understanding of human bodies (Merleau-Ponty, 1962), we pay careful attention to how participants, in their interactions as living bodies, directly participate in and sense the social meanings implied in each other's actions. In terms of analysis, this intercorporeal starting point also requires the adoption of the researchers' own bodies to co-empathize with the communicative meanings experienced by the participants in the interactions that are revealed in the video data (Katila and Philipsen, 2019; Katila and Raudaskoski, 2020; Katila and Turja, 2021).

Results

In this section, we exemplify a nurse's interkinesthetic practices in action by showing how the nurse employs an array of multisensorial—haptic, kinesthetic, aural, and visual—body techniques embedded together to successfully accomplish an institutional task. We do this by uncovering the moment-by-moment unfolding interkinesthetic movement trajectories and multisensorial actions of "highlighting" (Goodwin, 1994), which allow aspects of the baby's bodily capabilities to "become visible" and, thus, perceptually available to co-present interlocutors. As introduced above, we analyze the details of a successful institutional action—the nurse engaging in a "walking formation" with the baby—to test the emergence of the baby's stepping response.

In the moment-by-moment interactions, it is the task of the nurse to first "make" the baby's body conduct the walking reflex. The baby by herself cannot stand upright, not to mention walk; thus, the nurse must engage with the baby in order to make the baby stand upright before they step together. Moreover, it is the nurse, through her embodied knowledge base as a health care professional, who then determines what "qualifies" as an adequate display of a stepping response. In other words, the nurse decides what kind of body movements of the baby can be treated as "stepping" and how long the baby must conduct these "symptoms" as sufficient proof of a "normally" functioning neonatal stepping. As explained by Goodwin (1994, p. 606).

Figure 1

Figure 2

Figure 3

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01 N1: [#1-2 A♪katotaanko vähänny otetaanko  me hyviä #3 ↑ASKELEITA
       [#1-2 A♪shall we see a little bit now if we take good #3 ↑STEPS
02 N2: [M♪nih?
       [M♪yeah?
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Figure 4

Figure 5

Figure 6

Extract, Part 1

"…the ability to see a meaningful event is not a transparent, psychological process but instead a socially situated activity accomplished through the deployment of a range of historically constituted discursive practices."

Notably, the nurse cannot simply request or prompt the baby to do the walking reflex; instead, it requires specific artful types of haptic handicraft as well as co-inhabiting the walking movement with the baby. Along with applying forms of professional touch, the nurse deploys her body into a type of professional interkinesthetic action—moving with the patient to make the patient move in the desired manner.

Making off an interkinesthetic formation of a "walking body"

In what follows, we illustrate how the nurse and the baby emerge through careful embodied coordination in an

interkinesthetic formation. In Extract 1 Part 1, we show how the nurse arranges the baby in an upright posture to allow the occurrence of the stepping and the "making of a walking body." We will analyze how the nurse accomplishes this by lifting and twisting the baby's body in an upright position while verbalizing the action. The nurse's gentle touch invites this asymmetric but reciprocal interkinesthetic body movement of lifting and being lifted. Embedded in the same haptic and tactile actions are caressing the baby's skin. Thus, different forms of tactile and haptic actions—lifting, stroking, and palpating—unite into a single interkinesthetically coordinated trajectory. In the extract, a 4-week-old baby (BA) arrives at the children's health care clinic with her mother (MO). Beside the main nurse (N1), a nurse trainee (N2) is present in the encounter (see Image 1, Participant map).

We will analyze the interactional organization of making a stepping or "walking body". The verbal transcription conventions are presented in Appendix 1. The conventions are modified for our purpose from the work of conversation analyst

Image 1
Participant map.

Jefferson (2004). In addition to more conventional transcription signs, A♪ before utterances is used to indicate adult-targeted voice, whereas I♪ indicates infant-targeted, high-pitched "baby talk" or "motherese" voice (see Fernald, 1985), often addressed at babies by caregivers.

In Figures 1, 2, N1 starts to lift the baby while twisting and lifting her to an upright position. Here, the baby's body is entirely lifted and moved by the nurse, and the trajectory of the movement is authored by her. However, the baby takes part in the movement by aligning with the nurse's corporeal language and allowing herself to be lifted. The bodies move together in a trajectory designed by the nurse in an interkinesthetic formation, with asymmetric but complementary kinesthetic roles. The baby is feeling her body being lifted and the nurse is simultaneously feeling the baby's body through touch as well as the baby's weight in her hands and arms. Thus, this intercorporeally coordinated action engages different but complementary aspects in the haptic system (Gibson, 1966) for both: the nurse engages in forms of active touch and moves the other to conduct the professional practice; the baby feels the sensation of being touched, lifted, and manipulated by the nurse. Essentially, these complementary aspects of touching and being touched only make sense together, and the sentient body of the nurse is also constantly being affected by the moving and sensible body of the baby. Moreover, verbal and embodied cues work together to create this tactilely coordinated interkinesthetic formation. N1 laminates the ongoing action by saying [A♪ shall we see a little bit now if we take good↑STEPS (line 01). Through this utterance, N1 discursively unites herself

and the baby—using the plural first-person form "we"—to create a shared agency (see Parry, 2017) with the baby. Through this grammatical form, N1 unites the baby into a co-embodied gestalt about to take steps. Importantly, uttered in an adult-targeted voice, N1 also informs the other co-present participants of what happens next.

N1 then supports the baby's body gently in an upright position and gently strokes the baby's back with her right hand (Figure 3). She then reaches the baby's bottom (Figure 4), and changes the position of her hands (Figure 5) so that both the baby and N1 face the same direction (Figure 6). The hands of the nurse move in various ways on the baby's body, manipulating the baby's body through "haptic communication" (Schindler, 2017). In concert with each other, these haptic communicative movements display skilled, professional handcraft. At the same time, the nurse's hands (1) move the baby's body and simultaneously corporeally request that the baby move her own body in a desired direction, acting as implicit embodied requests, (2) palpate the baby's body, and (3) gently soothe the baby's body. In this haptic movement, various types of professional touch in nursing—"instrumental" and "expressive" (Watson, 1975; Routasalo, 1999; Van Dongen and Elema, 2001; Paterson, 2005)—intersect.

To summarize, in Extract 1 Part 1, we see how the nurse connects her body to that of the baby through touch, and then moves the baby's body in various ways relevant to the institutional task-at-hand. Her hands, moving together with the baby through the haptic actions of lifting, twisting, and escorting the baby's body, include creative and institutionalized forms of professional touch and interkinesthesia that enable the baby's body to emerge in an upright body posture required for the forthcoming stepping. The success of the action not only includes manipulative touch, but it also includes more affective forms of touch as well as accompanying verbal actions that manage the "participation framework" (see Goodwin and Goodwin, 2004) with other co-present participants, especially the baby's mother. However, in Extract 1 Part 1, the nurse primarily moves, touches, and manipulates the baby's body to present the baby's body in a desired fashion. Although the co-embodied, interkinesthetic movement is present here in the form of the complementary roles of moving and being moved, in Extract 1 Part 2, the moment continues into more equally distributed labor concerning the movement of the baby's body—the co-embodied interkinesthetic formation of the baby's "walking body".

Highlighting certain parts of the body to initiate specific types of movement

In Extract 1 Part 2, which immediately follows Extract 1 Part 1, we illustrate how the nurse moves the baby's body

Figure 7   Figure 8   Figure 9   Figure 10

Extract, Part 2

in a certain way to encourage the emergence of the neonatal stepping to occur. The emergence of the baby's stepping is enabled by the nurse's table, which acts as a medium for the forthcoming stepping. The nurse moves the baby's body against the table in a manner that makes stepping and the desired movement trajectory relevant. This emerges as a professional interkinesthetic action of "highlighting" (Goodwin, 1994), as it enables the specific movement capabilities of the baby to "become visible" and thus perceptually available to all co-present participants.

After accomplishing an upright posture, N1 first lifts the baby's body slightly (Figure 7), and then lands her feet back to the table (Figure 8). After providing this momentum for the baby's body to start stepping by touching the table with the baby's feet, the nurse then circles the baby's feet lightly against the table clockwise (Figure 9). By moving the baby's body up and against the table in this specific manner, the nurse creates a scaffold, a narrow field of potential next body movements for the baby to act upon next. This body technique not only communicates to the baby about the relevance of the feet, but also about the relevance of moving the leg forward. The circle illustrated in Figure 9 initiates movement of the feet, and as the movement of the circle flows clockwise, it is embodiedly relevant for the baby's left leg to continue the movement. As N1 then slightly tilts the baby toward the left, this embedded haptic directive results in the baby "taking her first step" with her left foot (Figure 10). This circling choreography of the bodies is only visually available for the analyst, but it is directly felt (inter)kinesthetically and haptically by the participants. We—the analysts—can only imagine through our own embodied knowledge the body-to-body sensed details of the finetuned haptic movements of the nurse, resulting in the baby moving in a desired manner. However, it is exactly these pre-reflexive and pre-discursive ways of the body that make the dance-like circling motion initiated by the nurse

understandable as a request for the baby to move in a particular manner. Such interkinesthetically accomplished ways of the nurse's body are professional practices that enable bringing forth relevant "symptoms"—stepping—in the baby's body and thus highlight aspects of the baby's body essential for successfully accomplishing the institutional task.

Thus far, we have described how the nurse accomplishes with the baby the corporeal "pre-requirement" for the stepping reflex to occur—upright posture (Extract 1 Part 2)—and the way in which the nurse palpates the baby's body to bring about certain next body movements in the baby's body, namely stepping. Next, we illustrate how the bodies of the baby and the nurse "walk together" in the form of an interkinesthetic stepping formation.

Infant stepping as a result of professional interkinesthesia

In Extract 1 Part 3, we will describe how, after the stepping has been initiated (Part 2), the nurse and baby together inhabit a stepping or walking body. Enabled by the interkinesthetic connection between the bodies, the movement trajectory entails a careful reciprocity of steering and being steered, leading the movement and being moved—somewhat similar to a couple dance. The tactile arrangement and the emerging asymmetric but reciprocal movements of the bodies resemble "shepherding" actions conducted by parents with their children in a "control formation," with the adult positioned behind the child (Cekaite, 2010, p. 2, 7). However, unlike in shepherding, the body of the baby here is being fully carried by the nurse, and the baby's stepping movements are corporeal responses to the continuous interkinesthetically orchestrated palpation moves.

Figure 11   Figure 12

```
03 N2: M♪vähän vielä        [#11 kävelee    #12 NO:IN
       M♪a little bit still [#11 walks      #12 LIKE THA:T
```

Figure 13   Figure 14   Figure 15

Extract, Part 3

After the baby has taken her first step (see Extract 1 Part 2, Figure 10), the embodied movements of the baby and the nurse unfold in a careful and rhythmic reciprocity involving their co-participation. It is only after the baby herself moves her own leg that N1 lightly steers the baby's body again toward the right, and this steering, accompanied by carrying the baby's body and moving it slightly forward, provides another scaffold for the baby's right leg to move forward and create another "step" (Figures 11, 12). During these first two steps, the nurse laminates the baby's steps with verbal evaluation, "a little bit still [walks LIKE THA:T" (line 03), through which she makes official to the baby and the other participants that how the baby has moved her body so far qualifies as an occurrence of neonatal stepping. In other words, the step is treated as successfully fulfilling the requirements of the institutional task and as qualifying as a "normal" movement and development of the body. By using the third-person singular verb form, "walks," N1 highlights the baby's agency in the walking activity and downplays her

own contribution in making the stepping possible. Further, N1 uses a baby-targeted or motherese tone of voice. The vocal quality she uses is very affective in nature, resonating an empathetic engagement with the baby. This affective aural action rhythmically co-occurs with the interkinesthetic one: the co-embodied steps occur with the same tempo as the health care practitioner's words, the two inhabiting a multi-sensorial—kinesthetic, haptic, and aural—intercorporeality.

Even though the category of stepping has now been officially accomplished, the co-embodied movement of the nurse and the baby continues. By carefully attuning to the timing of the baby's locomotion, N1 again steers the baby's body slightly from left to right once more (Figures 13, 14), using the rhythm of the baby's steps while holding and moving the baby forward at the speed initiated by the baby with her walking tempo. Showing an active agency in stopping the movement, the baby then "collapses" at the table and lets her body be held entirely by the nurse (Figure 15).

In summary, Extract 1 Part 3 shows us how the baby—in spite of the fact that as a one-month-old, she obviously cannot walk—is made to inhabit a walking body. The emerging stepping activity is an entirely co-embodied and interkinesthetic accomplishment, requiring the intercorporeal collaboration of the nurse and baby: while the nurse is holding and moving the baby's body forward, the baby is the one who actually provides the steps and therefore also actively participates in the tempo and unfolding of the movement. Furthermore, the type of action is not just any type of stepping but an institution-specific category of stepping reflex that resembles the recognizable body technique of walking. For it to be recognizable as a stepping reflex, the co-embodied stepping action of the baby and the nurse must be "environmentally coupled" (Goodwin, 2007) with the operation table and, more broadly, the specific institutional context.

As for the forms of professional touch, we observe that they are entirely intertwined with forms of professional interkinesthesia. Engaging the haptic system and sensations of moving and being moved, the distribution of the corporeal body control between the nurse and the baby constantly "fluctuates" (see Guo et al., 2020). Furthermore, these interkinesthetic activities are here orchestrated not only through touch but also through co-occurring vocal expressions, which together create a shared affective space that all co-present participants embody. Kinesthetic sensation is not only embedded in touch; it is included in all body movements (Gibson, 1966, p. 111), including vocal action. Therefore, interkinesthesia, even if closely related to touching and being touched, entails more generally the idea of moving comprehensively in ways that make sense together.

In Extract 1 Parts 1–3, we have demonstrated how the interkinesthetic ability of human beings is harnessed as an institutional action for the nurse's "professional vision" (Goodwin, 1994). Importantly, it brings forth how the stepping reflex is an entirely intercorporeal accomplishment wherein biological, neural, and motor development is enmeshed within the professional skill of the nurse and the moment-by-moment unfolding of the body-to-body communication between the nurse and the baby.

Indeed, the fluent and unattended way in which the nurse moves with the baby's body exemplifies well the embeddedness of the skilled and professionalized aspect of her interkinesthetic abilities. The specific body movements of making the baby step are certainly learned and habitualized as a result of countless times of repetition of similar movements with babies but are still actualized in a novel moment, with a new participant—a baby who has no previous experience on moving with the nurse in this specific manner. Elsewhere, in the context of analyzing breathing together with the patient in a therapist's office, we (Philipsen and Katila, 2021, p. 11) suggested that:

In order to grasp such opportunities for interkinesthetic co-participation, the therapist cannot simply act as a distanced or professionalized body, but must lend their body to the intercorporeal momentum, and as a consequence also be open to be influenced by the body of the patient.

Arguably, an intercorporeal momentum of a similar kind also takes place in the current context, when the nurse is witnessed lending her body for the purpose of making the baby's body move—first to be in an upright posture and then step—in certain ways.

Discussion: The professionalized ways of the nurse's body

In this study, we have exemplified what we called professional interkinesthesia at the child health care nurse's office. We showed how, deploying an array of professional kinesthetic and haptic movements, such as lifting, twisting, moving with and moving from one side to another, the nurse was able to make the baby move in an institutionally relevant manner—to conduct the "neonatal stepping." Especially when deploying a specific circling movement while touching the table with the baby's feet, the nurse was able to provide a scaffold for the baby's neonatal stepping response to occur. This professional interkinesthetic "highlighting" (Goodwin, 1994) made it possible for the baby's task-relevant capabilities to "become visible" and publicly observable.

These body techniques are a combination of both the embodied and professional skills of the nurse. They are habitualized to the extent that they are rarely explicitly attended to but still always conducted in a slightly new and creative way with a new patient. Indeed, as the bodies and embodied affordances of each nurse are all different, so are the bodies and embodied affordances of each baby who comes to the clinic. Thus, the examinations involve elements of historically learned and habitualized practices as well as spontaneous coordination and attunement in each new encounter. For instance, not all babies are able to respond to the embodied movements of the nurse and conduct the stepping, even if the nurse makes all relevant body trajectories to bring about these movements in the baby. Needless to say, the neonatal stepping is not only a result of the intercorporeal communication between the nurse and the baby, but the baby must have actually developed this embodied tendency so that the interactional and kinesthetic emergence of the stepping is possible.

Our detailed video analysis exemplified how making of a normally moving body required the nurse initiating an interkinesthetic formation with the baby, and their bodies to move in unison by attuning to each other's movements through tactile, aural, visual, and affective resonance. During these

moments of interkinesthetic togetherness, the baby and nurse are in the process of "making" (Behnke, 1997) the baby's body move and react normally. As expressed by Behnke (1997, p. 198):

> even if my body is something I do, I do not do it alone: the micromovements through which I am continually making a body are situated within a more encompassing interkinesthetic field, including not only the movements and micromovements of those around me, but also the sedimented traces of such movements and micromovements in the artifacts around me.

Extensively growing and developing during the first months and years of their lives, newborn human bodies are in a constant process of making. Moving together in health care examinations provides a vivid culmination point of not only the making of a moving body, but the making of a "normally" moving body: that is, a body that fulfills the criteria of the normal movement of a body at a certain age discovered by developmental psychology.

Moreover, these visits to health care clinics—among the first ones, if not the first one in the newborn's life—also provide some of the baby's first exposures to modes of behavior when presenting one's body as an "object for medical investigation" (Heath, 2006). These first moments of the socialization of children into the role of a patient in health care require embodied guidance and controlling touch from the professionals, as well as acts of empathy and soothing through touch and, for instance, the motherese tone of voice. By including controlling and soothing tactile and aural actions, the health care practitioner is able to prompt the baby toward specific types of behavior expected in a health care meeting.

Finally, although in this study we have only addressed one very specific example, forms of professional interkinesthesia are everywhere in different types of health care encounters involving body work. In the future, more studies exploring forms of skilled body work and professional interkinesthesia are needed to uncover the multitude of ways in which health care practitioners use their bodies in interaction with the patients to accomplish institutional tasks. Embodied interaction influences the success of the health care operations and, thus, unveiling its detailed dynamics are of interest not only to researchers of health and embodied interaction but also to health care practitioners.

As conductors of hands-on body work, the hands of health care practitioners are especially skilled at moving and moving with the bodies of the patients. Although neonatal stepping is a good example of co-embodied agency, health care professionals constantly "lend" their bodies for the sake of institutional actions to various extents and in various ways. These ways of moving together are professionalized, institutionalized, and habitualized versions of the human bodies' basic ability and tendency to coordinate movement with other people, that is, the interkinesthetic co-embodiment.

Data availability statement

The dataset is not available for sharing because of confidentiality reasons. Requests to access these datasets should be directed to julia.katila@tuni.fi.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Tampere Region. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

JK wrote most of the data-analysis, theoretical part, introduction methods and materials, and conclusions. JP wrote some parts and commented on the data-analysis, helped with theoretical part, and conclusions. 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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Appendix

Table A1   The transcription conventions used in the conversations.

Numbers in brackets indicate a time gap in tenths of a second.

(.)	A dot enclosed in brackets indicates a micropause of less than two-tenths of a second.
=	This indicates an absolute contiguity between utterances.
()	This indicates an unclear utterance or another sound.
:	Colons indicate a stretching of a sound.
.	A full stop indicates a falling tone.
,	A comma indicates a continuing tone.
↑↓	Upward and downward arrows mark the overall rise or fall in pitch across a phrase.
° °	This indicates a silent voice speech.
Under	This indicates the speaker's emphasis.
@ @	This indicates speech produced with a smiley voice.
(())	This indicates the analyst's comment.
A♪	This indicates adult-targeted voice
I♪	This indicates infant-targeted

Frontiers in Communication

Developing Kinesemiotics: Challenges and solutions using the Functional Grammar of Dance

Arianna Maiorani* and Chun Liu

Communication and Media Division, School of Social Sciences and Humanities, Loughborough University, Loughborough, United Kingdom

This article aims to test the applicability and the possibility of adaptation of the Functional Grammar of Dance, which is at the core of the development of the new interdisciplinary research area called Kinesemiotics. As a model of analysis for movement-based communication, the Functional Grammar of Dance has already been used for the analysis of classical ballet choreography, and it is currently employed in a collaborative research project involving the authors of this article and their research group at Loughborough University in the UK, the University of Bremen in Germany, and the English National Ballet. The testing opportunity is provided by the challenging analysis of an iconic choreography of the 20th century: *Lamentation*, a solo piece created by Martha Graham. The analysis will show the applicability of the theory and the adaptability of the model of analysis, and it will also provide examples of the way a new type of annotation based on this grammar has been created and applied using the ELAN annotation software. The use of ELAN includes the implementation of a specifically compiled controlled vocabulary providing labels for coding the materiality, structure, and semantics of dance discourse systematically.

Introduction

In January 1930, an iconic modern dance solo created by Martha Graham (one of the great founders and pioneers of western modern dance), *Lamentation*, was first performed in New York. Graham described it as "a solo piece in which I wear a long tube of material to indicate the tragedy that obsesses the body, the ability to stretch inside your own skin, to witness and test the perimeters and boundaries of grief, which is honorable and universal" (Graham, 1991, p. 117) (see Figure 1)[1]. The piece became a foundational

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1   The media frame is from the *Lamentation* performed by Peggy Lyman (1976) who was principal dancer with the Martha Graham Dance Company. This is the version of *Lamentation* we used for the analysis and all the media frames included in the present paper are from this version (Available from https://www.youtube.com/watch?v=Dn7lGuROMxQ, last accessed 01 July, 2022). For copyright reasons, all the media frames included in the paper are blurred.

FIGURE 1
The costume in *Lamentation*.

example of modern dance and movement experimentation with costume materials, another important practice-based research area in which Graham was a pioneer throughout her career. The main aim of this article is precisely to test "the perimeters and boundaries" of the Functional Grammar of Dance movement (FGD) (Maiorani, 2017, 2021a), which informs our previous work on the analysis of movement-based communication in ballet performance, and which we would like to test further in its principles and in its potential to capture how movement-based communication can also happen through the interaction between choreographed movement and costume materials. The ultimate aim of this paper is to show that the FGD can not only be applied to the analysis of how dancers (and artists in general who practice movement-based communication) communicate and interpret a role through the way their moving bodies interact with a performance space, but that it can also be applied to research on how this type of communication can be enacted even in the absence of movement *across* space. This will show the usefulness of the central FGD notion of *projection* even in the case of analysis that is performed on very restricted movement. The analysis of *Lamentation* that we are going to perform will show how the famous tube of stretchy material that constrains the dancer's movement in *Lamentation* actually provides a three-dimensional quality to a choreography that is mostly designed on a bidimensional plane of horizontal and vertical lines, much more typical of the still representations that viewers experience when looking at paintings and pictures even in the presence of linear perspective.
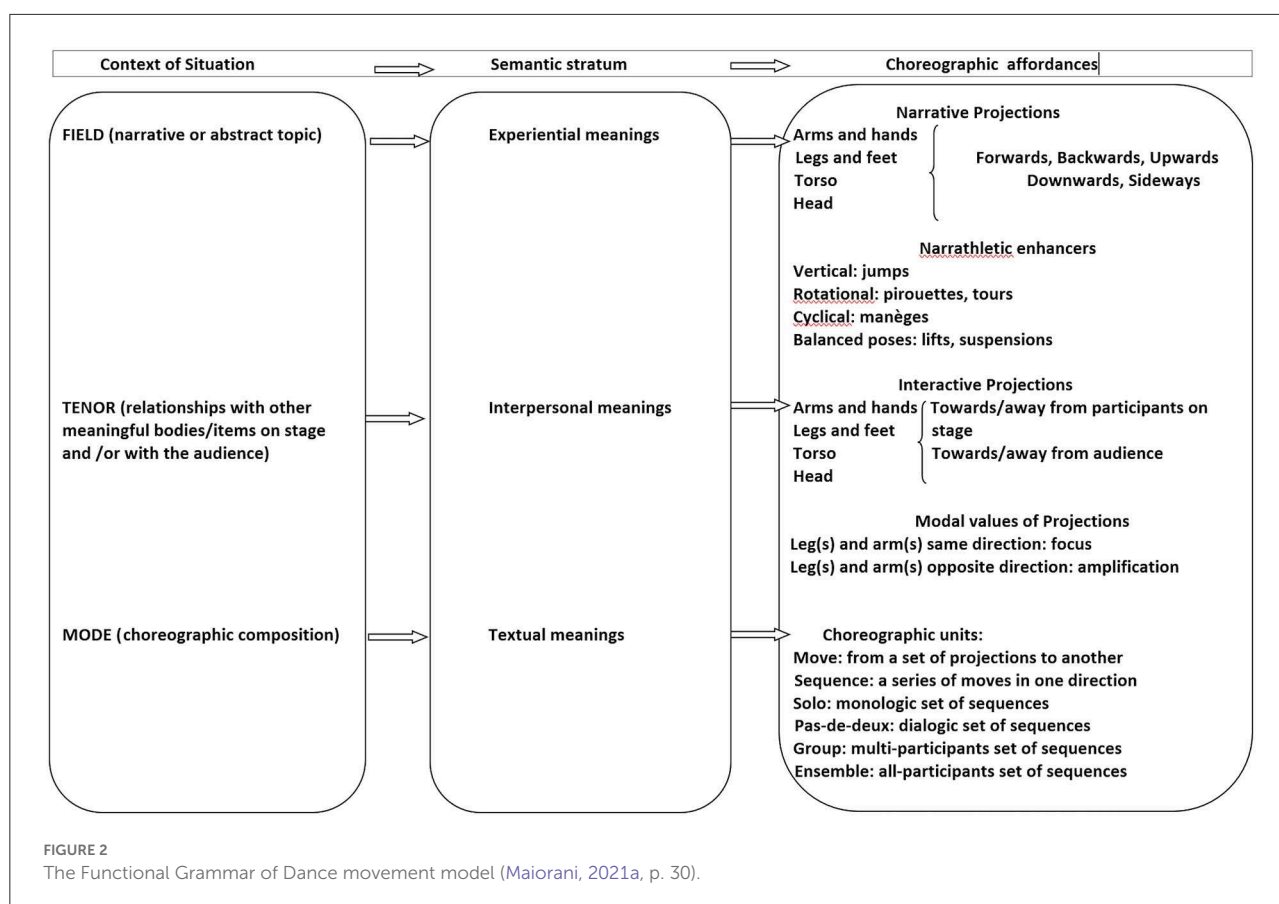

The FGD and the development of Kinesemiotics

The FGD (Maiorani, 2017, 2021a) was created drawing on M.A.K Halliday's Functional Grammar (Halliday and Matthiessen, 2013) for verbal language, and Multimodal Discourse Analysis (Kress and Van Leeuwen, 2006; Kress, 2009; O'Toole, 2011; Bateman et al., 2017; Bateman, 2019) to meet the challenge of finding a method of analysis for movement-based communication. It is a model that could be used by scholars from different disciplines to understand and analyse systematically how communication can happen through the interaction between body and space, without having to use complicated notation systems that require specialist training. The use of the FGD only requires a basic knowledge of the principles of Systemic Functional Linguistics theory (see below), which are widely known in most research communities focusing on communication; no special training in annotation is required. The ultimate aim of the FGD is to provide a framework for understanding meaning created through a movement-based performance that can be easily adapted to different contexts, and that can be flexibly used in manual analysis as well as in research involving digital movement capture and software creation for creative, archival, and pedagogical use. The FGD is also meant to elicit and enhance interdisciplinarity: it is not an alternative to traditional notation systems (i.e., Labanotation or Benesh notation) which focus on physical movement and its qualities, and it is not an alternative to videorecording as it is not dependent on a viewer's or camera's point of view. All data that is collected through the use of the FGD has the dancer/performer as its center and creator of movement *and* meaning. Different dancers may make different choices for the same dance piece and modify a given choreography, thus creating different meanings and not just different movements even if dancing in the same role. Traditional notation systems capture physical movement and its physical qualities: they are movement analysis systems rather than dance analysis systems, where the term "dance" already implies acts of interpretation and communication beyond the physical dimension of movement (see Adshead-Lansdale, 1994, p. 16). They also do not record the semiotic role of a dance performance space and how that space interacts with dance movement when enacting communication (Munjee, 2015; Brandão, 2017). It is precisely on these more communication-oriented aspects of dance analysis that our account focuses: the FGD analyses how meaning is created *through* movement *during* a movement-based performance, and it captures interpretation and dance discourse realisation *in fieri* and from the point of view of the dancer. The analysis we propose in this article follows a long tradition of studies that approach dance as a language drawing on several disciplines and approaching it from several perspectives (see Maiorani, 2021a). These studies have focused on understanding whether any universals can be traced

among different styles, and whether these can be recognised as forming a basic, overarching semiotic system. Starting by comparing dance to verbal communication in order to highlight its differences and specificities (Hanna, 1979; Blacking, 1983), scholars have also advocated a linguistics-based approach to the study of dance and the analysis of choreography that would facilitate the description of movement-based meaning-making processes for students and non-practitioners (Adshead-Lansdale, 1981; Foster, 1986). This trend led to Hutchinson-Guest's (2005) reconsideration of Labanotation itself with the use of grammar concepts and labels borrowed from verbal structural grammar, a fascinating attempt that is however limited to a comparative exercise and does not achieve a systematic description of dance as a semiotic system. With a more distinctive socio-semiotic approach, Williams (1999) compared dancers' bodies to other people's bodies as socio-semiotic constructions. This approach precedes more practice-based studies in kinesthetic empathy that have evolved focusing on the cognitive nature of movement and on an audience's empathic response (Opacic et al., 2009; Reason and Reynolds, 2010). Moreover, by recognizing the gap that exists between the experience of a live dance performance and the data that is made available through its recording and/or annotation, scholars have also tried to figure out whether there would be more effective ways of archiving the complexity of this form of art and communication (Adshead-Lansdale, 1994; Brandstetter and Klein, 2012). More linguistically oriented studies have started considering the application of some concepts of grammar to the way the body is used in dance: they promoted the idea of dance as a system of signs (Bannerman, 2010) and generated a general recognition that if a grammar needs to be considered it needs to be created for being specifically used with dance (Bannerman, 2014; Matluck Brooks and Meglin, 2015; Keevallik, 2018).

Research carried out so far using the FGD is at the core of the development of a new and interdisciplinary area of research called Kinesemiotics, which is aimed at the development of multimodal theory focused on movement-based communication. Kinesemiotics also aims at individuating and potentially developing its practical applications in various domains, including digital elaboration and data archival that may be used for immersive experiences, for supporting enhanced teaching interactive activities, for heritage preservation, etc. As it is being developed through the collaboration with various artists and professional practitioners from the English National Ballet, Kinesemiotics is also oriented towards an enhanced awareness of the way movement-based communication is construed with a positive impact on related activities, for professionals as well as for scholars and non-experts (see interview with professional ENB dancer Junor Souza in Maiorani, 2021a). Even though the FGD draws theoretically on some principles of Systemic Functional Linguistics generated for verbal language analysis, the data collected through its use is not finalised at *translating* dance

into verbal language (see Maiorani, 2021a, p. 8). By analyzing how dancers interact with meaningful portions of space, we collect data on what the viewer is offered to experience during a performance, the movement-based discourse on which an audience can then elaborate an interpretation. It is a language-driven approach in that it draws on a theoretical framework that incorporates the non-verbal contextual dimension of a text into verbal realisations, but it works with the ontology of movement-based communication and the materiality of the human body and different types of performance space. This is reflected in the distinction between the *physical space,* which enables dance discourse to develop through movement in the physical environment where it is carried out, and the *contextual space,* which contributes to the meaning of dance discourse by providing meaningful areas for the realisation of *projections* in a performance environment. In the FGD model, these two spaces overlap and enable dance discourse to be realised. The contextual space of a dance performance is populated by people, objects, props, light effects, and any other items that can determine the semiotic salience of different areas. Following the principles of Systemic Functional Linguistics, the FGD is based on the realisation of three types of meanings that account for three main metafunctions that Halliday sees fulfilled by any semiotic system working to enact communication: Experiential, Interpersonal, and Textual. The core principle of the SFL theory is that whenever communication takes place, whatever system is used, the participants in the act of communication mainly engage in three tasks simultaneously: they represent some happening or event that construes human experience, they establish some type of interpersonal relationship, and they do it in a coherent way by building up structures that allow for the communicative act to be realised, human experience to be represented, and human relationships to be established and entertained (see Halliday and Matthiessen, 2013). The socio-cultural as well as physical context in which the act of communication happens is incorporated in the act itself as it determines the choices that the participants make within the meaning potential of the semiotic systems they use in order to make the message as effective and functional as possible. Therefore, each context is defined through three main dimensions that activate three types of meanings: Field, which is the dimension that accounts for the topic of an act of communication and activates the experiential meanings; Tenor, which accounts for the relationships that are created and/or entertained during an act of communication; and Mode, which accounts for the way the act of communication is coherently structured and conveyed. Experiential, interpersonal, and textual meanings are realised simultaneously by co-existing and co-functioning structures in a simple clause, which is the basic unit of analysis. In the FGD these structures are the choreographic affordances available for each choreographer to create a piece of dance. Figure 2 provides an overview of the FGD model.

FIGURE 2
The Functional Grammar of Dance movement model (Maiorani, 2021a, p. 30).

The basic unit of analysis of the FGD is the *move,* which is "the smallest structural unit of motivated movement that marks the enactment of projections by separating them through the necessary flow of body parts" (Maiorani, 2021a, p. 34). This notion allows us to incorporate the idea of movement flow across space: a *move* is made by performing physical movement across the physical space and by the interaction of the different dancer's body parts with the contextual space, an interaction that is marked by *projections*. A projection is "the interactive connection between body parts and space that generates movement-based communication" (Maiorani, 2021a, p. 28). Projections capture dynamic processes through which dancers create meanings by performing choreographed movement that interacts with meaningful portions of the contextual space. By marking the sets of projections at the starting and at the arrival point of a *move*, it is possible to define how movement develops across space and to frame the semiotic dynamics of the meaning-making process carried out by dance. In this way, the sets of projections are connected through the displacement across space itself in a specific direction, and the analysis of a *move* cannot be misunderstood for the analysis of static positions.

The FGD distinguishes between two different types of projections that are realised simultaneously: Narrative

Projections are meant to express action, interaction, and emotional change; they can be intensified by *narrathletic enhancers* (Maiorani, 2021a, p. 33), movements that accompany the narration with physical virtuosities that are mainly meant to showcase the dancers' technical capabilities. Interactive Projections, on the other hand, signal whether a dancer's body interacts with people and/or items on stage or with the audience. Narrative and interactive projections realise experiential and interpersonal meanings respectively, whereas textual meanings are analysed by looking at Choreographic Units of different sizes, all based on the basic unit of analysis: the *move*. Projections can also be modalised by *focus* or *amplification*: these two Modal values depend on how many body articulators respectively project in the same direction or in different directions. Moreover, projections might also be distinguished in relation to their orientation towards the inner world of the character that a dancer is interpreting or vice versa: *reflective* projections are, therefore, directed towards the body of the dancer who realises them, indicating a focus on the narrative towards the character's personal sphere; *deflective* projections, on the other hand, indicate a focus towards interaction with other characters on stage (see Maiorani et al., in press).

The structural unit above the *move* is the Minimal Ballet Sequence (MBS). The MBS is made by two consecutive *moves*, which is the smallest number of units that can define a trajectory. The MBS defines the syntactic relationship existing between *moves*, providing a more consistent semantic basis for dance discourse analysis. Depending on whether the trajectory of an MBS does or does not maintain the same direction in both *moves*, the syntactic relationship will be continuous or varied, which will impact on more extended dance discourse patterns.

The FGD can be potentially adapted to different types of movement-based performances, and it has been so far applied to test the possibility of automated dance discourse capture (see Maiorani et al., in press). The FGD is also currently employed in a major collaborative research project funded by the Arts and Humanities Research Council in the UK and the Deutsche Forschungsgemeinschaft (German Research Foundation) in Germany[2]. In this article we want to test the strength of its principles by carrying out the analysis of an iconic modern dance choreography where there is no displacement across space.

Lamentation: Data from an iconic dance solo

The data for this paper is a modern dance solo piece, *Lamentation,* choreographed by Martha Graham on the music composed by Zoltán Kodály. The piece premiered at the Maxine Elliott's Theater in New York on January 8, 1930 and was performed by Graham herself. The version we analysed was performed by Peggy Lyman (1976). The piece lasts less than three-and-a-half-minutes and is performed almost entirely with the dancer sitting on a white bench, a choreographic feature which "creates an image of intense isolation and struggle" (Savrami, 2013, p. 35). The soloist is encased and shrouded in a tube of purple jersey which keeps most parts of her body hidden from the audience, except her face, hands, and feet. The rest of the dancer's body can be inferred through the stretches of the cloth that almost always adheres to her. The costume used in this performance is similar to the particular clothes that were documented to be worn at burial ceremonies celebrated in antiquity by several western cultures, for example by the

Greeks and the Romans (see Savrami, 2013). Its specifically designed adherent and stretchy tube-like shape allowed Graham to experiment with the effects of stretching materials on the creation and communicative impact of choreography, a type of performance-based research that she carried out throughout her activity as a dancer and choreographer. Graham experimented not only with costumes but also with props and objects that were designed specifically for her work[3].

At the opening of the piece, the dancer sits at the center of a backless bench set on the stage with the long side facing the audience. The piece starts with the dancer shaking her head softly from side to side, her torso bent forward, towards the front of the stage, and her legs set apart towards its opposite sides. Most of the choreography is based on movements that involve the upper part of the body and upper articulators: torso, head, arms, and hands perform structured movements in different directions. Only towards the end of the piece does the dancer briefly stand from her sitting position before returning to a sitting one and closing in a deeply crouched position in the dramatic finale. For almost the entire time, the dancer's hands hold onto the cloth creating various stretching effects and designing geometrical figures through it, which often hide her face to highlight even more the bodily tension that is supposed to express and to trap equally the dancer's/character's pain.

Several scholars have critically analysed this iconic experimental piece and they provided interesting readings and interpretations: for example, Bannerman (1999, p. 16) considers it along with Graham's other creations in the early 1930s', which she describes as related to "the individual's struggle for freedom." Savrami (2013), instead, analyses the types of grief conveyed in *Lamentation* by drawing upon Kübler-Ross (1997) theorised five stages of grieving: denial and isolation, anger, bargaining, depression, and, finally, acceptance. Savrami argues that out of the five stages of grieving proposed by Kübler-Ross, denial and isolation, anger, and acceptance are those expressed in *Lamentation*. Some other interpretations of this piece are based on annotations made using the traditional Labanotation system, which records the deconstructed positions performed by the dancer's body parts and their physical characteristics (see Reynolds, 2002). More recently, Warburton (2018, p. 11) highlighted the universal meaningfulness of this choreography focusing on what the audience's reception of it *could* be: "Graham (1930) is a prime example of the ways choreographers created a dancing body that sought to express the universality of feeling that transcended individual experience. It is a work not about an individual's grief at the loss of a particular person or thing, but about grief as an experience that everybody could (supposedly) recognise."

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2   The project is entitled *The Kinesemiotic Body: a pragmatic account of the local discourse organisation of dance* and is being carried out by two research teams: one based at Loughborough University (UK), led by Dr Arianna Maiorani and including Professor Massimiliano Zecca, Dr Russell Lock and Ms Chun Liu; the other based at the University of Bremen (DE), led by Professor John Bateman and including Ms Dayaha Markhabayeva. The project is carried out in collaboration with the artists of the English National Ballet. More details are available here: *Kinesemiotic Body – Universität Bremen (uni-bremen.de)*.

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3   Her collaboration with American Japanese artist Isamu Noguchi, for example, produced outstanding stage sets for ballet based on Greek mythological figures.

With our analysis we want to offer something different from what has been proposed so far: not an external point of view or an interpretation based on traditional movement annotations, but a data collection and an analysis that will showcase how the movement-based communication enacted by the dancer performing *Lamentation*–and in particular the interpreter of the version we analysed–creates through the interaction between her body and the contextual space as semiotic material that the audience can interpret. As a matter of fact, the following two sections of this article are going to focus on all the challenges we had to face to annotate and analyse this piece with the FGD, as they all offered important opportunities to develop the FGD model and the theory that supports it, and to improve our expertise in using it and adapting it.

Putting the FGD to work: Our method of analysis and its implementation

The FGD has been so far applied to analyse dance performances that involve movements across space (e.g., Maiorani, 2021a,b; Maiorani et al., in press) in order to capture its materiality, structure, and semantics. Maiorani et al. (in press) have provided a template for annotating dance sequences that are performed through movement across space using ELAN (https://archive.mpi.nl/tla/elan). ELAN is a multifunctional and versatile software developed by the Max Planck Institute for Psycholinguistics at Nijmegen for annotating audio and video materials. The use of the template involves the creation of a rich controlled vocabulary that draws on the FGD and that allows for an easy annotation of movement structures as well as narrative and interactive projections. The annotation is based on segmentations of a dance performance into *moves,* and it also includes a higher level of segmentation into MBSs. All the segments are adjacent, which means that the arrival point of a *move* coincides with the starting point of the following one. ELAN annotation is organised by tiers created by the notator: a tier gathers annotations that code the same element of the data. At *move* level, we created tiers to account for the dancer's physical movements in space, and the realisation of projection structures, narrative projections, *narrathletic enhancers* (if any), interactive projections, and modal values of projections, all in relation to the different body articulators (i.e., arms, hands, legs, feet, torso, and head). At MBS level, one tier was created to code the discursive trajectory constructed by MBSs. This template created for classical ballet can generally be adapted to be applied to any dance sequence of different styles. However, when we started applying it to the analysis of *Lamentation*, we were immediately faced with a fundamental problem: there is no movement across space in this choreography, and we therefore had to delve into the theoretical principles at the core of the FGD to adapt the very notion (and unit of analysis) of

move to this new analytical challenge. The first questions we asked ourselves were: how do we recognise the boundaries of a *move* if there is no displacement across space? How do we mark the starting and arrival sets of projections that define and distinguish different *moves*? Our first solution was to look at shapes that were created through the costume stretching over the dancer's body, and to segment the piece according to changes in shape. However, we soon realised that this choice would not allow us to segment according to objective, retrievable, and repeatable criteria. The perception of a shape change can be arbitrary and linked to different perceived dimensions like size (which in itself can change according to different parameters like length, height, thickness, width, etc.) or angle width, or slant, or volume, or rotation, or prominence, etc. Moreover, depending on where they sit with respect to the performance space, different members of the audience could perceive shapes and shape changes in different ways. We also considered the case of a non-live experience of the piece (which is what we had by looking at the video recording of Lyman's performance): if an audience watches a performance on recorded video, the camera's point of view may impact on the perception of shapes and shape changes. It mediates the audience's point of view with its own point of view. We also considered that with the dancer sitting on a bench for most of the time, which obviously reduces the mobility and movement range of lower articulators, a focus on shape changes would mean mostly looking at the upper body parts and neglecting the lower articulators. The shapes perceived by the audience during the performance are an *effect* of the discourse enacted by the solo, not a structuring principle. We therefore discarded this solution and focused on the body articulators as they keep on moving even if no movement *across* space is performed. We then decided that we needed to adapt the FGD notion of *move* instead of finding an alternative to it: the *move* incorporates the dancer's point of view on movement that is not subject to the same potential variations as the audience's point of view.

We also needed a principle through which we could use the same notion of *move*, with clear boundaries marked by sets of projections enacted by all the articulators, and which could provide us with segments that we could then use to build bigger units like MBSs. Maintaining the principle of units marked by sets of projections was fundamental as they can capture local variations caused by different choices made by different interpreters. For these reasons, we decided to focus on the dancer's torso as all articulators are attached to it. At first, we thought we could segment the solo according to the overlap of *torso orientation* and *torso direction* (see Maiorani et al., in press): we thought that changes in these two dimensions of torso projections would provide us with clear boundaries for projection sets that would enable us to replace the starting set and arrival set of a *move*. However, while orientation in a *move* does indeed determine the range of projections that the different body articulators can enact within the contextual

space of a performance, the meaning of the discursive event actually depends on the relationship that orientation has with the *direction* of the *move* (see Maiorani et al., in press).

Additionally, *move* direction and *move* orientation do not necessarily overlap. For example, the effect of a dance *move* going "backward" is created by the opposition between *move* direction and *move* orientation: think of a dancer moving in the direction of the right side of a stage but with their articulators oriented towards the left side. If the dancer "turned" and re-oriented the articulators towards the right side while still going in the same direction, the same movement would be then perceived as going "forward." The meaning attached to the perception of a movement "backward" determines the meaning of the projections enacted by the articulators, with the dancer producing a general effect of taking their distance from someone or something as opposed to approaching someone or something when the perception of the movement is "forward." Direction is the dimension of a *move* through which a dancer can trace a discourse trajectory and thus provide us with a way of segmenting also the upper level of MBS. We therefore arrived at the conclusion that segmenting the solo according to changes in torso direction would be the best solution as it would allow us to work on the idea of movement towards a trajectory even in the absence of movement across space. Segmentation based on torso direction is the only way of marking displacement *across* space and trajectory that involve all articulators in the absence of the physical displacement itself. This solution allowed us to adapt the *move* as a unit of analysis and abide by the very structural and semantic principles that define it. We also had to adapt our controlled vocabulary accordingly: for *Lamentation* we use the phrase "connecting to" for torso direction as it incorporates the dynamic idea of movement intention across space in the analysis of projections that are actually performed all in the same location throughout the performance. In a way, this solution echoes the solution offered by Cohn (2013, 2020) in terms of cognitive visual processes enacted when reading a comic strip: the cognitive processes enacted when reading comic strips *imply* the visual flow of narration whereas those enacted when watching a film sequence *involve* the visual flow. Following his *Parallel Interfacing Narrative-Semantics Model (PINS Model)*, defined as "a theory of sequential image processing characterised by an interaction between two representational levels: semantics and narrative structure" (Cohn, 2013, p. 352), Cohn segments the reading process into panels, the already visually defined units through which a narrative is deployed in comics: "most images in visual narratives are created (i.e., drawn) intentionally to belong to a sequence, and readers in turn are tasked with finding the specific cues relevant for that context" (Cohn, 2013, p. 355). This narrative intention echoes the discursive intentionality that is intrinsic to the act of choreographic creation, whether the choreography is based on a more traditional plot or on a more abstract topic. Moreover, in order to explain how the human brain processes narrative connections through structural cues,

Cohn identifies "attentional and perceptual processes" (Cohn, 2013, p. 355) that guide the extraction of the most relevant content cues from the context, thus activating information that "may include knowledge about objects and entities (including roles like agents and patients), spatial locations, and events and actions" (Cohn, 2013, p. 352). Comics therefore work on the assumption that readers will be able to infer narrative connections. As Cohn explains, "[i]nferences can be viewed as a process of situation model construction triggered in the absence of information provided overtly" (Cohn, 2021, p. 352). Following the changes in torso direction carried out by the dancer, the audience of *Lamentation* can capture movement intention cues; based on the cues enacted by the body part to which all human articulators are attached– the torso- we can segment this choreography that does not move across space following the principles of the FGD.

Importing and implementing the FGD into ELAN (2022): Our data annotation and analysis

We annotated *Lamentation* using ELAN and adapting the template created by Maiorani et al. (in press) described above. We created similar tiers at *move* level and at MBS level, but we decided not to include tiers for *narrathletic enhancers* and modal values of projections in the analysis visualisation as they are not present in this specific solo. We also created adjacent segments to demonstrate the starting and arrival positions of *moves* and MBSs. The starting point of a segment marks the moment when the torso direction starts to change, whereas the arrival point marks the moment when the direction is finally reached, and another change is about to start. As per traditional *moves* that are carried out across space, the arrival point of each segment corresponds to the starting point of the following one. We coded the arrival point of each *move* and adopted the FGD-derived controlled vocabulary when entering annotation values in the coding process. Regarding the coding of physical projection structures, we coded them in relation to the directions of *moves* as the FGD specifies; note that in this specific solo the directions of *moves* are signalled by the changes of torso directions. As mentioned above, we have also expanded the controlled vocabulary because *Lamentation*, as a piece of modern dance, provides data that is not usually found in traditional ballet, which is what we have mostly annotated so far. For example, when annotating the physical movement of hands, we have created the term "handling/tight" to describe the instance where the dancer's hands are closed in a fist and holding onto the stretching cloth. Figures 3–6 present all the tiers we have created and examples of annotation we have carried out with ELAN. More specifically, Figures 3, 4 show the annotation values of MBS 24 and its constituent *moves*, i.e., *moves* 47 and 48. The

annotation values of *moves* 47 and 48 code the arrival points of the two *moves,* respectively. The media frames of the arrival points of *moves* 47 and 48 are presented in Figures 5, 6. A list of participants and space values is provided at the end of the article.

Carrying out data segmentation, which involves identifying the starting position and the arrival position of a change in torso direction, was a challenging task as using the FGD repeatedly for the same dance style involves acquiring expertise but also habits. Both coders had to adapt their analytical practice to the
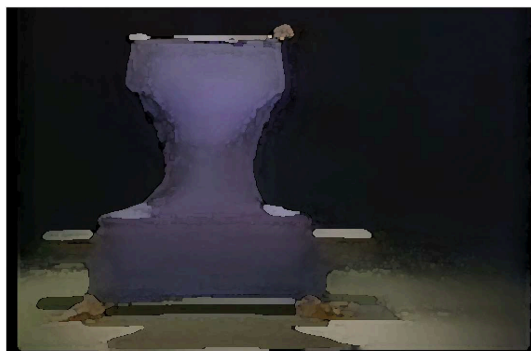
FIGURE 5
The media frame of the arrival point of *move* 47.

FIGURE 6
The media frame of the arrival point of *move* 48.

new parameters and pay attention to the dancer's performance of contraction and release of her solar plexus: this muscular contraction is one of the fundamental principles of Graham's movement technique, and it can give the impression that a change in torso direction is about to start even though there is no such actual change. Addressing these challenges involved sometimes careful repeated viewing by both coders to make sure that the segments aptly capture the changes in torso direction, but it also involved becoming much better acquainted with the specific materiality of this choreography. With respect to segmentation, *Lamentation* also posed another challenge that led to the recognition and creation of yet another possibility of annotation. The piece starts with a long interval where the dancer keeps sitting, facing the audience, and shaking her head, with no change in torso direction. This is not the traditional and relatively static starting position one would expect in a classical ballet. We annotated this interval as a dynamic set of starting projections rather than a *move* as there is no change in torso direction. This starting position is dynamic because it is not realised at a specific static point in time but *over* a period of time. Lastly, during annotation we also encountered technical

challenges posed by the mismatch between the annotation values of a *move* and the default media frame displayed by ELAN for the specific segment where the *move* is located. As mentioned earlier, the annotation values we entered code the arrival point of each *move*. However, both in ELAN's Annotation working mode, which is the generic mode for working with annotations in several ways that offer various options in terms of viewing, editing, and searching (see Figure 7), and in ELAN's Transcription working mode, which is designed to enhance the efficiency and speed of data transcription with a keyboard-driven interface (see Figure 8), the default media frame that is visualised is the starting point of the segment. When checking the annotation values by clicking on a segment (for example, in the Grid Viewer of the Annotation working mode which displays the annotation values of all segments from a single tier, as in Figure 7), the framework displayed on the screen gives the impression that the annotation values (coding the arrival point of the *move*) do not match the media frame (showing the starting point of the *move*). Taking *move* 47 as an example again, the media frame that corresponds to the annotation values of *move* 47 (Figures 3, 4) is the one presented in Figure 5 as outlined earlier. However, the default media frame for *move* 47 presented in ELAN is different (see Figures 7, 8) and it does not correspond to the annotation values. This mismatch occurs because the default media frame in ELAN shows the starting point of *move* 47, rather than the arrival point which is what we coded. Such mismatch may lead to confusion and hinder the cross-checking between the annotation values and the media frames. Therefore, when carrying out cross-checks, we needed to make sure that the media frame we looked at was the one that showed the arrival point of the *move*. Currently, we can only do this manually in ELAN: in the Annotation working mode, we play the media and pause it at the arrival point of the *move*; alternatively, we can drag the progress bar and place it to the specific point. In this way, it may be difficult and time consuming to locate the exact frame. It would be helpful if ELAN provided options to display the frame of the arrival point of the segment automatically while presenting its annotation values. We consider identifying this particular limitation of ELAN another result of our research: our solution to operate with the current version and our experience can help other researchers in a similar situation prevent cross-check-related mistakes and adopt a similar solution.

After addressing the challenges mentioned above, we entered annotation values for each segment and double-checked them against their corresponding media frames. Based on the annotation, we conducted a qualitative analysis and quantitative analysis of the data: qualitative results lead to a new insightful reading of the choreographic strategies enacted in this piece, and that can serve as a blueprint for further research, while quantitative results reinforce the emergence of qualitative patterns in the discursive strategy enacted by the piece.
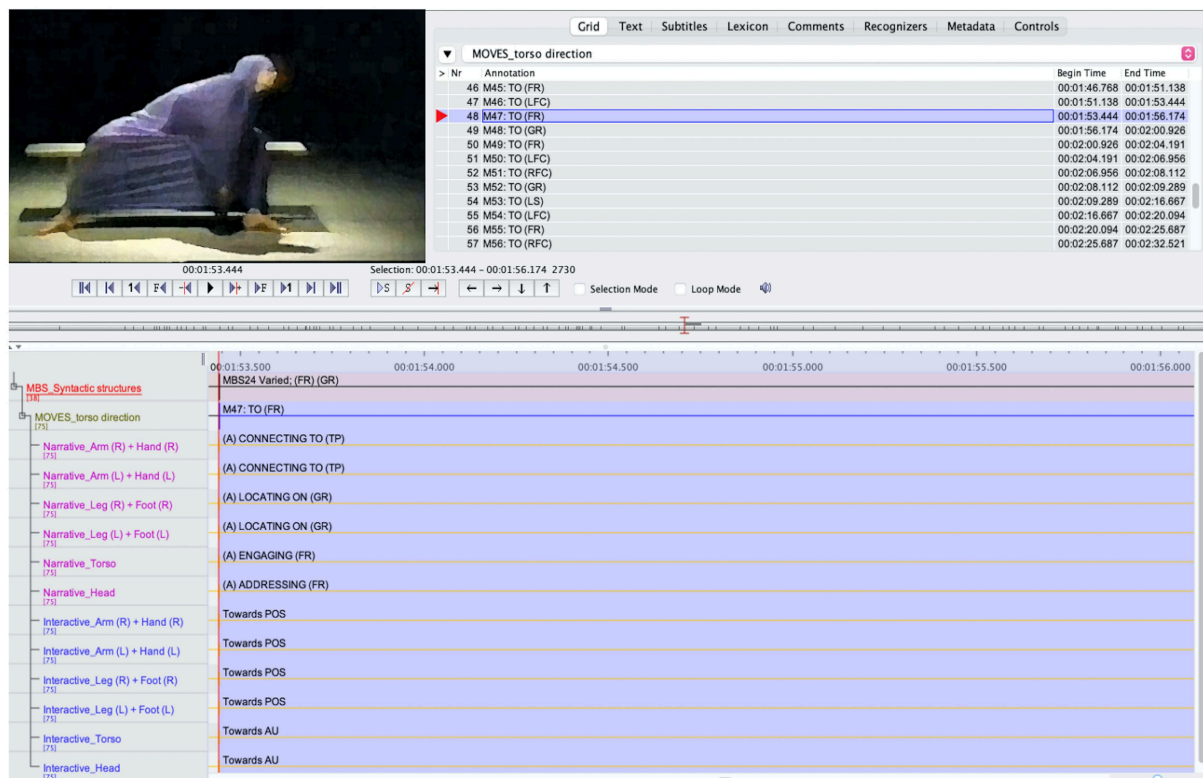
FIGURE 7
ELAN's Annotation working mode and its Grid Viewer (showing *move* 47 and its default media frame).
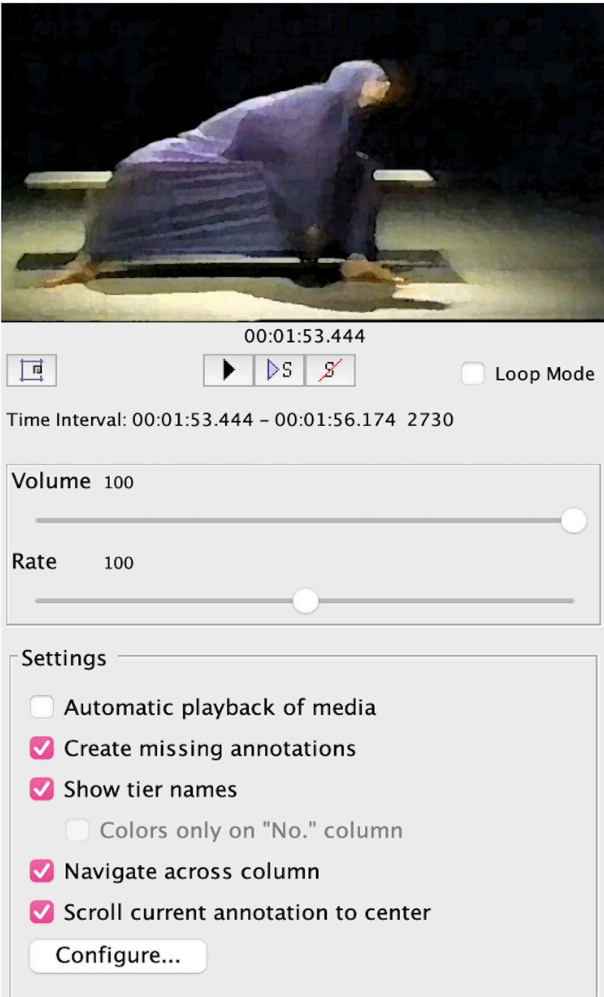
Discussion of results: An FGD-based interpretation

According to our analysis, the whole piece contains 74 *moves* and 37 MBSs. We will start by discussing our results at the discursive level of MBSs and then address how they relate to the more complex data yielded at *move* level.

What happens at the level of MBS

The direction in each MBS always changes in this specific solo. The default syntactic relationships between *moves* in *Lamentation* is varied because it is precisely the change of *move* direction that signals the occurrence of a new *move* as no other change can mark segmentation due to the absence of movement across space. This finding therefore suggests that the perception of sets of projections in a choreographed piece of dance that does not include movement *across* space is determined by visual cues that *imply* an intention to move towards a direction without actually performing that movement. Dance that does not involve movement across space can be segmented according to the same principles of movement-based communication deployed by the FGD but based on visual cues that impact

on the possibility of realising alternation between varied and continuous discursive patterns. This does not mean, however, that achieving other types of variation in discursive patterns is impossible. On the contrary, we found out that by adding a quantitative element to our analysis we could capture that discursive variation that was produced through the alternation of vertically oriented and horizontally oriented MBSs in cycles that become progressively shorter: vertically oriented cycles are realised when torso direction changes in *moves* occur mostly between the top and ground areas of the performance space; horizontally oriented cycles are realised when torso direction changes in *moves* occur mostly between the left and right areas of the performance space. Visually, this discursive pattern suggests the repeated drawing in space of an iconic shape, that of a cross. This cyclical alternation in *Lamentation* deploys as follows:

- MBSs 1–4: horizontally oriented cycle.
- MBSs 5–13: vertically oriented cycle.
- MBSs 14–18 horizontally oriented cycle.
- MBSs 19–26 vertically oriented cycle.
- MBSs 27–30 horizontally oriented cycle.
- MBSs 31–32 vertically oriented cycle.
- MBSs 33–34 horizontally oriented cycle.
- MBSs 35–37 vertically oriented cycle.

ELAN's Transcription working mode (showing *move* 47 and its default media frame).

With progressively fewer MBSs in each cycle, this alternation produces a discursive rhythm that becomes more and more hectic as the piece approaches its dramatic conclusion. The shape of a cross is a powerful symbol across cultures that is frequently associated with pain, grief, religious content, and–most traditionally in western countries–with the "lamentation" of women at the foot of crucified Jesus Christ, traditionally represented in western pictorial art as enshrouded by a dark or purple cloth. This visual pattern matches Graham's fascination for and investigation of Christian figures and cultures, as evidenced also by her personal correspondence and notes (see for example Graham, 1991, p. 199).

What happens at the level of *move*.

At the level of *move*, *Lamentation* offers a very simple scene, with only one dancer who interprets a symbolic character with universal resonances; there is also only one prop, the backless bench on which the character is seated. Lights are only used to highlight the interaction between body and stretchy cloth as effectively as possible, therefore a white light is simply and crudely projected from above onto the dancer. Consequently, both narrative and interactive projections will be directed to areas of the performance space that, like the character, will be charged with widely recognised cultural values, such as "heavens" or "powers above" for the top, "earth" for the ground,

TABLE 1 Narrative projections of arms and hands.

Narrative projections: Arm (right) + Hand (right)		Narrative projections: Arm (left) + Hand (left)	
A connecting to Agent (dancer)	34	A connecting to Agent	43
A connecting to GR	14	A connecting to GR	12
A connecting to TP	12	A connecting to TP	7
A connecting to FR	4	A connecting to LS	4
A connecting to LS	3	A connecting to RS	2
A connecting to LFC	3	A connecting to FR	2
A connecting to RS	2	A connecting to RFC	2
A connecting to RFC	2	A connecting to LFC	2

TABLE 2 Narrative projections of legs and feet.

Narrative projections: Leg (right) + Foot (right)		Narrative projections: Leg (left) + Foot (left)	
A Locating on GR	61	A Locating on GR	62
A Going to GR	8	A Going to GR	9
A Connecting to FR	4	A Connecting to FR	2
A Connecting to GR	1	A Connecting to GR	1

"others" and/or "somewhere else" for the right and left side areas. Narrative projections are therefore directed either to these "values" (deflective) or towards the character herself (reflective), whereas interactive projections will highlight the solitude of a character who can only find a visible interactant in the audience–an interactant that, as data will show, is rarely addressed. The stretchy costume will dramatically mediate all these projections by providing them equally with visual amplification and visual constraints. Narrative and interactive projections realise patterns of local discursive events that can then be collated to the wider discourse patterns realised at MBS level. The analysis performed through the use of the FGD shows a very interesting distribution of realisations of narrative projections by groups of articulators.

Narrative projections

In terms of narrative projections, projections realised by upper and lower articulators show consistently different narrative functions. Arms and hands project reflectively towards the dancer from *move* 1 through *move* 24, with bent arms and hands holding tight onto the stretching cloth, thus focusing the first part of the piece onto the grieving character contracted towards herself. Then projections start moving alternatively towards ground and top, with arms stretching and hands still mostly clutching onto the cloth and/or holding each other. Halfway through the piece, around *move* 40, the oscillation of projections starts involving also the right and left side areas of the performance space. At *move* 50 the left arm starts

projecting towards the dancer herself again until at *move* 55 both arms do, marking a redirection of the narrative towards the character. From *move* 56, arms and hands projections start drawing a cross-like pattern again, alternating between top and bottom and right and left side areas of the performance space, until they all project reflectively back to the dancer at *move* 64 to draw the attention to her before the dramatic finale where the left arm and hand keep on holding to her, while the right arm stretches towards the top to then end projecting towards the ground. The quantitative analysis of the data shown in Table 1 confirms the preponderance of reflective narrative projections realised by arms and hands and a good balance between vertically and horizontally oriented narrative projections. This corroborates the results of the qualitative analysis of the data which highlights a major focus on the grieving character in terms of number of projections and the reference to a cross-like shape as a movement motif in terms of projections distribution.

Legs and feet narrative projections mostly have the function to not just ground the piece but locate it to a very small space right at the center of the bench. There are just a few instances around *moves* 15 and 17, 40 and 41, and 49 and 50 when one of the legs briefly projects towards the audience in a quick attempt at leaving the ground that is immediately redressed. In this way a solid base is provided for the narrative enacted by arms and hands that focuses alternatively on the character and on the drawing of a cross-like choreographic pattern. Also in this case, the quantitative analysis of the data corroborates the results of the qualitative analysis in terms of number and distribution of projections, as shown in Table 2.

TABLE 3 Narrative projections of torso and head.

Narrative projections: Torso		Narrative projections: Head	
A engaging GR	38	A addressing GR	26
A engaging FR	12	A addressing TP	19
A engaging TP	11	A addressing LS	11
A engaging LS	6	A addressing RFC	7
A engaging RFC	3	A addressing LFC	4
A engaging LFC	2	A addressing RS	4
A engaging RS	2	A addressing BG	2
—		A addressing FR	1

Torso and head narrative projections are more dynamically distributed, and throughout the piece they alternate projections to the right and left areas of the performance space as well as to the front, top, and ground, with a majority of alternations between front, top, and ground that highlights the isolation of the character who is torn between the "heavens" (perhaps offering hope and/or consolation) and an "earth" (perhaps indicating resignation), and who has nobody around to turn to except the audience. This shows that there is a constant repetition of movement structures drawing a cross-like shape at the core of the choreography and, therefore, at the core of the visual representation that the audience is offered, as well as a profound performative intention to engage the audience directly with the "lamentation." However, while corroborating the data of the qualitative analysis in terms of the design of a cross-like figure, the quantitative analysis shown in Table 3 demonstrates something that might escape the naked eye: it is the torso that projects to the front mostly, whereas the head projects to the front only once. This supports even more an interpretation of the character as being completely isolated in her grief, encapsulated into the stretchy halo created by the costume.

Interactive projections and projection structures

Interactive projections for most of the articulators are mainly directed towards empty spaces, which matches the character's loneliness communicated by narrative projections. However, interactive projections also follow interesting patterns related to the way they are distributed among the various articulators, as shown in Table 4.

Table 4 shows that interactive projections directed towards the audience form clusters around larger groups of *moves* up until two thirds of the piece, and then then they become less frequent and more scattered. Interactive projections towards the realised by the torso open and close the piece: this acknowledgment of an audience matches the preponderance of the audience engagement realised through narrative torso

TABLE 4 Clusters of *moves* that project towards the audience (AU) and articulators that carry out the projections towards the AU.

Moves that project towards the AU	Articulators that realise the projections towards the AU
Move 11	Torso
Move 13	Leg (right)
Move 15	Leg (left) + foot (left)
Move 16	Torso
Move 17	Leg (left) + foot (left)
Move 20	Torso
Move 21	Torso
Move 26	Torso
Move 27	Torso
Move 39	Torso
Move 40	Arm (right) + hand (right); arm (left) + hand (left)
Move 45	Arm (right) + hand (right); arm (left) + hand (left)
Move 47	Head + torso
Move 49	Leg (right) + foot (right)
Move 50	Leg (right) + foot (right)
Move 51	Arm (right) + hand (right)
Move 55	Leg (left)
Move 64	Torso
Move 71	Torso
Move 73	Torso

projections. torso projections. Besides, the torso interactively projects towards the audience mostly vertically oriented, thus involving them directly in the dramatic oscillation between the oscillation between the "heavens" and the "earth." Interactive projections towards the limbs are by contrast mostly concentrated in the central part of the piece, when there is also an increase in the number of articulators involved. Interestingly, the only time when Interestingly, the only time when the head realises an interactive projection towards the approximately

TABLE 5 Interactive projections of all articulators.

	Arm (right) + hand (right)	Arm (left) + hand (left)	Leg (right) + foot (right)	Leg (left) + foot (left)	Torso	Head
Toward POS	70	72	70	72	62	73
Toward AU	4	2	4	2	12	1

TABLE 6 Projection structure of all articulators with respect to torso direction.

	Arm (right) + hand (right)	Arm (left) + hand (left)	Leg (right) + foot (right)	Leg (left) + foot (left)	Torso	Head
Vertically perpendicular to torso direction	53	56	57	58	—	13
Horizontally perpendicular to torso direction	4	1	9	1	—	20
Following torso direction	17	15	4	9	74	41
Opposite to torso direction	—	2	4	6	—	—

halfway through the piece, reinforced by the same type of interactive projection realised by the torso and marking the central point of the performance like the center where the two axes composing the cross-like shape meet.

Even in the case of interactive projections, the results of the quantitative analysis shown in Table 5 confirm and reinforce the results of the qualitative analysis. Interactive projections are mostly realised towards the empty stage space in various directions and only a minor portion is realised by various articulators towards the audience. Most of the latter are realised by the torso, which consequently takes frontal position on stage, and only one by the head.

Quantitative analysis of projection structures (shown in Table 6) also produced very interesting results about the movement structure of all articulators when projecting, which matches the cross-like discursive pattern shown at the level of MBSs. Most of the projections realised by the limbs are horizontally perpendicular to the torso direction, and most of the projections realised by the head follow the torso direction, which altogether suggests the sustained performance of a cross-like shape that does not appear explicitly in the choreography but that is modularly repeated through projections both at *move* and at MBS level throughout the performance. Moreover, this cross-like shape is realised rather bi-dimensionally, through the constant use of a vertical and a horizontal axis on a plane that is the same as the bench plane. It is the stretchy costume that, by enrobing the body and enshrouding movements, provides it with the abstract volume of a third dimension.

Conclusions

Our analysis of Martha Graham's *Lamentation* in the version danced by Peggy Lyman (1976) allowed us to test the adaptability of the FGD model of analysis, which had previously been used for the analysis of classical ballet, to a very challenging modern dance choreography. The challenge was not only in the change of dance style but also–and mostly–in the fact that this solo is performed without moving across space, which is a fundamental condition for segmenting the choreography into *moves*, the FGD basic units of analysis.

The analysis of *Lamentation* therefore challenged the concepts at the core of the theory that supports the FGD model, and it allowed us to demonstrate that not only is the notion of *move* as the smallest structural unit that marks the enactment of sets of projections within the movement flow a solid one, but also that its theoretical foundation, the relationship between movement and space covered by the human body, holds even when movement *across* space is only implied by the intentional cue of direction, one of the *move's* fundamental dimensions.

Our analysis also highlighted the relationship between the semantic level of *move* and the syntactic level of MBS as determinant to the realisation of specific movement-based discursive patterns, even when the usual possibility of MBS trajectory realisations is constrained by the absence of movement across space. Our work with ELAN using the FGD also allowed us to highlight some limitations of this widely used software that requires improvement, and to offer viable solutions to researchers who might encounter similar challenges. Our discussion demonstrated that the analysis of dance choreography carried out by using the FGD model can indeed produce original qualitative and quantitative data that provides insightful readings and sheds new light even on an iconic piece such as *Lamentation*. In fact, our qualitative analysis allowed us to recognise the realisation of discursive patterns that reproduce a highly charged symbolic shape in western cultures, and that these discursive patterns are generated by projection patterns at the semantic level of *move*. Quantitative analysis supported and corroborated our qualitative analysis, thus showing that the results obtained using the FGD can also benefit from the input of quantitative data.

The analysis of *Lamentation* also allowed us to meet the challenge of addressing an iconic dance piece that experiments with costume and costume material, and to arrive at a re-definition of the relationship between Graham's choreography and the stretchy tube of cloth that is not only based on its dramatic function. In fact, we have provided evidence that the costume used in *Lamentation*, besides evoking a dramatic idea of constraint, also has the fundamental function of visually mediating all projections, thus providing the volume of tridimensionality to the bi-dimensional cross-like shape designed at various levels by the choreography. The costume then becomes the resonance box of a bi-dimensional moving icon.

All these results provide us with more evidence and more motivation to continue our work on the development of the FGD model of analysis and of Kinesemiotics theory by expanding their application towards new areas of movement-based communication.

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 article has been written by AM and CL. AM leading the qualitative analysis. CL leading the implementation of the FGD in ELAN. 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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Frontiers in Communication

Measuring embodied conceptualizations of pitch in singing performances: Insights from an OpenPose study

Valentijn Prové*

Department of Linguistics, KU Leuven, Leuven, Belgium

People conceptualize auditory pitch as vertical space: low and high pitch correspond to low and high space, respectively. The strength of this cross-modal correspondence, however, seems to vary across different cultural contexts and a debate on the different factors underlying this variation is currently taking place. According to one hypothesis, pitch mappings are semantically mediated. For instance, the use of conventional metaphors such as "falling" or "rising" melodies strengthens a pitch-height mapping to the detriment of other possible mappings (e.g., pitch as bright/dark color or small/big size). Hence, entrenched pitch terms shape specific conceptualizations. The deterministic role of language is called into question by the hypothesis that different pitch mappings share a less constraining conceptual basis. As such, conceptual primitives may be concretized *ad hoc* into specific domains so that more local variation is possible. This claim is supported, for instance, by the finding that musicians use language-congruent (conventional) and language-incongruent (*ad hoc*) mappings interchangeably. The present paper substantiates this observation by investigating the head movements of musically trained and untrained speakers of Dutch in a melody reproduction task, as embodied instantiations of a vertical conceptualization of pitch. The OpenPose algorithm was used to track the movement trajectories in detail. The results show that untrained participants systematically made language-congruent movements, while trained participants showed more diverse behaviors, including language-incongruent movements. The difference between the two groups could not be attributed to the level of accuracy in the singing performances. In sum, this study argues for a joint consideration of more entrenched (e.g., linguistic metaphors) and more context-dependent (e.g., musical training and task) factors in accounting for variability in pitch representations.

KEYWORDS

embodiment, singing, head movement, cross-modal correspondences, pitch

Introduction

As part of the present volume on kinesemiotics, this paper subscribes to a particular view on movement-based communication according to which bodies are always situated both in physical and cultural space (Maiorani, 2021). In physical space,

bodily movement follows dichotomic schemes that are essential and universal, such as upward/downward or forward/backward. However, the potential of these schemes to be used for meaning-making relies on contextual values (Maiorani, 2021, 27). Hence, meaningful movements are choices that are made relative to other acts in a physical repertoire and in a cultural context. In ballet performances, for instance, the cultural space is structured locally by the audience and the stage, which is divided into different portions by setting and lighting (Maiorani, 2021, 26). As such, dancers map a physical choice (e.g., making a forward movement in space) onto a cultural choice (e.g., addressing the audience as part of the space). The dual semiosis sketched here applies to different communicative processes and I believe it offers a refreshing perspective on the flexibility of meaning across socio-cultural contexts. In this paper, I will address the Research Topic of cross-cultural conceptualizations of auditory pitch. Humans make sense of pitch frequency by mapping it onto scalar, physical qualities such as high/low space, bright/dark color or small/big size. Since these mappings require different sensory modalities to be integrated, the term cross-modal correspondences is commonly used to refer to this phenomenon (Parise, 2015). The question as to how these arguably universal correspondences structure pitch conceptualizations in different cultural contexts has led to a vivid debate.

People naturally seem to associate auditory pitch with qualities pertaining to different sensory domains such as brightness, angularity, size, and height (cf. Spence, 2011; Walker, 2016 and Eitan, 2017 for reviews). Cross-modal correspondences form a relatively old yet very popular Research Topic because of their intuitive nature and their potential for application (Parise, 2015). Many studies have focused on how different pitch correspondences serve as a basis for communication. From a linguistic perspective, as a matter of fact, the multitude of metaphors lexicalizing pitch relationships is striking. To illustrate, tones are referred to as "thin" and "thick" in Turkish (Dolscheid et al., 2020) or "tight" and "loose" by the Kreung people Cambodja (Parkinson et al., 2012), to cite only two examples. Crucially, studies influenced by Cognitive Metaphor Theory (Zbikowski, 2002; Ashley, 2004; Shayan et al., 2011; Dolscheid et al., 2013, 2020; Casasanto, 2017; Cox, 2017; Fernandez-Prieto et al., 2017; Holler et al., 2022) propose that the way pitch qualities are coded in a language, shapes the way people conceive of pitch and vice versa. As such, pitch mappings become hard-wired during development because of the linguistic system and its conventional nature. A key finding challenging this claim is that Western participants are also consistent in applying unfamiliar metaphors for pitch (Eitan and Timmers, 2010). In a similar fashion, people can rely on higher-order schemes in making sense of visual pitch representations, for instance when the directionality on a vertical pitch axis is reversed (Antović et al., 2020). As such, people do not necessarily have a pre-existing percept of pitch as a spatial analog. This

finding is supported by research on the SMARC effect, which suggests that the pitch-height mapping occurs at an early stage of processing as due to a generalized magnitude representation (Rusconi et al., 2006; Lidji et al., 2007; Prpic and Domijan, 2018). In an experiment carried out by Pitteri et al. (2021), reaction times for congruent pitch mappings were even faster if the pitch-height and the pitch-brightness mapping were combined. Therefore, the deterministic role of the linguistic system should be questioned.

A further non-linguistic factor that reveals the ambivalence of semantic strengthening effects is musical training. On the one hand, musicians have been shown to be more consistent than non-musicians in their gestural depictions of dynamic pitch contours in a communication task, demonstrating a more entrenched vertical conceptualization (Küssner et al., 2014). Indeed, musicians are more familiar with terms and techniques that embody a spatial pitch metaphor such as staff notation or specific instruments. To illustrate, Timmers and Li (2016) showed that pianistic expertise strengthens a lateral pitch-space mapping. It should be noted, however, that the experimental methods used in these studies, a communication task and a forced choice paradigm, respectively, prompt participants to react in an efficient way. This means that, if there is a convention available, it is likely to be used in these contexts. However, in a series of experiments involving more subjective pitch mappings in the domain of tonality (Maimon et al., 2021), musicians did not rely more on conventional metaphors than non-musicians did. Moreover, a qualitative study on the use of pitch metaphors in lyric singing classes (Prové and Feyaerts, 2022) showed that singing teachers blend conventional and unconventional conceptualizations in one multimodal expression. In one example, the teacher depicts how the student should sing a rising melody with a high note that is difficult to produce, by bending the knees, pointing downwards along her legs as the melody rises (non-conventional), and subsequently pointing upwards so as to indicate where the highest note should be (conventional). Hence, although musicians can be argued to have most contact with conventional pitch-height metaphors in Western cultures, they can also be characterized as more flexibly using both entrenched and *ad hoc* pitch mappings in order to adapt to different contexts. Such a reasoning makes it harder to assign a dominant role to semantic mediation.

In this paper, I am supporting this argument by hypothesizing that Western non-musicians (native speakers of Dutch, which is a pitch-height language) make more consistent language-congruent vertical head movements compared to musically trained participants while reproducing rising and falling melodies in a singing task. Whereas, it is likely that both groups of participants will react to musical tasks by making vertical head movements (Wöllner and Jensenius, 2017; Swarbrick et al., 2019; González Sánchez et al., 2020; Zelechowska et al., 2020), the directionality of the head movements may rely on different effects. On the one hand,

language-congruent movements (i.e., downward movement while singing falling pitch contours and vice versa) could be expected on the basis of the embodied simulation hypothesis (Barsalou, 1999; Casasanto and Gijssels, 2015; Cuccio and Fontana, 2017; Hostetter and Alibali, 2019) because they would be a physical manifestation of the more entrenched pitch-height mapping. On the other hand, the gesture-vocal coupling might disturb optimal body tension in singing performances (cf. Pearson and Pouw, 2022 for a recent discussion) and lead to reduced or even reversed (language-incongruent) movements For instance, stretching the body creates a tension in the vocal apparatus which is, paradoxically, suboptimal for singing high-pitched tones (cf. Turner and Kenny, 2011 for a review on the relation between posture and performance). As such, I hypothesize musicians to adapt their embodied behavior to the context of singing more than non-musicians do. Another possibility is that, independent from the participants' musical training, better singing performances correlate less with congruent head movements. This is a case in point for an *ad hoc* conceptualization of pitch: the musically trained (or better skilled) participants, albeit more familiar with the metaphorical pitch conventions, are expected to use the pitch-height mapping less in the specific singing task. The design of the empirical study is based on an unpublished paper (Baptist, 2014).

Based on the empirical study outlined above, I argue for a joint consideration of entrenched and *ad hoc* factors in the conceptualization of pitch. This reconciliatory position can also be motivated by recent developments in metaphor theory. In the last decade, metaphors have been increasingly studied as dynamic analogies that are made relevant in human interactions to different degrees (Müller and Tag, 2010; Kolter et al., 2012; Zlatev and Devylder, 2020). To illustrate, ballet teachers elaborate metaphors verbally and gesturally so that an analogy between two different sensory feelings can be interactionally negotiated (Müller and Ladewig, 2013). Although it should be made clear that analogies are a more complex phenomenon pertaining to the domain of communication, they may be indicative of the natural flexibility that cross-domain mappings offer. As Walker (2016) argues, mappings are transitive. For instance, if high is bright, and bright is thin, then high will be thin (Walker, 2016, 107). Crucially, some mappings have an ambiguous relation to magnitude: if high is "more" and thin is "less," high pitch is both "less" and "more" (Eitan and Timmers, 2010: 420). Hence, if pitch conceptualization involves the percept of an axis, it can be determined *ad hoc* which end is "more." Moreover, while increasing and decreasing qualities can be associated in synesthesia, different movement axes are compatible with these magnitude representations. The example *par excellence* of flexibility in activating cross-modal correspondences may concern orchestra conductors, who use a relatively limited collection of gestures to depict complex and interrelated properties of sound such as loudness, timbre and tempo (Globerson et al., 2021). As a result, one single property may be

depicted on all three vertical, horizontal and sagittal movement axes (Meissl et al., 2022).

Materials and methods

In order to test the hypothesis outlined above, I designed an experiment that required participants to reproduce melodies while being filmed. I obtained written consent from 38 native speakers of Dutch (age range 18–25) to record their data for this study. The choice of participants was forced in that (a) they were not allowed to be trained in singing and (b) I created a group with no musical training at all (i.e., unable to read staff notation, $n = 19$, "untrained") and a musically trained group (i.e., able to read staff notation, $= 19$, "trained") to create a between-subject variable for *training*. The latter group had been participating in music trainings for 7.35 years on average (SD = 4.18). All participants were students at the author's institution and they received a cinema ticket as a reimbursement for their participation. One participant (group "untrained") was excluded from the analysis because of data loss during the recording.

As for the experimental procedure, I copied the task and the musical stimuli from an unpublished pilot study (Baptist, 2014). I asked the participants to stand on a marked spot on the ground while being filmed both from a frontal perspective and in profile using two camcorders (Sony HDR-CX160, 720x576, 25 fps). They would hear a melody being played twice in a row from a speaker behind them, which they would reproduce using the vocalization "la." It should be noted that the "a" vocal is produced relatively low in the mouth cavity, which might have interfered with the head movements. I will address this potential confound again in the discussion. I rehearsed the procedure two times to allow the participants to get acquainted with the task. During this try-out, they were allowed to ask questions. Subsequently, I played seven more melodies in a random order, which constituted the actual experiment. After the experiment, the participants received an explanation about the objectives of this study and they could withdraw their data if they wished (which did not happen).

For this procedure, I used three types of melodies with two or three different difficulty levels per type because it was hard to predict the singing skills of the participants. All the stimuli and their notations can be found in Supplementary materials. The falling melodies ("f1" and "f2") were designed in such a way that there was a static phase (three times the same tone) and a linear dynamic phase (a scale to the octave below). The rising melodies ("r1," "r2" and "r3") were constructed in exactly the same way, using the octave above in reference to the start tone. Finally, the interval melodies ("i1" and "i2") were rising too, but I used interval of a fifth and the range was one octave and a fifth. Interval melodies were considered to be more difficult variants of the rising melodies because the intervals between the notes are more difficult to reproduce. To construct the variable "*melody type*" in the analysis, one melody per type was selected

("r2", "i2" and "f2"), according to the hypothesis that lower notes in the falling melodies and higher notes in the rising melodies would elicit more prominent head movement. Melody "r1" was excluded because some participants reported to feel uncomfortable to sing it so "r2" was selected as the highest version. Melody "i2" was selected as its counterpart with larger intervals because the end note is the same. Finally, melody "f2" was selected as the lowest version of the falling melody type. I composed the musical stimuli using the Musescore[1] software and I exported the sound with a built-in piano sample.

In order to asses vertical head movements, I used the videos that showed the participants in profile and I automatically estimated the two-dimensional position of their nose in pixels (px) using OpenPose (Cao et al., 2017), which is an open-source algorithm for video-based body part tracking. I adjusted incorrect data points by applying a smoothing filter[2]. Concerning auditory pitch, I used Praat (Boersma and Weeninck, 2022) to extract the pitch contours of both the stimuli and the participants' sound production in Herz (Hz), based on the audio that was recorded by the frontal camera. I resampled the pitch data according to the frame rate of the videos (25 fps) and the same smoothing filter was applied to exclude incorrect data points. As a next step, I used the ELAN-software (Wittenburg et al., 2006) to segment the videos into action units where the participants were singing the melodies. I used a visualization of the audio waveform to manually determine the beginning and the end point of the actions. As for the following steps, I always used the time stamps of these actions to process the data and construct the variables in R Markdown (Xie et al., 2018)[3]. For each action unit, I z-scaled both the movement and pitch data (i.e., in terms of the distance of each data point from the mean in standard deviation units) and I centered the data relative to the first data point at the beginning of the participants' sound production, that is the first data point is subtracted from itself and every subsequent observation. This means that the starting point of every movement trajectory or pitch contour was a zero. Moreover, the standardized scores made the trajectories comparable across the participants, eliminating individual differences between body sizes and positions.

On the basis of the data described above, I calculated two measures. First, the slope of vertical movement measures how strongly the movement is directed on the vertical axis (hereafter: *vertical directionality*). This variable was constructed by calculating the correlation coefficient of the vertical

movement data in time. A value of zero entails no directionality, a -1 entails a perfect downward relationship and a 1 entails a perfect upward relationship. Second, *singing accuracy* was calculated using Dynamic Time Warping (DTW, Pouw and Dixon, 2020), which rendered a quantification of the similarity between the standardized pitch contours of the stimulus and the participants' sound production. A zero entails perfect accuracy, because the closer the value is to zero, the less one time series has to be stretched and truncated to match the other, that is the more aligned the pitch contours are. I emphasize that singing accuracy was measured in terms of pitch only.

In what follows, I present a regression analysis with the variables *singing accuracy* (response variable or covariate), *vertical directionality* (response variable), *training* (independent variable, between-subject) *and melody type* (independent variable, within-subject) outlined in this section. I built nested linear regression models using the "lme4" package in R (Bates et al., 2015). I always started with a null model containing a random intercept for the individual participants and I gradually added the *training* and *melody type* factors and their two-way interaction. In order to determine the best model and its significance, I used the Likelihood Ratio test as prescribed in Winter (2013).

Results

Before carrying out the statistical analyses, I visually explored the contours of the vertical head movement trajectories by plotting their temporal unfolding. From a visual inspection of the trajectories per melody (as illustrated in Figure 1), it is clear that the participants behaved in different individual ways. Some movements feature clear upward or downward movement, whereas others have more variable contours. Therefore, it should be noted again that directionality refers to a general trend in the movement trajectory.

As for *singing accuracy* (M = 0.33, SD = 0.21), the scores ranged from almost perfectly matching (0.06) to highly dissimilar (0.79) pitch contours. The group of trained participants did not perform better, increasing the accuracy by only 0.05 units (SE = 0.03, t-score = -1.64) compared to the untrained group that could not [$\chi^2_{(1)} = 2.66$, $p = $ ns]. Adding *melody type* significantly improved the null model [$\chi^2_{(2)} = 96.64$, $p < 0.001$], with interval melodies decreasing the quality by 0.15 units (SE = 0.02, t-score = 6.68) and rising melodies decreasing the quality by 0.29 units (SE = 0.02, t-score = 12.99). There was no significant interaction effect between *training* and *melody type*, which implies that interval and rising melodies were reproduced less accurately compared to falling melodies in both groups.
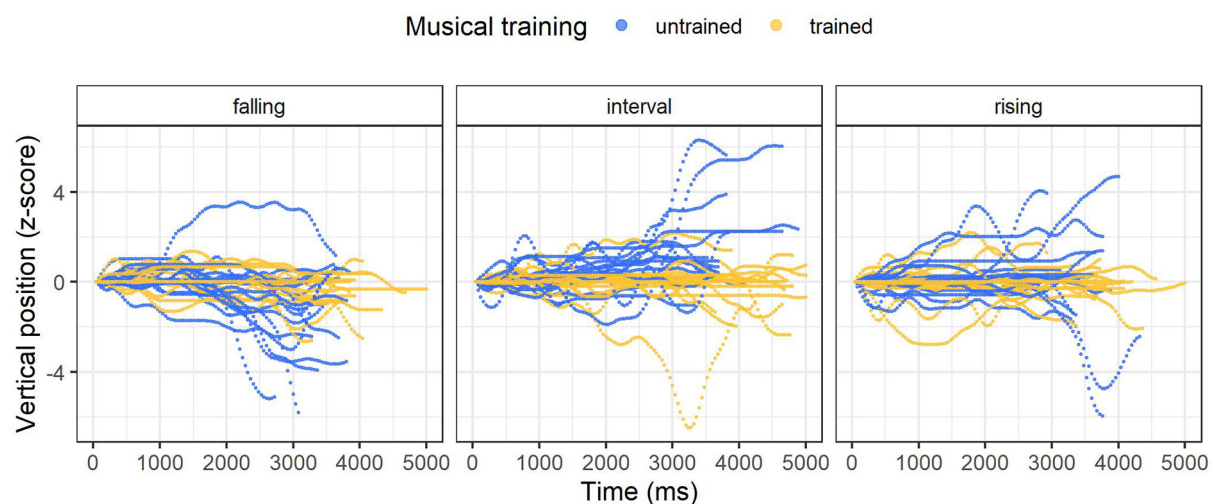
The best regression model for *vertical directionality* involved both the *training* and the *melody type* factors and their two-way interaction effect [$\chi^2_{(2)} = 9.18$, $p < 0.05$]. Falling melodies systematically correlated with downward head movement in

FIGURE 1
Plot of the vertical head movement trajectories per melody type. Participants who can and cannot read staff notation are marked yellow and blue, respectively.

both the untrained [model fit = −0.46, 95 % CI (−0.71, −0.20)] and the trained [model fit = −0.34, 95 % CI (−0.59, −0.09)] groups. By contrast, interval and rising melodies yielded different effects when comparing the two groups. In the untrained group, both the interval melodies [model fit = 0.55, 95 % CI (0.28, 0.82)] and linear rising melodies [model fit = 0.29, 95 % CI (0.04, 0.55)] correlated with upward head movements. Conversely, the trained group decreased the head movement slopes for both the interval melodies (by 0.69 units, SE = 0.22, t-score = −3.07) and the linear rising melodies (by 0.44 units, SE = 0.22, t-score = −1.99). As a consequence, the head movement slopes associated with these melody types were fitted close to zero [resp. −0.02, 95 % CI (−0.27, 0.23) and −0.03 95 % CI (−0.28, 0.22)]. In sum, this result implies that the musically trained participants made systematic downward movements when reproducing falling melodies, but no systematic upward or downward movements in the case of interval or linear rising melodies.

The plot in Figure 2 illustrates the fitted values for each factor level in *melody type* in both groups. The red bars represent the 95% confidence intervals and the dots represent the observed data points. The color of the dots is determined by the *singing accuracy* variable (green = perfect match, red = highly dissimilar) and the gray lines connect the observations from the individual participants. The violin boxes indicate the density of the observed data. Importantly, from a closer visual inspection of the violin plots, it is clear that the data points for interval and the rising melodies in the trained group are distributed along the entire axis without being skewed at a particular point. In relation to the fitted values that were close to zero (resp. −0.02 and −0.03, cf. previous paragraph), this entails that the null-effect is

due to an approximately equal amount of melody-congruent and melody-incongruent movements. That is, the musically trained group should be characterized as showing a range of different behaviors, including more incongruent movements compared to the untrained group. Moreover, the reactions to the different types of melodies within the same participants, as illustrated by the gray lines that connect the observations in the plot, are less consistent in the trained group.

To conclude, adding *singing accuracy* as a covariate in the regression model predicting *vertical directionality* did not improve the model significantly [$\chi^2_{(3)} = 2.34$, p = ns]. Given that *singing accuracy* was not influenced by the training level (cf. *supra*), this result entails that it is the degree of musical training as a relatively broad factor encompassing different types of learning and skills and not the singing skill in itself that reduces congruent head movement when singing melodies.

Discussion

This paper has investigated vertical head movements during a scale reproduction task in musically trained and untrained speakers of Dutch. In doing so, it has explored a new setting to investigate contextual factors that may influence the *ad hoc* conceptualization of pitch as verticality. In line with Antović et al. (2020), it adds to the literature questioning the predominance of the semantic strengthening effect occurring, for instance, in Western societies that use linguistic expressions pertaining to the domain of vertical space such as "falling" and "rising" melodies.
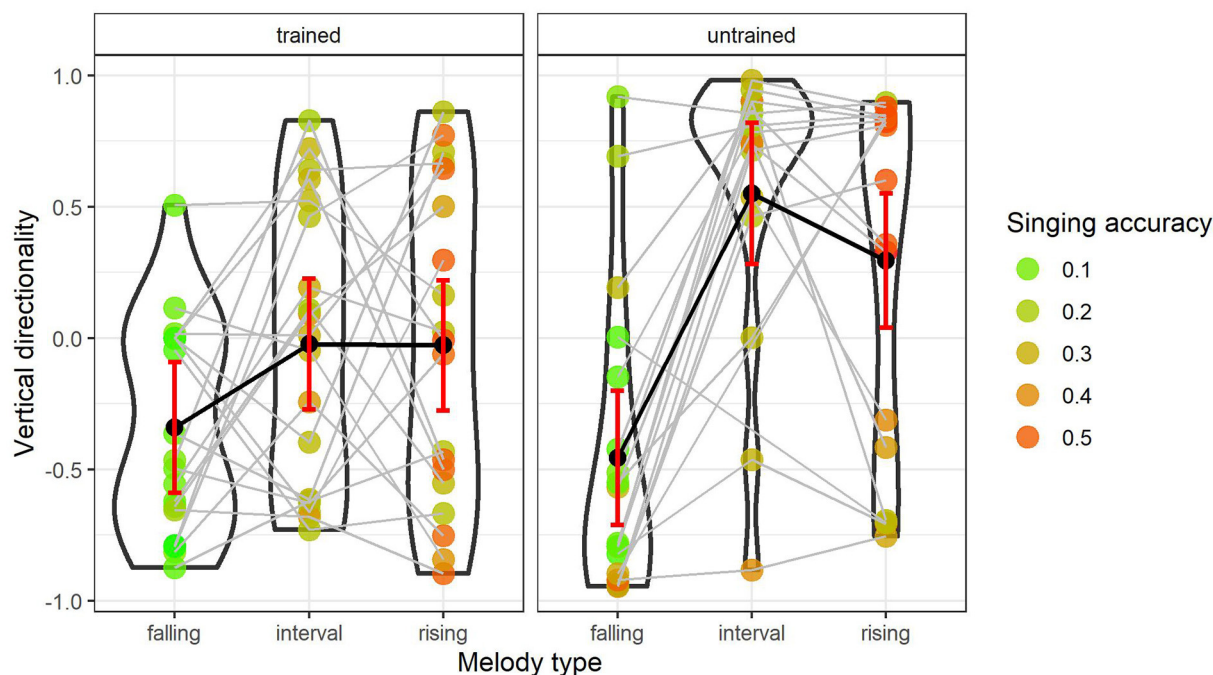
FIGURE 2
Estimations for vertical directionality. The red bars indicate 95% confidence intervals and the dots represent the individual data points (head movement slope per melody) per condition in each of the two groups. The colors of the dots represent the singing accuracy: green is more accurate and red is less accurate.

The semantic mediation hypothesis entails that our linguistic system shapes the way we structure the concept of pitch (Casasanto, 2017). As such, investigating pitch metaphors provides a window on mental pitch representations. To illustrate, the Farsi language offers a low codability for pitch (Holler et al., 2022). Whereas, a pitch-thickness metaphor is commonly preferred, other expressions involving verticality can also be used. Therefore, Farsi speakers have less consistent conceptualizations of pitch. Conversely, the Dutch language almost exclusively features a conventional metaphor for pitch-height so that the vertical conceptualization is more stable.

This claim can be nuanced by investigating the effect of musical training in a music-relevant setting. Musicians have been shown to be both more consistent in their use of conventional metaphors (Küssner et al., 2014) and in their flexible use of unfamiliar mappings (Eitan and Timmers, 2010; Maimon et al., 2021). Observing language-incongruent preferences in musicians demonstrates that a choice is made between different possible mappings that may or may not be supported by language. This trade-off effect is supported by evidence that pitch mappings are transitive (Walker, 2016) and that they rely on higher-order schemes such as generalized magnitude representations (Eitan and Timmers, 2010; Pitteri et al., 2021) or amodal conceptual primitives (Antović et al., 2020).

In order to lend support to the latter hypothesis, I conducted a behavioral experiment in which speakers of Dutch had to reproduce falling and rising scales and rising tone sequences with larger intervals using the vocalization "la." I hypothesized that a musically trained group ($n = 19$) would make less congruent head movements compared to a musically untrained group ($n = 19$). Musicians, although very familiar with Western musical conventions such as staff notation, are expected to be better at "escaping" the language-congruent vertical mapping that might have detrimental effects on the singing quality if gestures start to regulate suboptimal tension in the vocal apparatus (cf. Turner and Kenny, 2011). The directionality of the participants' head movements during their singing performances was computed using the vertical movement trajectories of the nose as tracked by the OpenPose (Cao et al., 2017) algorithm. The accuracy of their performance was assessed using Dynamic Time Warping (Pouw and Dixon, 2020), which yielded a measure of how similar the pitch contours of the stimuli and the participant's melody reproductions were.

As for the results, the musically untrained group of participants systematically made downward head movements when singing falling melodies and upward movements when singing rising melodies (both for the interval type and the linear scale type). Musically trained participants behaved in

a less equivocal way. While reproducing falling scales, they made systematic downward head movements as well, although this effect was less strong compared to the untrained group. Crucially, their movements aligning with both types of rising melodies were more diverse, including more incongruent movements. Hence, I find partial support for the claim that trained musicians adhere less to the more entrenched vertical pitch mapping of the Dutch language. This inconsistent behavior can be attributed to interconnected conceptualizations of auditory qualities that may interfere (cf. Parise, 2015 for a discussion). In contrast to static pitch in isolated tones, for instance, pitch sequences may trigger perceptions of loudness and dynamic progression (Eitan, 2013). Magnitude representations that underly pitch mapping are relevant for these dimensions as well. Moreover, the vocalization "la," which involves a vowel that is produced relatively low in the mouth cavity, might have elicited downward movement as well.

Moreover, I excluded the possibility that the effect of the musically trained and untrained groups of participants on pitch-congruent head movements was merely due to more accurate singing performances. I found two arguments to support this claim. On the one hand, the musically trained group did not perform better than the untrained group. Rather, falling melodies were reproduced more precisely compared to the interval and rising type in both groups. On the other hand, adding singing accuracy to the model predicting the directionality of head movements did not result in a significant effect. Hence, musical training was independent from singing skill and it was a much better predictor. On the whole, the results of the present empirical study offer support for the claim that cross-modal correspondences for auditory pitch share underlying associative processes allowing for contextual variation that cannot be explained by linguistic structure alone (Walker, 2016; Antović et al., 2020; Maimon et al., 2021).

The most important limitation of this study is that it remains unclear how musically trained and trained participants exactly differ from each other. Different skills may have proven useful in executing the experimental task: more experience with scales, more experience with live performance, a better development of imagery, a better familiarity with the discourse on suboptimal musical behavior, a transfer of their skill in playing musical instruments to singing etc. In this vein, the hypothesis that musician use more flexible and diverse mappings in their online conceptualization of pitch still needs more rigorous investigation. Future studies could also compare musicians and non-musicians from different linguistic groups to offer more conclusive results in the semantic-mediation debate.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: https://zenodo.org/record/7082438.

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. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2022.957987/full#supplementary-material

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The materiality of lines: The kinaesthetics of bodily movement uniting dance and prehistoric cave art

Michael O'Connor[1,2]* and Alan Cienki[1]

[1]Faculty of Humanities and Network Institute, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, [2]DAS Graduate School, Amsterdam University of the Arts, Amsterdam, Netherlands

We take two seemingly disparate practices as the foci for this work—dance and prehistoric cave art—in order to illuminate commonalities in embodied practices that reveal new theoretical insights. Whereas, dance clearly uses temporal traces of the body to shape space and create meaning, cave drawings have also begun to be explained and interpreted through kinesthetic and embodied metaphorical techniques. A key element that these fields have in common is the role of lines. The study of lines has become its own field of research, largely due to Ingold's foundational work on "linealogy". Considering the animate nature of lines and the kinesthetic response they have on the body, contemporary artistic practices can find parallels to the nature of ancient rock art if we recognize the similarity these fields share in the formation of and interpretation of meaning through movement and material engagement. Lines are a phenomenon that, when looked at as traces—memories of movement that once took place—become an organizing principle that brings distant fields like rock art and dance together. Thus, this article takes Tilley's suggestion that "a truly phenomenological study of imagery is grounded in the kinaesthetics of bodily movement" and applies it to three different artistic practices. Tilley proposes that an artifact may be ambiguous in its meaning because it relays a variety of information, which is often layered and contradictory. Here we see, in cognitive archeology, the idea that the articulation of ambiguous lines is an attempt to bring like-minded things (in the thoughts of the one drawing or dancing) together. The authors propose that the ambiguity of lines allows for a type of withness between the mind, body, and environment, allowing us to consider the mind as extended. Lastly, the nature of lines as extended mind motivate us to propose the term of "signature" in order to circumvent the dilemma of a static sign in regards to movement.

KEYWORDS

extended mind theory, rock art (painting), dance research, linealogy, lines as movement, ambiguity, signature

Introduction

Lines, as simple geometric forms, have the potential for complex, multimodal realizations. We can see this in terms of human experience with linear forms: in the various ways we encounter them, lines can be perceived visually or by touch, and can be ephemerally created by the body or generated more concretely with materials. In this essay, we examine three contemporary movement practices of line creation through the lens of ancient cave drawings. The intent with this comparison is to foster thought around the relationship between movement, line, and extended mind. First, we present a drawing activity where movement in cities is captured by simple drawn lines and consider how this could be compared to ancient humans drawing their surroundings on cave walls. Then we examine how arbitrarily drawn lines can, when perceived, be brought into kinesthetic and kinetic expressions by dancers. Lastly, we look at a practice where dancers translate the lines of landscapes and architecture into their body.

A key element that these (and many other) movement practices have in common is the role of lines. The study of lines has become its own field of research, largely due to Ingold's (2007; 2015) foundational work on "linealogy". Considering the animate nature of lines (the way they can be traced through movement) and the kinesthetic response they have on the body, contemporary dance practices can glean felt knowledge from perceived lines in space, lines of others' bodies (traces and designs), and imagined lines with felt meaning. These can find parallels to the nature of ancient rock art if we recognize the similarity these fields share in the formation of, and interpretation of, meaning through movement. Lines are a phenomenon that, when looked at as traces—memories of movement that once took place (Leyton, 1992, p. 79)—become an organizing principle that brings distant fields like rock art and dance together. Thus, instead of approaching lines through abstract proposals like those of Deleuze and Guattari (1988), where a "body without organs" is desired, this article will engage with material culture studies—resourcing the analysis of lines from ancient cave drawings/rock art and the phenomenology involved.

Malafouris (2004) and Renfrew (2004) together developed Material Engagement Theory (henceforth, MET) with the intention to contribute to the theory of extended mind (as per, for example, Clark and Chalmers, 1998; Malafouris and Renfrew, 2010) and propose that cognition is discovered through the body's engagement with materials. Going a step further than embodied or embedded cognition, MET argues for a serious look at the workings between body, mind, and the material world because "once the conventional demarcations of skin and skull are removed it appears that conventional cognitive science loses the analytical purity of its object of study" (Malafouris, 2013, p. 228). In additional to MET, the kinesthetic approach

FIGURE 1
Cave drawing from Lascaux II paintings, Lascaux, France.

FIGURE 2
Rock carving from Gobustan National Park near Baku, Azerbaijan.

to analyzing rock art from Christopher Tilley will play a key role in this article's exploration of lines. Traditionally, rock art, encompassing colored cave drawings (Figure 1) and rock carvings (Figure 2) made with incisions (types referred to interchangeably within this essay), has fundamentally been approached with the question of "what does it mean?" (Tilley, 2016, ch. 1, par. 6). Typically, the drawings consist of items such as animals like deer, horse, rhinoceros, fish; objects like boats and tools; geometric shapes; and occasionally human figures. Tilley suggests that to interpret rock art, we should not analyze it like words on canvas. Instead, "a truly phenomenological study of imagery is grounded in the kinaesthetics of bodily movement. It explores the manner in which imagery impacts on and through the body and is understood through the medium of the relationship of the body to the phenomenal world within which it is enveloped" (Tilley, 2016, ch. 1, par. 12).

As proposed by Klein (2010), scientific research and artistic research should not be distinguished as mutually exclusive categories because they both seek new knowledge. Artistic research is itself the method whereby artistic creation and

theoretical reflection are inextricably linked (Klein, 2018, p. 78). Artistic research blends theory-informed practice and practice-informed theory, often drawing on theoretical paradigms from diverse fields of study. In the practices that follow, we will discuss the possibilities for how lines, as phenomena with multimodal potential, can blur the demarcations of what is mental, corporeal, and material within artistic practices. In doing so, we propose that lines, as concepts, take on a materiality of their own.

Drawing landscapes

The first practice[1] to compare alongside cave drawings involves drawings consisting of lines of motion. The traces of lines that are "created by movement are not perceived or perceivable but are, through and through, imaginatively constituted phenomena. The patterns emerge in the form of imagined trajectories that a moving body draws in the process of moving" (Sheets-Johnstone, 2016, p. 116). In this practice, the first author (the drawer) uses any writing utensil, a material to draw on, usually a simple piece of paper, and finds a location to observe. Over the time frame of 5–10 min, the drawer translates any line of movement imaginatively perceived into a line on the paper. When it comes to imagery created by drawing, Ingold proposes that "the pencil is not an image-based technology, nor is the drawing an image. It is the trace of an observational gesture that follows what is going on" (Ingold, 2010, p. 310). The paper stands for the visual field of the drawer and starts to accumulate lines whereby no distinction is made between what is being translated—a passerby, car, bird, or bicycle—all items appear simply as a line. They take on no other distinguishing element (see Figures 3, 4). In this way, the traces only show their spatio-temporal-energetic nature (Sheets-Johnstone, 2016, p. 117), to use Sheets-Johnstone's language, or the possible *vitality affects* (dynamic qualities of experience) of the original movements, to use a term from Stern (1985, p. 54). The difference may reside in the quality of the line, thus the spatio-temporal-energetic gesture that translates the seen line into a kinetic and material form. Ingold proposes that in the act of drawing, a pencil "does not hover but carries on its way from where the hand is now positioned, responding only to the present conditions in its vicinity rather than to any imagined future state" (Ingold, 2010, p. 301). In this practice, the hand responds to the present perception the drawer has of the landscape.

Leyton, in his book *The Structure of Paintings*, credits Picasso for discovering that "sight is a creative act", and continues himself that "Sight is an active exploration and manipulation of

objects" (Leyton, 2006, p. 152). In the practice described above, the drawer is visually engaged with the landscape bringing seen movement into traces on the paper through the use of the tool in real time. Anthropologist and archeologist Tilley aligns himself with Merleau-Ponty and they both state that touch and vision "involve the same sets of embodied relations between the subject and the world" (Tilley, 2016, ch. 1, sec: The Fleshy Image: Merleau-Ponty, par. 8). Tilley states: "we look at things in the world and become fused with them. We become part of them and they become part of us" (Tilley, 2016, ch. 1, par. 10). Paterson agrees and in his book *The Sense of Touch* gives us an example stating that, when looking for something lost, "eyes and hands explore and we realize that vision and touch are equally prehensile and kinaesthetic" (Paterson, 2007, p. 30). Paterson also directs our attention to the investigations within disability research, particularly Gabriel Farrell's book *The Story of Blindness*. In the chapter "Fingers for Eyes", Farrell quotes blind teacher and psychologist Pierre Villey: "Sight is long-distance touch, with the sensation of color added. Touch is near sight minus the sensation of color, and with the sense of rugosity [texture] added. The two senses give us knowledge of the same order (in Farrell, 1956, p. 93). In this sense, vision is not passive, but connects us to what we see, and brings proximity to what is often regarded as distal.

When we acknowledge that sight is a way to as-if touch material, our eyes have the capacity to take on similar engagement as our hands do. Therefore, as the drawer's eyes engage with the different movement qualities, what is seen can be translated without difficulty back into movement by our hands and left within the lines drawn. When looking at the function of the pencil drawing in this exercise, we can consider Malafouris' (2013, p. 154) suggestion that tools function as enactive cognitive prostheses. In extended mind theories (e.g., Clark and Chalmers, 1998; Gallagher, 2013), there is no demarcation for where the mind clearly stops[2]—but the engagement of cognition extends into the action and material and in this case extended into the lines and markings left. Malafouris proposes that "early markings and lines do not externalize anything but the very process of externalization" and that he "will approach mark making not as a passive representational object but as an active prosthetic perceptual means of making sense. That is, marks will be treated as enactive projections" (Malafouris, 2013, p. 180).

By considering sight as a prosthetic tool that connects us to our surroundings, the lines of motion we see in this activity allow perception to be an important component for extended mind. Here we can draw upon the notion of mental scanning, as characterized by the cognitive linguist Ronald W. Langacker. Describing it as "tracing a mental path" (Langacker,

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1 Borgdorff's definition of practice in the arts: "Art practice—both the art object and the creative process—embodies situated, tacit knowledge that can be revealed and articulated by means of experimentation and interpretation" (Borgdorff, 2007, p. 14).

2 This proposal mirrors the Blind Man's Stick hypothesis where Bateson (1972/1987, p. 324) asks, "where does the blind man's self begin? At the tip of the stick? At the handle of the stick? Or as some point halfway up the stick?"

2008, p. 82), he notes, "It is by means of scanning—through space in the case of objects, and through time for events—that their constitutive patches or states are integrated to create the seamless conception of their spatial or temporal extensionality" (Langacker, 2008, p. 109–110). Additionally, as proposed by MET, the pencil can be seen as a tool extending cognition into action. But even more radically, MET proclaims that we can see the lines left as externalization of sense-making and perception. Mentally scanned, imagined traces, when rendered visually, translated into drawn lines, made through gestures with a tool, capture the qualitative movement between perception, objects, and materials.

From disability studies, art, cognitive linguistics, and anthropology, a variety of fields speak of externalization through different forms of mental, visual, or physical movement as lines. The ability to easily integrate scanning as touching and drawing as perceiving in this practice, exemplifying an extended mind, can be explained by the words of Sheets-Johnstone: "The quality of our movement in drawing extends into the quality of the lines drawn, just as the quality of our movement in everyday life extends into the character of our doings" (Sheets-Johnstone, 2016, p. 117). The lines we make engage the quality of our character with our surroundings.

In Figure 3, one may try to decipher which lines would be coins being tossed vs. taxis driving by, based on the spatio-temporal-energetic nature of those objects in relation to gravity and context. The size of one's own body, when viewing this image afterwards, creates a kinesthetic response in relation to the imagined movement. In Figure 4, the three types of moving objects remain indistinct due to the similarity of their drawn qualities—straight lines clustered in the same location. In both drawings, the background landscape that these moving elements operate in remains undrawn, but greatly influences the objects' movement and the drawer's perception during the creation. The negative space on the paper (what was not drawn upon) suggests by means of absence what could be there; inanimate parts of the landscape: buildings, streets, city squares. The lines that overlap also convey a passing of time, something which can be seen as providing a visual instantiation of a particular type of mental scanning that Langacker calls "summary scanning". He points out (Langacker, 2008, p. 83), "As we scan through a complex scene, successively attending to various facets of it, the elements apprehended at each stage are summed, or superimposed. In this way a detailed conception is progressively built up, becoming active and available as a simultaneously accessible whole for a certain span of processing time." Indeed, the drawing, by reifying this scanning, provides a material product that allows for temporally unlimited and shared accessibility to it.

In this artistic practice, we can see how lines blur the demarcations of the mental, corporeal, and material through the body's ability to move them between modes of the traced, the visualized, and the imagined. Sight, when approached as a tactile act in combination with drawing, bring vision and movement

FIGURE 3
Sé Alfama, Lisbon: Trams, Tuk Tuk, taxis, people, coins, motorcycles, birds. Drawn by: Michael O'Connor.

FIGURE 4
Amsterdam: Walkers, Bikers, Cars. Drawn by: Michael O'Connor.

together as perceptual tools creating a feeling of fusing the body with the environment. For Ingold, the ocular itineration of joining tactile with the visual is where vision resides and is the practice of what he calls *togethering* (Ingold, 2010, p. 308). When drawing the imagined traces from movement, the vitality of the objects and subjects is felt by the drawer through the material engagement of line making. Additionally, the completed drawings themselves offer a viewer a kinesthetic engagement through the possibility of sensing their spatio-temporal-energetic nature.

Components of cognitive archeology

The line making practices discussed here seek to share the same approach as MET—in that marks from creative gestures are continuations of thinking in time and space (Malafouris, 2021, p. 114). This commonality is where we find

resonance with these studies, and as artistic research, seek to draw upon theoretical notions from seemingly diverse fields. However, researchers of ancient mark making (the perceived or felt difference of lines on or in a surface) (Malafouris, 2021, p. 95–96) draw upon other scientific fields of study as well. The field of cognitive archeology defines lines, and marks in general, according to certain criteria in order to determine their significance and to distinguish their relevance as forms of material engagement. Cognitive archeology can be defined as "an approach to studying human cognitive evolution that applies theories and concepts developed in the cognitive sciences to archaeological remains of the prehistoric past" (Coolidge and Wynn, 2016, p. 386). Four general criteria for identifying instances of mark making in archeology are: antiquity, artificiality, intentionality/deliberateness, and symbolism (Malafouris, 2013, p. 184). Within a contemporary artistic research practice, antiquity would be irrelevant, as the distinction between contemporary marks and ancient marks is already known. Likewise, artificiality is not a relevant distinction here because all lines created here are made by the artist. Whether imagined, seen or made with the body, there is no confusion where the line comes from—they are a phenomenon brought into a present body.

The third and fourth criteria, however—that a mark is deliberate and symbolizes something demonstrative of human thought processes—are important for this discussion. Deliberateness is seen in the practices because the lines are actively translated between different domains: from imagined to drawn, drawn to kinetic, and perceived to kinetic. Lastly, the criterion of symbolism is concerned with the point that the mark is attached to meaning. In the previous and upcoming practices, what can be interpreted as the meaning of the lines resides in their spatio-temporal-energetic form, which stems from the materials being translated. Therefore, these two criteria from cognitive archeology are also applicable to use to look for traces of cognition in material engagement, *via* the marks and lines left behind in the artistic practices. Combining these two criteria, we will call this deliberate sense-making. Here we build on Sheets-Johnstone's notion of kinetic sense-making, which she defines as "making meaning through movement and making sense of movement" (Sheets-Johnstone, 1999, p. 170).

Let us imagine a dance floor is covered in sand (or see Figure 5, for an example with a natural sand "floor") and a dancer starts moving in the space, creating strokes and traced lines behind any of their movements that touch the floor. The traces in the sand constitute an embodied, enacted thought process left by the dancer through movement. While feeling the texture of the sand under their feet, the sand informs and influences how the person moves. Knowing the texture of sand, the dancer can be precise or careless; both qualities creating either defined or vague lines left behind. The interaction of the dancer's thinking through the body while being with the sand as material is rather easy to see. The marks left behind do not
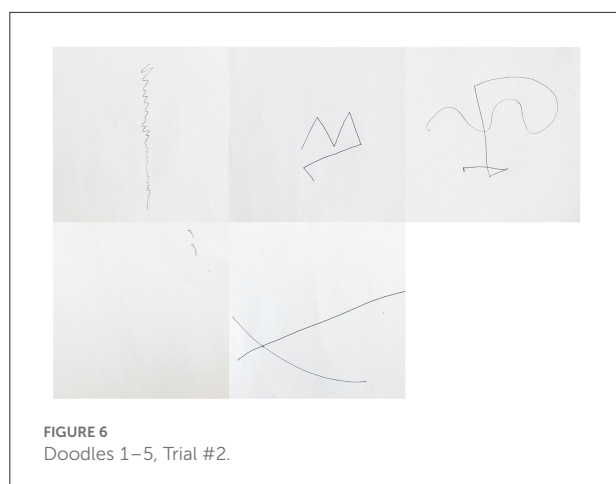

FIGURE 5
Video still from dance film *Between Foam and Origami* by Michael O'Connor. A circle is seen drawn in the wet sand from the dancer's foot before it quickly disappears in the tide. Camera: Lukas Georgiou.

represent anything specific, but constitute the *thinking while doing*. Likewise, as material engagement theory wants to posit, a person holding a tool or a drawing apparatus is doing the same thinking by doing. It is this shift away from representation that is relevant here, or as Malafouris explains; "Marks made with a pen on paper are not an ongoing external record of the contents of mental states; they are an extension of those states. Cognition and action arise together" (Malafouris, 2013, p. 74). Ingold defines drawing as a tool of observation in that it "combines observation and description in a single gestural movement" (Ingold, 2010, p. 303). Lines become the material from which we can perceive a type of deliberate sense-making.

Turning back to cognitive archeologists, one question they look at is focused not on what the incisions in caves and rocks mean, but "what did the activity of mark making do for the ancient mind" (Malafouris, 2013, p. 190). The lines show the maker's cognitive template, thus in that way, mark-making action and thinking are the same. Malafouris points out that studies in scribbling[3] have received little attention in archaeological research and suggests this crossover of different fields could support each other (Malafouris, 2013, p. 193). Like studies from (Stamatopoulou, 2011, p. 166), that show scribbling actions stimulate further actions and subsequently contain and express meaning, improvised dance is also a type of trace making, but involves "scribbling" in the air, which stimulates further actions and likewise expresses meaning. In the next practice, we will examine doodled lines on paper (a kind of pictorial extension of scribbling) and their transfer to kinetic traces made by the body. This translation of drawn lines into

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3 It is no coincidence that etymological connections can be traced for the word *scribble* and words in several Indo-European language for "writing" (e.g., Latin *scribere*, German *schreiben*) to the Proto-Indo-European root **skribh-*, meaning 'to cut', as in to carve marks into a surface (Online Etymological Dictionary, n.d.).

FIGURE 6
Doodles 1–5, Trial #2.

movement reveals dancers' ability to find and make meaning out of what seems to be meaningless forms.

Dance doodles

In this next practice, arbitrarily drawn lines are used to create performed lines of movement by dancers. Each of five dancers were asked to draw one doodle on a separate piece of paper. The term *doodle* was used to invite the drawing of a small line that did not take up the whole page. Each dancer then privately chose an order for the five drawings. For each doodle, they translated the line drawing into their body as movement. Then they created a movement sequence that came from that order. One at a time, the dancers performed their dance of five doodles as one connected action. The other four dancers watching tried to guess the order of the doodles for that performer.

In this practice, the watchers are not neutral. They are the drawers of the doodles, and even more, they are familiar with the doodles in that they too have chosen an order and put the lines into their own body. They each have a drawn relationship to one of the doodles, and a kinesthetic translation into action for all five doodles themselves. While watching the others dance, they were in fact not looking at the drawings while guessing an order. As they had translated the numbered doodles into a sequence of actions for themselves, they could use memory and self-movement translations to recognize the other dancers' actions, rather than referencing the drawings to compare. In the first run through, the correct orders guessed were inconsistent. Those who thought they knew the correct order of the dancer's line movements were not necessarily correct. Those who thought their guesses were partially accurate actually guessed perfectly. What can be noted in the first time is that the dancers were asked to just draw a line without knowing what would follow (what the experiment was). By calling it a "doodle" this may have been why some of the drawings in the first try out were

similar, as people drew what they had thought by definition a doodle was. Many of the lines looked rather similar, which would make it difficult to differentiate between them. In the second trial (see Figure 6), repeating the exercise, the dancers already know what the experiment was. Even without seeing what others drew, or agreeing to make larger distinctions, the variety between the drawings was more diverse. Additionally, three of the drawings could be said to convey simpler proposals allowing for greater readability. Participants used more recognizable features in their drawings, like angles or curves, meeting points or symmetry. In addition, the second trial had the advantage that the participants had more practice in reading movements within this abstract exercise. They also had the insight to create more recognizable translations, knowing others will be guessing them.

What stands out however, is not how precisely the dancers were able to match the movement to the drawing, but more interestingly, the different approaches that each dancer used to translate the same lines, and the knowledge they had of other dancers' attempts to read the movements, even while their own translation was distinctly different. For example, in a discussion afterwards they stated they could recognize that their two jumps were another dancer's two claps. In this case, it should be noted it is not just the number of elements that is the same, but the similar sonar, rhythmic, temporal, and percussive aspects involved when feet hit the ground or hands clap together. This is an example of what Sheets-Johnstone means by making meaning through movement and it highlights the deliberate sense-making components that this practice shares with mark making in archeology. The doodles hold meaning in their spatio-temporal-energetic form that can be reproduced and understood in a variety of ways.

Trial #2
Doodle one: A tight wavy line running vertically.
Doodle two: Two angles of the same size with an open bottom and an additional angle.
Doodle three: A circular wavy line that turns back in on itself before making a vertical drop with a horizontal bottom.
Doodle four: Two small vertical dashes.
Doodle five: Two lines crossing like an asymmetrical X.

In the second trial, three of the dancers took the same approach to translating the first drawing of the wavy vertical line, rendering that by vibrating their body while standing in place. For the fifth drawing, one dancer ran across the diagonal of the space, ran backwards and then turned to a different corner and ran diagonally across the space again. The cross of the X was a point in the middle of the space and her body translated the X as a pathway through the room. The second dancer crawled across the floor in a straight line and then retreated back on the same line. The X was not made, but symmetry and straightness was translated. The position of the X on the paper also resembled

the position in the studio space, from the audience's perspective, on the lower left side. Another translation approach from a different dancer depicted the two lines crossing by looking over each of her shoulders. This translation used eye sight as an imagined line through space and the X was crossed where her body stood. Lastly, the final dancer translated the two crossed lines by swinging each one of his arms from a raised position down and behind him. The crossing point was his hands held together from the starting position.

Tilley outlines the process of textual interpretation as follows: "A person wishing to understand a text places him or herself immediately in a dialogic situation involving a question and answer process" (Tilley, 2015, p. 117). In the translation process in the present practice, when a dancer sees lines that they have to interpret, though it is not a text of words, they need to fall into the same dialogical question and answer situation [which we will consider below using Shotter's (2010) term, "withness"]. They have to decide what parts of the lines speak to them, what spacing, what contours— what information can they translate into movement.

In the case of our study, the lines are not symbolic or representation—they are purely abstract. Therefore, the watchers, as trained dancers, have to interpret what possible array of choices a colleague may be pulling from in order to make a conclusion about what action would pair with the drawing. By being able to recognize how the dancer was translating the line into their body, the watchers can make guesses for the order. In order to guess, they need to pull from the spatio-temporal-energetic qualities made by traces, designs and imagined lines. The nature of this experiment requires the observers to be flexible with the unfinished and ambiguous nature of the line. One doodle that was two dashes on the paper was translated as hand gestures. Rather than a symbolic approach where these lines would mean hands, the lines have an open-endedness to them, that allows a dancer to translate in a variety of ways. This requires the dancer and watcher to engage in a dialogical relationship with the intertwining meaning that the lines hold. The dancer did not translate that doodle the same way into their own body, but can recognize what another dancer was thinking with their translation, due to the effort involved, and temporal and qualitative similarities.[4] In addition, certain features like

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4 Mirror neuron studies in monkeys have looked at and debated the ability one has to understand the actions of others from inside, even when one has not done or cannot do the action themselves (Rizzolatti and Sinigaglia, 2010, p. 260). These studies have also proposed that understanding the "motor behaviour of others might require a mechanism different from mirroring" (Rizzolatti and Sinigaglia, 2010). Differences in recognizing others' motor actions versus motor intentions also opens up questions about which mechanisms in the brain are required. If these doodle practices require more than mirroring mechanisms, no neurophysiological data can explain how the 'mentalizing network' might work" (Rizzolatti and Sinigaglia, 2010, p. 271).

symmetry or quantity, are recognizable, for example when the two lines are translated as two jumps, or two claps. The task of translating drawn dashes into a jumping action, or an auditory action from two hands coming together, should not be underestimated. "Simple line drawings can give visible shape to patterns of forces or other structural qualities" (Arnheim, 1969, p. 135). This argues in favor of considering lines from a multimodal perspective, considering their ability to materialize as sound or actions, with timing and dynamic information that is translated with and through the body.

Tilley's (2016, ch. 1, sec: From Sensory Experience to a Kinaesthetic Perspective of Rock Art, par. 9) definition of kinesthetic is relevant here: "the study of the active effects of imagery in relation to the human body, its balance, effort, postures, and gestures". In a previous study, a short movement was performed and the dancer as well as the watcher then drew a doodle translating what was felt or seen into a drawn line. In this reversed practice (O'Connor, 2023), whether felt or seen by multiple people, all of the drawn doodles had some similarities. This suggests commonalities in what traces are imagined as movement when watched and a general ability for people to translate those into drawn "gestures". Considering this reverse practice reveals a type of empathic ability to see similar imagined lines from kinetic movement, and the ability to translate those into drawings, it is not surprising that the ability to guess a doodle's translation into movement is also possible. "Meaning is derived from and through the flesh, not a cognitive precipitate of the mind without a body, or a body without organs" (Tilley, 2008, ch. 1, par. 12). Thus, if we follow the view that Lakoff and Johnson (1999) characterize as "embodied scientific realism", we can point out that the people in both practices have the same body and its capabilities that they can draw upon for reference when they are imagining lines, and translations of lines to actions. Turning back to Sheets-Johnstone, she explains this is possible because we are aware of the shapes of our bodies through joint angularity created through imagined lines, as well as imagined lines that appear as traces, e.g., when we reach for a book—"What are imaginatively constituted in all instances are *lines*" (Sheets-Johnstone, 2016, p. 116).

Studying the translations that are possible from line drawings to embodied movements and back again illustrates the same approach Tilley proposes for analyzing rock art: "The body both limits and constrains, and enables us to perceive and react to imagery in specific embodied ways" (Tilley, 2016, ch. 1, par. 8). Ingold explains that "following materials and copying gestures both call for observation" (Ingold, 2010, p. 308). He states that these activities require "an intimate coupling of the movement of the observer's attention with currents of activity in the environment" (Ingold, 2010, p. 308). He argues that one does not observe passively from a distance, but instead one participates within the process of the production of drawn lines, and when watching graphic lines, one is "reunited" with the "inked traces" (Ingold, 2010, p. 308).

Moved by materials: Tracing contours in space

In the last practice discussed here, lines, body and materials take on a different composition. Compared to the first exercise where traces of movement were perceived (and imagined) in space and translated into a drawn line, or the second exercise where drawn lines were brought into traced lines of the body, in this practice, lines already existing in architecture or landscapes are only traced and brought into movement of the dancers' bodies. Whereas, in the first practice, we could discuss whether the drawn lines have some symbolic status, as they leave a perceived trace that stays after the initial action has happened in the environment, and in the second practice we could equate some desire to seek symbolism with the fact that, in the practice, viewers were searching for iconic features between the drawings and the performed interpretations, the third practice here bypasses the question of sign or symbol in the creation of lines. Lines perceived in landscapes or architectural components are brought into the body of the dancer by tracing the lines with parts of their body. Tracing used here is similar to the tracing mode of presentation used in gesture studies where the shape or path of an object is drawn as if tracing its contour (Müller, 2014, p. 1691). The lines created by tracing the perceived lines do not stand for anything other than "captures" of the mental and/or visual scanning involved, but aligning with the proposal of MET, they aim to substantiate the material and concept the body is engaging with. In a way, this practice is similar to the first, but the lines here are visually perceived instead of imagined from movement traces, and the tracing happens without a pen and paper. The similarity of this practice to the second practice is that the dancer is also bringing visible lines into their body as movement, but the tracing practice does not require interpretation, but aims for copying the contours of the lines as tracing actions.

As MET hypothesizes, prehistoric humans, using their own kinesthetic sense, engaged with materials to substantiate concepts of deer, boats, and fish etc. in the process of creating cave art. We could say that the drawer was also *moved* by these objects (in both literal and figurative senses), and through movement, united their own gesture with materials to create lines on cave walls, allowing their expression to be surrogates for their emotional and mental activities.

Malafouris (2008) uses the potter and clay as another example to understand how material, action, and cognition work together. Malafouris acknowledges the potter's sensorimotor attunement to the clay's affordances by means of visual-haptic engagement, with "affordances" here referring to what Gibson defines as an action possibility formed by the relationship between any property of the physical environment and an organism (Gibson, 1979, p. 127). The dance practiced in the current study proposes the same material engagement is

happening through lines but without tactile engagement. The dancers themselves engage with materials, but instead of holding materials in their hands to create lines, the lines of material are already embedded in the walls, architecture and even other dancer's bodies around them. The dancers are not touching the buildings or materials they see, but they allow the affordances and perceived vitality affects created by the lines to literally move them, through traces and responses (see Figures 7–9). When we remember that vision itself can be considered a type of touch and connection, and that the architectural lines are brought into gestures through an act of tracing, this coupling of action and perception could be also considered a type of material engagement.

Instead of a person using a gesture to place a line on the wall in the act of drawing a horse or deer, a dancer traces the lines they see already in the environment. In both instances, the human engages with the lines, bringing forth or activating the conceptual elements the lines hold. When scanning the environment for lines during the practice, it is the different kinds of lines, textures, and vitality affects associated
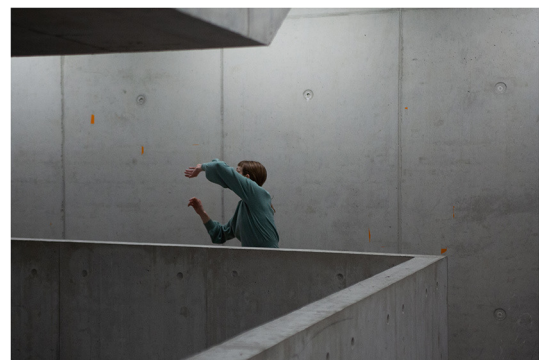

FIGURE 7
Sophia Obermeyer tracing lines in architecture as a dance practice. Photo: Niels Weijer.

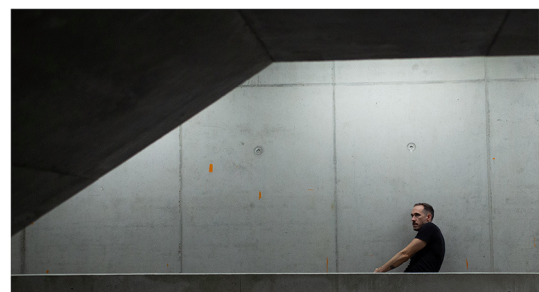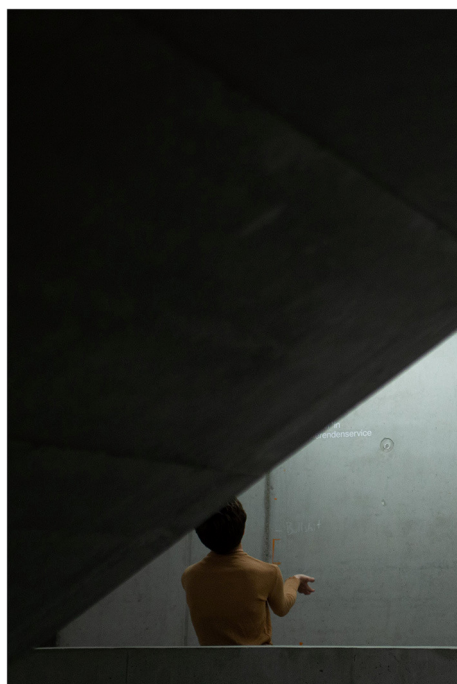**FIGURE 8**
Michael O'Connor tracing lines in architecture as a dance practice. Photo: Niels Weijer.

FIGURE 9
Samuel Feldhandler tracing lines in architecture as a dance practice. Photo: Niels Weijer.

with those lines, that then bring movements into the dancer's body. The gestures and movement express what the dancer is perceiving, using lines to foster movement and substantiate their own subjectivity through the engagement of material and lines. The improvisation the dancers create is based on their individual perception. How and what they see in the space takes on different forms in their body. By bringing the lines of space into themselves, they substantiate—in other words: bring meaning to—the intertwinement of action, perception, material and body. The meaning that is involved here is the kind Johnson's describes as concerning "the character and significance of a person's interactions with their environments" (Johnson, 2007, p. 10). Embodied meaning for Johnson is about ongoing experiences and how things relate and connect to other things. In Figures 7–9, each dancer reveals their own perception of the same architecture by means of different interactions with the lines seen in the environment.

Lines as a phenomenon do not inherently constitute a codified semiotic system, nor do they necessarily rely on other signs for their forms or meanings. Tilley, as well as MET, also questions the reflective approach to interpreting ancient line drawings in the attempt to propose that cognition extends into materials. "Meaning does not just reflect; it is also produced, contrived. In other words, meaning arises from operations performed on things" (Tilley, 2015, p. 126). In the dance

practice, one dancer explained her position. She noticed that one dancer may have been translating a line of color on a wall as a linear movement in their body. Another dancer then used that dancer's body as an affordance[5] to incite movement in themselves. Lastly, she then used the second dancer as material that she could trace. She summarized the situation as, "I am translating the body of someone translating someone else's interpretation of gray." The meaning exacted in this description exemplifies what Tilley is highlighting—that meaning is not passive and reflective, but through the performance of these dancers interacting and their awareness of each other, this unique moment of situated understanding prevails. As the third dancer, she is aware she may be holding the color of the wall that is extended through the body of two other dancers by her deliberate engagement. The meaning of color, in this case, extends through the materiality of multiple people creating lines. Returning to think about this in relation to ancient cave drawings, Malafouris points out that we could surmise how over time they took on symbolic functions (Malafouris, 2013, p. 193) due to the original embodied kinesthetic actions needed to create them. As dance is an embodied kinesthetic action, the main difference between dance and cave drawing lies in whether the gestures made leave perceived permanent lines, as with drawn figures, or imagined temporal lines, as with dance.

In the dance practice, the dancers bring the lines they see around them into their body by using different parts of their body to trace proximal, distal, large, or small lines. Through their movement, their perception of the space also changes. Compared to the creation of the rock art that Malafouris discusses, Tilley explains throughout his writing that engaging with rock art, be it cave drawings or rock carvings, also requires movement; one must move across landscapes and situate oneself in certain positions in relation to the images while standing on the very rocks themselves. "All perceptive experience has a bodily basis in movement through and exploration of the landscape, as the site of all the sense organs and the brain, and as a sense organ in itself with the skin as its boundary" (Tilley, 2008, ch. 1, sec: from Sensory experience to a kinaesthetic perspective on rock art, par. 4). Tilley explains that the dynamic interconnection between kineasthetic and sensory experience connects the perceiver to the environment they are in, changing them. "The landscape provides a rich and structured sensory domain through which the body moves and thinks, and the manner in which this movement and thought take place is fundamentally influenced by their particular material characteristics" (Tilley, 2008, paragraph 7). Like the prehistoric cave drawer and the archaeologist investigating, the dancer is the line creator and simultaneously the perceiver, moving through the landscape's surface, observing as they create.

5 Affordances, in the Gibsonian definition as it relates to interactions between humans, are the behaviors and possible interactions that another person affords (Gibson, 1979, p. 135).

The relationship the dancers have to the lines in the architecture are not like relating to art hanging on a wall, but like Tilley brings our awareness to when viewing rock art, the dancers are also on and in what they are perceiving.

Signature: Becoming one with the line

In the "reading" of cave drawings and rock carvings, the lines marked to account for elk, people, boats and fish, had been traditionally deciphered as if they were a text (Malafouris, 2013, p. 91). Tilley and MET approach rock art differently. Tilley proposes the body in motion is a necessary element in reading rock art and MET proposes the rock art should not be seen as representational signs to begin with.

"A kinesthetic approach" says Tilley, "is one that attempts to restore the power of imagery in relation to human agency. Images are fundamental in society not because they can be verbally described as meaning this or representing that, but because they require different forms of bodily actions in order to encounter and experience them. Experiencing the image through our bodies is powerful because these images alter us in subtle ways that may require no talk of their meaning" (Tilley, 2008, ch. 1, sec: Images in the Landscape, par. 6). Here Tilley brings our attention to the idea that the importance of imagery is not what it stands for, but that the experience of the body when interacting with them is meaningful in itself, and that this space of interaction moves us in ways we are not able to articulate with words. He continues, "So the significance of the image is not primarily what it stands for, or seeks to represent, but the event of its bodily experience" (Tilley, 2008). Malafouris agrees: "Material signs do not represent; they enact. They do not stand for reality; they bring forth reality" (Malafouris, 2013, p. 118). For this reason, MET sees external representations not as a starting point of investigation but as an ending (Iliopoulos, 2019, p. 50). The act itself makes the experience important. In prioritizing the drawing of a line as an act of improvisation, Ingold states: "A graphic anthropology, then, would aim not at a complete description of what is already there, or has already come to pass, but at joining together with persons and other things in the movements of their formation" (Ingold, 2010, p. 304). Ingold defines drawing as a tool of observation in that it "combines observation and description in a single gestural movement" (Ingold, 2010, p. 303).

Phenomenologist Sheets-Johnstone also directs our attention again to the moving body's importance in the development of signs and language: "When we frame the inquiry 'how did human languages originate' in terms not of adaptations but of living bodies, we are necessarily confronted with the creation of meaning, a creation that did not arise *de novo* but that was grounded in an already present semantic repertoire, itself grounded in archetypal corporeal-kinetic forms

and relations, as suggested, follow along biological Family lines, i.e., for hominids, along primatological lines" (Sheets-Johnstone, 2009, p. 234). What she is addressing here reminds us, when thinking of how we as humans developed and learned language and meaning, not only within our own individual development, but as a species, the prelinguistic movement and experience went hand in hand with the growing thoughts and then came to be expressed in language systems.

Following on the proposals from Tilley, MET, and Sheets-Johnstone, if lines in rock art are not approached for their symbolic reference, the abstract lines seen in these different creative practices are not themselves after-the-fact signs of reflection either. Instead, as we argue, these creative practices aim to place importance on the materiality of the line as an act of extended cognition. The lines' potential for multimodal interpretation in terms of their movement characteristics (either the movement required to create them or the movement they inspire in the viewer) allow them to be meaningful. In the act of using cognitive archelogy to compare the use of lines as deliberate-sensemaking tools in dance, the concept of *signature* comes to mind as a more applicable term than that of *sign*.

Whereas, a line drawing of a rhinoceros provides a representation that is sufficiently iconic as to allow one to link it to the actual animal, drawn lines from cars moving in landscapes or ephemeral lines of the body tracing cracks in the cement of a building do not bring the original object into focus in the same way, but rather only the dynamic qualities and contours from those lines themselves. In this way, lines bring focus to the movement within the perception of the referent object and this brings us to why the term *signature* is offered here in exchange for *sign*.

A signature marks a personal, distinctly unique, situated time and place for one subject. It is recognizable by the line's movement characteristics and even is expected to be different each time. For these reasons, a signature varies greatly from a sign, as it gestures toward a movement of sense-making of identity and location. A signature extends the individual thoughts as traced lines into the world as movement. "To bring forth a world means to enact dimensions of meaning and significance through the living body in action and through multiple kinds of physiological, sensorimotor, and interpersonal couplings. The mind is what occurs in these enactments and [is] not what goes on in the head" (Di Paolo et al., 2018, p. 17). Here we find a question from (Ingold, 2010, p. 300) appropriate: "What if the living being *is* the line of its own movement?" A signature is a sign in motion connected to the internal/external world of one person.

A person's signature (in the traditional sense of the word as well as the way we are using it here) is also directly related to one's body. Thoughts from Bergson on the body relevant to this are referred to by Tilley: "As my body moves in space, all the other images vary, while that image, my body, remains invariable. I must, therefore, make it a center, to which I refer

all the other images. My belief in an external world does not come from, cannot come, from the fact that I project outside myself sensations that are unextended.... *My body* is that which stands out at the center of these perceptions: *my personality* is the being to which these actions must be referred" (Bergson, 1991, p. 46–47). Tilley explains that, for Bergson, the moving body and personality are indistinct from each other in that they are the person (Tilley, 2008, ch. 1, sec: Body, Image and Memeory in Bergson, par. 3). If we think of the moving body as an act of *signaturing*, we can also make correlations to one's personal way of moving as the center of their perception. "Cognition is not about transposing a world of predefined significance into the inside of an agent. It is about agents moving within the world and singly or collectively changing it in ways that are significant according to the forms of life they enact" (Di Paolo et al., 2018, p. 21). The act of signaturing can be seen as a form of deliberate sense-making—a making sense of lines as movement and the intertwined materiality of body, cognition, and world.

By bringing focus to the enactive creation of the line making, and the kinesthetic movement involved in perceiving lines, we see the relevance in the term *signature* in order to put focus on meaning that originates from the engagement. "Meaning does not reside in the material sign; it emerges from the various parameters of its performance and usage as there are actualized in the process of engagement" (Malafouris, 2013, p. 117). MET acknowledges that a material sign can be both a signifier in itself and simultaneously a signified representation of something else (Malafouris, 2013, p. 17). Due to this double nature of material signs, the shift toward the term signature also brings together the maker and the traces left when focusing specifically on the materiality of lines. The act of signaturing is then thought to bring individual meaning through the proposition of extended mind to the lines that are drawn. What seems like meaningless lines, can therefore be given importance when we focus on the actions involved in their material creation. "In the case of material signs, we do not read meaningful symbols; we meaningfully engage meaningless symbols" (Malafouris, 2013, p. 117). In this way, the materiality of lines in this practice maintains a scope of ambiguity over iconicity: only the spatio-temporal-energetic meaning related to the lines is intended to be conveyed in the practice, rather than iconic forms for the purpose of communicating what the referent object is. Therefore, let us look at the element of ambiguity within the context of linear engagement within artistic practices through the lens of material culture.

Ambiguity: Landscape to mindscape

The field of material culture studies proposes that an artifact may be ambiguous in its meaning because it relays a variety of information, often layered and contradictory, through the same media (Tilley, 2002, p. 28). From the perspective of

visual thinking, Arnheim draws our attention to meaning made through experiential associations. "Remember the old laws of association: items will become connected when they have frequently appeared together; or when they resemble each other" (Arnheim, 1969, p. 54). He goes on to say things that "resemble each other are tied together in vision" specifically (Arnheim, 1969, p. 55).

Tilley proposes that images of different concepts resemble each other, or look the same on purpose in cave art, to create ambiguity. The ambiguity is thought to be used to link things together (Tilley, 2015, p. 144). In the drawings, "Many of the boat depictions resemble water birds" (Tilley, 2015, p. 76). Tilley also points out that the removal of the elk's legs transforms it into a boat. "Such ambiguity, it might be suggested, is not just the result of incomplete preservation or of a technically inept artisan but is intended to forge connections and links" (Tilley, 2015, p. 77). Neuroscientist Zeki studies the neurobiological foundations of ambiguity and explains that the brain's organizational structure makes possible the ability to see things with multiple interpretations and that this attribute makes ambiguity for the visual brain a stable feature (Zeki, 2004, p. 187).

In viewing these links, "Visual perception, [...], is not a passive recording of stimulus material but an active concern of the mind" (Arnheim, 1969, p. 37). We could also say it is an active concern of the body, as the eyes move, the breath and body engage in a whole kinesthetic response, as Tilley has drawn our attention to. Malafouris sees perception as a mode of probing the outside world rather than representing it and thus the cave drawings are continuous prosthetics of this probing mechanism which extend the visual brain (Malafouris, 2013, p. 203). Perception is not discovering things already there—it is about being present and aware in the very moment of formation itself (Ingold, 2022).

Instead, the articulation of ambiguous lines is an attempt to bring like-minded things (in the thoughts of the one drawing or dancing) together. O'Connor (2022) proposes that the ambiguity of lines allows for a type of *withness* (Shotter, 2010) between the mind, body, and environment, allowing us to consider the mind as extended. Shotter defines withness as our ability to "think along with subsidiary awareness of certain felt experiences as they occur to us from within our engaged involvement in a particular unfolding process and [...] these inner feelings play a crucial role in guiding our actions" (Shotter, 2006, p. 586). As cognitive archeology suggests, lines with indistinct references do not necessarily appear because the agent could not articulate better what they meant, or what they wanted to express. As Zeki shows us, ambiguity is a natural part of human experience. Shotter proposes, when we experience things we do not fully understand, we have the opportunity to orientate ourselves around yet-named "things" and we should move "to *sensings of likeness* that can be meant and understood as one-and-the-same in countless different circumstances (Shotter, 2015, p.

234). Shotter points out that we "continually ignore the original openness and unfinishedness of world processes" when we seek out determined things with the mindset that they just need to be discovered (Shotter, 2016, p. 37). Rather than approaching lines that we make as some problem to solve, we take Shotter's suggestion in that "we are seeking to resolve what we at first encounter as an indeterminate, ambiguous, or bewildering situation by our active inquiries within it—conducted in the course of our living, engaged, attentive movements within it" (Shotter, 2016, p. 79). Respectively, Ingold describes these moments as "coupling our own movements of description with our observations of what is going on in the world, which are, in turn, necessarily coupled—through the participatory act of togetherin—with the trajectories of those with whom, or with which, we join" (Ingold, 2010, p. 304).

How this can be understood within the practices here, is that the practitioner should not try to be creative, nor try to execute a goal, a specific movement, nor aim for bringing oneself to a certain after-the-fact thought-out ideal situation. Instead, the practitioners engaged in these tasks should allow the perception to be indeterminate such that their actions can forge ambiguous connections with the material environment. Zeki relates the relationship of ambiguity to unfinishedness as a strength in art work, allowing works to be open for different interpretations (Zeki, 2004, p. 190). If we consider lines as something that moves, then the very nature of lines in architecture conjure movement when viewing them. By translating those lines into movement made by the body, we give the opportunity for our movement to make sense because of proximity and relational similarity. "Meanings resulting from relations between events and dynamic happenings are contingent on movement" (Sheets-Johnstone, 2009, p. 169). It is the deliberate sense-making, or (what can now be called) signaturing one does when generating lines in these practices that, like the similarities between figures in rock art, bring meaning between the ambiguity within lines.

Malafouris invites us to see that while the "toolmaker brings forth the possibility of a new form of tactile thinking, the image maker brings forth the possibility of a new form of visual thinking (Malafouris, 2013, p. 203). With this approach, we can see that the dancer, using their body as a tool to make kinetic images, either drawn or through gestures, brings forth a *visual-tactile way of thinking*. Thus, if in these practices, the body is attuned with the lines in the space around them, the thinking is taking place with the material. The lines are the material in which the dancer is engaged. Further, as Arnheim proposes: "Thoughts need shape, and shape must be derived from some medium" (Arnheim, 1969, p. 226). In continued questioning of what the medium shaping thoughts is, if we consider the moving body, which makes temporal lines, to be *thinking as an extended mind through its engagement with linear materials*, the medium, the materiality of thinking, is also lines. As Arnheim (1969, p. 27) asks, "What are the mental shapes of thoughts[?]", we would not go further in finding what the shapes are, but rather we can consider what all shapes are made of, and for this we can say:

lines. The shape of our thoughts can be seen in the shape of the lines we produce.

Possible beginnings

Looking at the lines of dance practices in the way we look at ancient rock art involves not only a metaphoric logic, mapping thinking about the latter onto the former: the kinesthetic approach to rock art proposed by Tilley brings movement-based meaning as a crucial element to this field, opening the door to dialogue with dance as artistic research. These fields of inquiry find a common ground in that "The counterpart to linguistic metaphor is material metaphor, metaphorical *material* relations between things, or aspects of a thing" (Tilley, 2008, ch. 1, sec: Kinaesthetics and phenomenological semiotics, par. 9).

Malafouris states archeology has yet to reach a consensus on how to answer the question of how modern symbolically competent humans came to be. Perhaps dance research cannot answer how we came to be, but can demonstrate, in real time, the multifacetedness of our ability to move, perceive, and think in lines, which enacts remnants of our ancient cognitive processes. But whereas in cave drawing, there is a tool, a tool maker, and the tool users, in dance, to say the body is the tool and the dancer is the tool user is inappropriate, because it separates the body from the dancer. The body and movement combine to become the material.

Tilley proposes that a new method of analysis is needed in order to rethink the semiotics of rock art. The method he promotes explores understanding the rock art by placing emphasis on what the rock art *does* to the body. This kineasthetic method that Tilley seeks is comparable with the approach in the practices described here because, as seen in the argument we have presented from Tilley, the images produce sensory effects on the bodies of those who perceive them and one does not have to know what they might represent. However, Tilley also incongruously claims that a kineastehetic approach to rock art without reference to meaning "would be deeply and unacceptably reductive since we would learn rather little about the specific form and nature of the images themselves" (Tilley, 2008, ch. 1, sec: Kinaesthetics and a phenomenological semiotics, par. 2).

Being moved by the images in the artistic practices here *is* the active product itself. In these works, describing the lines substantiates those materials and concepts on a visceral level, and the understanding is placed only in that particular moment. In contrast to the idea that "thinking takes place through the syntactic arrangement of symbolic representations, MET must rely on a model of cognition wherein new thoughts emerge through a dynamical engagement between the human mind and the material world" (Iliopoulos, 2019, p. 44). As the present practices are intended to investigate movement generated by perception of lines for artistic purposes, what the environment *does* to the body and how that reveals the dancer's temporal

and situated perceptions is what is looked at and is what differs from rock art analysis. The significance is the signature it creates with the individual who is moved. By sensing, and attempting to notice, as a means of describing without words the dynamics of the lines that we can access, and how they move in and through our body, we gain the opportunity to understand a situation in the terms of the situation that we are part of. We need to be able to assess and access how we are involved, and to do so in an ongoing way from within, as Shotter requests (Shotter, 2016, p. 82). Ingold proposes that doing, observing and describing can be joined together in the acts of "following the materials, to copy the gestures, and to draw the lines" (Ingold, 2010, p. 304). Only then, from this point, where we are moved by the materials through our own linear engagement, can we move toward a different way of making sense with objects, materials, and landscapes. Through the perspective of material engagement and extended mind we can understand city landscapes through the lines of drawn gestures, and we can *make sense with* a building by translating its lines appearing as cracked cement, structural beams, and designed edges.

Material Engagement Theory wants to go against the view that a person has a closed off mind inside a skull, chooses to pick up a tool (disconnected from their own body), creates a line or mark somewhere out in space, and then the residue of that trace is something to be interpreted. This piece-meal approach to disjoined parts in time is for some easier to understand, but similar to Barad's notion of intra-action[6] (Barad, 2007, p. 33), we are making what Malafouris calls, "category mistakes" by thinking we can isolate minds, body, and things (Malafouris, 2013, p. 208). This is where dance, providing a trace in space, can be used functionally to offer a comparison with rock and cave art, to show how mind, body, and material unite. Dancing as line making uses the body as material, where cognition and body unite in motion and may leave subtle traces on surfaces or imagined ambiguous traces in space. Having put a tool in someone's hand, they can use the same gestures and movements that then create lines that only differ from movements with empty hands in that the line making with the tool has a more permanent or more visible result. Lines are seen here for their ability to intertwine cognition and material culture. Malafouris proposes they should not be seen as boundaries that separate (Malafouris, 2013, p. 201), but instead as the practices here have shown: as having a nature that slides between modes

of expression and perception, creating a type of materiality of experience.

Ethics statement

Author contributions

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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.

Publisher's note

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6 Barad defines intra-actions as agencies that emerge through relational mutual entanglements. "It is through specific agential intra-actions that the boundaries and properties of the components of phenomena become determinate and that particular concepts (that is, particular material articulations of the world) become meaningful" (Barad, 2007, p. 139).

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| Frontiers in Communication

Influence of Aikido and Taijiquan-Tuishou on Contact Improvisation

Sebastián Gómez-Lozano[1], Alfonso Vargas-Macías[2],
Clare Kelly-Lahon[3], Kiko León[4] and
María Eugenia García-Sottile[5]*

[1] Performing Arts Research Group, Faculty of Sport, Catholic San Antonio University, Murcia, Spain,
[2] Telehusa Centre for Flamenco Research, Cádiz, Spain, [3] Department of Marketing, Tourism and
Sport, Atlantic Technological University, Sligo, Ireland, [4] Optimization of Training and Sports
Performance Research Group, Faculty of Sport Science, University of Extremadura, Cáceres, Spain,
[5] Physical Activity, Performance and Quality of Life Research Group, Faculty of Physical Activity and
Sport Sciences, Catholic University of Valencia, Valencia, Spain

Oriental Martial Arts such as Taijiquan-Tuishou and Aikido represent some of
the Asian influences on western culture resulting from immigration from China
and Japan to the United States of America during the middle of the 20th
century. Contact Improvisation, a style of post-modern dance performed in
pairs, is one of the manifestations enriched by this oriental influence. The
purpose of this manuscript is to document which dynamic, proprioceptive and
somatic elements were transferred to the choreographic language of Contact
Improvisation from these martial arts. In the case of Contact Improvisation,
the most important technical components highlighted include: center of
gravity, weight sharing, point of contact, sphericity, rolling, the embryonic
relationship of axial axis and limbs, *ki* and proprioceptive communication.
Although an evolution in the interpretation of the meanings and uses of
this particular dance form may exist, we can nonetheless establish some
kinesthetic communication codes and strategies derived directly from its
original sources. These sources belong to martial arts such as Aikido and
Tuishou or Taijiquan and are essential to the intercultural communication
component of the Contact Improvisation duo since they involve the learning of
fundamentals and principles of non-verbal interaction considered as specific
for the mastery of intercorporeality. This is discussed in light of the work of
Mark Young, a Contact Improvisation choreographer who maintains Paxton's
legacy of roll technique documented in "Material for the Spine" by perfecting
the execution and technical variations of *helix rolls* in a constructed system of
spirals. This concurrence of strategies adopted from Aikido and Taijiquan and
the usefulness of these elements in terms of performing this partner dance
would appear to be key in the understanding of Contact Improvisation.

KEYWORDS

contact improvisation, choreography, martial arts, intercultural communication, non-
verbal communication

Introduction

The postmodern dance style, Contact Improvisation (CI), was broadly discussed in 2008 in the book "Caught falling: the confluence of contact improvisation, Nancy Stark Smith, and other moving ideas" by the co-founders of Contact Improvisation, Nancy Stark-Smith (1952 New York, NY United States—2020 Florence, MA United States) and Steve Paxton (1939 Phoenix, AZ United States) co-authored by David Koteen. This book provided a theoretical compilation, bringing together different definitions of Contact Improvisation with the common thread being the appearance of concepts belonging to the field of physical laws governing bodies such as weight dialogue, balance, reflexes, impulses, bodies in movement and in physical contact, gravity, momentum, inertia, friction, and centrifugal force. As an example, one of the definitions stated that "Contact Improvisation is a form of partner dance originated in 1972 by choreographer Steve Paxton based on the communication between two moving bodies that are in physical contact and their combined relationship to the physical laws that govern their movement - gravity, momentum, friction, inertia, centrifugal force, etc." (Koteen et al., 2008, p. 12). If we look closely at these parameters, they are the same ones that underlie the technical development of certain disciplines of martial arts. Specifically, we refer to those where spatial, proprioceptive, and tactile communication predominates in pair work, such as Aikido[1] and Tuishou (Kauz, 2007, p. 62).

Aikido is a discipline that derives from traditional Japanese martial arts (Benedetti, 1993, p. 14) where combat methods, mostly unarmed, are linked to traditional warrior arts and the military caste known as buke (Protin, 1977, p. 109–110). It is a discipline of coordination, a way of strengthening the mind and body, of fusing the individual's physical and mental powers so that the individual may become a more fully integrated human being. The word Aikido means method or way (do) for the coordination of harmony (Ai) of mental energy or spirit (ki). The Aikido method was developed by Master Morei Ueshiba (1883 Tanabe, Japan- 1969 Iwama, Japan) in Japan between 1930 and 1960 (Westbrook and Ratti, 1970, p. 17–18). Although it should be noted that it is difficult to isolate the technical dimension from the spiritual or personal, it is also risky to trace its religious, historical, and cultural genesis. We can, however, consider the origin of the birth of Buddha 556 BC as an essential seed of influence of what is now the modern discipline of Aikido (Protin, 1977, p. 31).

Tuishou, on the other hand, is a modality involving high contact skill in duets and is the most widespread martial art form of Taijiquan. This training modality was created by Chen Wangting (1600 Chenjiagou, Henan China-1680) who founded the system some 350 years ago (Gaffney, 2006, p.32). Chen

Wangting, who resided in Wenxian County, Henan Province (China), was a military warrior of the imperial guard of the Qin Dynasty (1644–1911) (Dudukchan, 2017, p. 5). The aim of Tuishou practice is to sensitize oneself to an opponent's movement and intention while concealing one's own intention and energy (Gaffney, 2006, p. 38). In a synthesized way, we can say that it consists of unbalancing the other using basic techniques of one's own martial art (Wolfson, 2007, p.40) while maintaining physical contact. Taijiquan has been used by missionaries and martial arts traders as a vehicle for the cultural transmission of Chinese culture to the West. Western practitioners have used it for a variety of purposes, from self-knowledge and spirituality to physical and social therapy (Wile, 2008, p. 37).

The transmigration of people and of ideas from East to West also influenced the development of somatic practices, encouraging exposure to philosophies and practices of mind and body, such as Eastern martial arts and yoga. It is in North America that most practitioners of somatic practices were concentrated and the personal experiences of these so-called "Somatic Pioneers" who had suffered decisive events in their lives (psychological traumas, physical injuries, or painful processes) triggered a change toward more holistic models and the establishment of a close relationship between movement pedagogy and rehabilitation. These pioneers developed the use of somatic awareness in movement work based mainly on dance, physiotherapy, and martial arts (Eddy, 2009, p. 11). Among the best-known somatic pioneers are Moshe Feldenkrais (1904–1984), Mabel Elsworth Todd (1880–1956), Irmgard Bartenieff (1900–1981), Gerda Alexander (1908–1994) and Ida Rolf (1896–1979). And, as mentioned above, their work was based on the influence of Eastern disciplines such as yoga, Chinese Internal Martial Arts, and Japanese Martial Arts (Eddy, 2009, p. 7).

We must return to the end of the 19th century to fully understand the germination of the relationship that was to evolve in the 1970s of Aikido and Taijiquan-Tuishou with the dance style of Contact Improvisation. At the end of this century, North America became a host continent for large migratory influxes from countries such as China, Japan, and the Philippines. Indeed, China became the main exporter of labor at that point in time. In the 20th century, Chinese citizens migrated to the West, both to North America and Britain (Liu, 2009, p. 213). A total of 408,493 Chinese-born people were admitted into the continental United States as visitors, students, or immigrants between 1850 and 1960. Japan succeeded China as the second most impactful migration influx to the United States. Japanese nationals first settled on the Island of Hawaii, a migratory stopover off the Pacific coast, and California, Washington, and Oregon were the primary states where Japanese migrants settled. In 1930, the state of California alone counted almost 100,000 Japanese immigrants (Boyd, 1971, p. 50). Immigration from China and Japan to the United States of America, especially in the last two decades of immigration in the 1950s and 1960s, had

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1   Rothman, 2000.

a lasting impact on local art and culture. This fact influenced the spread of Chinese martial arts such as Taijiquan to the West. Tuishou, or pushing hands, was one of the six components of the art along with *qigong, neigong*, weapons applications, and self-defense (Ryan, 2008, p. 527).

From this decade on, Eastern philosophies were of particular interest to many American artists as an alternative to the Western model. Similarly, Zen practice was seen as an antidote to the competitiveness that characterized the capitalist society of the time (Novack, 1990, p. 184). In the case of Aikido, it was after World War II that Morei Ueshiba decided to expand the knowledge of this discipline both to Japan and the rest of the West[2]. In the 1960s, interest in body training from martial arts such as Taijiquan, Karate, Judo, and Aikido increased throughout North America (Novack, 1990, p. 52). Specifically, the city of New York became the meeting point of two distinguished masters, Yoshimitsu Yamada (1938 Tokyo), who taught at the *Aikikai* in Manhattan, and Zheng Manqing (1902 Wenzou, China-1975 Taipei, Taiwan), who established the Taijiquan Association in New York's Chinatown, and later his own school at Bowery. In retrospect, we can recognize these two figures as essential in the development of the Contact Improvisation style of dance, both for the accessibility of their teachings and the opening to the West of meditation practices based on *Zen* Buddhism or *Taoism* (Protin, 1977, p. 31–32). In short, martial arts masters transmitted cultural elements that permeated contemporary dance.

From its birth in 1972, Contact Improvisation philosophy declared itself as an evolving system open to a wide range of sources both for inspiration and to help establish working principles and skills (Stark-Smith, 1980, p. 2). The existing material in Contact Improvisation did not differ, in the words of Steve Paxton, from that found in wrestling, jitterbug, or Aikido, among partner disciplines, but is defined as a form of activity that is unique in that its objectives are different from other forms of duo activity (Paxton, 1975, p. 40–42). Specifically, both Taijiquan and Aikido influenced the founder of Contact Improvisation, Steve Paxton, in those years prior to 1972. For his part, Mark Young (1965, Toronto, ON Canada) became a practitioner of this style of dance following a serious traffic accident in Vancouver on 26 June 1997. This was 25 years after the foundation of Contact Improvisation. Mark Young was part of a second generation of dancers who developed a system of spirals based on Taijiquan-Tuishou work. Mark Young had previously studied in the 1990s with Master Moy Lin-shin (1931–1998) of the *Taoist Tai Chi* society in Toronto. At the beginning of the 21st century Mark Young built one of Contact Improvisation's most unique training centers called the "Leviathan Studio" on Lasqueti Island (British Columbia, Canada) (Gómez-Lozano et al., 2022b, p. 10). In Mark Young's

spiral system one can recognize kinesthetic patterns of radius-ulnar rotation which is characteristic of Taijiquan forms (Gómez-Lozano et al., 2022a); and particularly recognizable is the Chen style (Wile, 2008, p. 26–27). Such a kinesthetic pattern is also used in the so-called "helix rolls" exercises designed by Steve Paxton and was influenced by the recurring interaction maneuvers in Aikido[3]. This concurrence of strategies adopted from Aikido and Taijiquan and the usefulness of these elements in terms of performing this partner dance would appear to be key in the understanding of Contact Improvisation.

It should also be noted here that as early as the 1960s, Huang (1970, p. 32) clearly states that Aikido draws on the fundamentals and principles of Taijiquan. These fundamentals in Contact Improvisation are embodied by two choreographers, Steve Paxton as the founder of the style, and Mark Young as an exponent of intergenerational relay. The semiotics of movement in American dance history itself took a turn in this journey of meanings when these martial arts were transferred to the postmodern dance style called Contact Improvisation (Novack, 1990, p. 59). We will follow a review methodology based on analyzing the most relevant existing audiovisual documentary records on Contact Improvisation combined with the bibliographic material found on the object of study up to the present day. As mentioned in the introduction, the purpose of this manuscript is to highlight and discuss which dynamic, proprioceptive, and somatic elements were transferred to the choreographic language of Contact Improvisation from the martial arts. Through this analysis, the common aspects in the practice of Aikido and Taijiquan-Tuishou will be identified as well as the extent of their influence on the practice of the Contact Improvisation duet.

Section 1. Characteristics of communicative language in Aikido

In a perspective close to self-knowledge, Aikido as a martial art is relegated to a somatic and integrative practice. Aikido is not only an effective Japanese self-defense combat method; it also enables the human being to rediscover their natural psycho-physical balance (Westbrook and Ratti, 1970, p. 17). Aikido is aimed at the search for harmony within oneself and between people, whether they are rivals or not. It is a discipline of coordination-harmony and mind-body strengthening (Cuéllar et al., 2019, p. 13–14). In other words, it can be said to represent the union of Taoism, Confucianism, and Buddhism which is synthesized in Shintoism (Protin, 1977, p. 13). Aikido according to Kohn (2003, p.139), must overcome the sporting competitive side or concept of "Hero" and aspire toward the concept of "Master" that each one of us can find in ourselves in that interaction with the other. In this sense, in the words of Levine

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2   Cohen, 1980.

3   Paxton, 2008.

(2007, p. 46) Aikido allows the unification of the whole body and mental system through proper posture by focusing attention on the body's center of gravity. In the practice of Aikido there is a cooperative interaction between individuals. For example, in the case of *tori* and *uke,* which is an attack-defense role system created for learning techniques, communication between the partners is extremely sensitive in terms of listening to the situations and phases of interaction that are generated. Kimmel and Rogler (2018, p. 195) develop this as "Theory of affordances to settings of coregulative interaction", in other words (Kimmel, 2012, p-77), good contact requires complex attentional and cognitive skills that make the body receptive to the partner, guide active perception, and create good dynamic form. This happens after many years of practice under the acquisition of the elements of understanding that underlie the practice and, in effect, creates a system of communication. Kimmel (2012, p. 78) adds the concept of the emergence of this flow within and between partners as a very powerful experience of bodily intersubjectivity.

Furthermore, the process of communication between two *aikidokas* (named to Aikido practitioners who follow its precepts) can only be understood when the martial origin of Aikido is explained. *Bujutsu*, *bushido,* or *budo* are different approaches performed throughout the history of traditional Japanese martial arts. These concepts can help us to understand contemporary Aikido or Aikido as we know it today. *Bujutsu* is a generic term used to describe the art of fighting in both strategy and technique in relation to dialogue between adversaries. This art was not only developed by military or warriors but also by other social classes such as peasants and Buddhist monks, which has helped to develop unarmed combat techniques (Protin, 1977, p. 109–110). *Bushido* is a concept related to morality and honor. And the expression *budo* determines the path of the warrior's spiritual realization (Benedetti, 1993, p. 15–16). In other words, it is inevitable to allude to the warrior origin of the use of weapons in order to understand *uke*'s non-verbal communication in relation to *tori*. At the origin of this combat duo, between *tori* and *uke*, there are points of contact that condition and affect the body in both a motor response of torsion and spiral movements (Figure 1).

In all the techniques used in Aikido, there is a living connection at the center of gravity of both opponents. Undoubtedly there is an opposition between the two *aikidokas*. This relationship is originally understood for survival but nowadays as an attitude of acceptance, non-resistance, victory over oneself, and the search for harmony (Tamura, 1991, p. 21). In this way, a series of bodily exercises is designed in Aikido whose purpose is to reveal to the aikidoka the potentiality, the unexplored possibilities of the body, to transcend the spirit and finally the unification of both (Protin, 1977, p. 13).

The posture of Aikido is everyday, detached from the fight and with an easy willingness to move in any direction, grounded and flexible at the same time. The *aikidoka* generates centrifugal

FIGURE 1
Aikido: contact points between Uke and Tori, hand and forearm. In the 3rd frame Jesús Arce (Black Belt, 5° Dan) in demonstration of Tori provoking torsion in Uke.

FIGURE 2
Aikido: Tori performing techniques on Uke through basically immobilizing, projections or combinations of both. Jesús Arce (Black Belt, 5° Dan) in demonstration.

forces from the center of gravity, creating enormous power with little effort of movement at the periphery. By lowering its center while spinning the *aikidoka* generates vortices from the spherical center of energy called *hara* (Westbrook and Ratti, 1970, p. 21) that project *uke* in a sinuous path. For longevity in his Aikido practice, the *aikidoka* cultivates smoothness and roundness in his movement (McKenna, 2004, p. 16). The communicative origin is an attacking intention of *uke* that must be neutralized by *tori* through basically immobilizing techniques, projections, or combinations of both (Westbrook and Ratti, 1970, p. 159) (Figure 2). All of these dynamics of circular, spherical, or spiral movements which emanate from the strategies and techniques used in the confrontation between aikidokas are what will later influence the founder of the Contact Improvisation style, Steve Paxton.

Section 2. Steve Paxton & Aikido

Steve Paxton was a dancer with Cunningham until 1960 and then he joined Robert Ellis Dunn as leader of the Judson Dance Theater Collective where he developed a different form

of choreography. In 1962, he became a founding member of the "Grand Union" and, later, the "ReUnion" companies. His own evolution as a movement researcher led him to study Aikido and its Buddhist influences for several years at the *Aikikai* in New York with Yoshimitsu Yamada *Sensei*[4]. The influence of Asian, and specifically Japanese, culture on Paxton is undoubtedly related to the "Merce Cunningham & Dance Company: World Tour 1964". The tour included musicians, artists, managers, and dancers traveling to 30 cities in 14 countries from Europe to Asia, ending in November in Japan[5]. It is possible that his Asian tour of Japan was instrumental in terms of the influence of Aikido: "Imagine my astonishment at discovering movement systems that were not aimed at astonishing the audience or derived from the aesthetic of a single artist (the choreographer); with the body seen and felt from the center rather than seen from the outside, and a posture with use of upward and downward directions at the same time, rather than the always upward practice of Western dance" (Steve Paxton in McKenna, 2004, p. 16). Particularly in the early years of Contact Improvisation's existence, it was possible to observe a close working model based on Eastern Martial Arts' training principles (Novack, 1990, p. 184).

In 1972, Steve Paxton stated that the working material on which he based Contact Improvisation could be found in many manifestations of the martial arts, such as Aikido. This Japanese martial art influenced Steve Paxton so much that he integrated Zen philosophy into his practice (Novack, 1990, p. 184). This fact is manifested both in the individual practice and in the way of integrating improvisation in the duo. First, by its introduction to standing meditation in the application of 20-min routines, allowing the gravity factor to act on the skeleton, using the minimum energy necessary to maintain verticality (Gómez-Lozano et al., 2022a) and second, during the action, apply the concept of "flow-dynamics of interaction". Kimmel (2012, p. 77) describes it in the Argentinian dance style Tango when individuality dissolves into a meditative unity, where time and space give way to a unique moment of presence, of "flow" in the couple. This way of approaching this new dance by couples, at the level of choreographic language, provided for a breaking of codes based on the work of sensitive and physical contact. In this new dance, new changes in spatial movement patterns were produced in relation to the work of Merce Cunningham. In 1972, the traceability of space in Steve Paxton's work in New York acquired a spherical conception based on curvilinear and spiral trajectories. Steve Paxton was later considered the producer of a new choreographic syntax coined in a style called Contact Improvisation[6].

Paxton himself had an even more revealing experience with Jack Wada *Sensei*, instructor of Aikido, University of California at Santa Cruz, during a demonstration at the Workshop on April 19, 1976. Paxton makes it clear that what is essential is invisible to the eye in relation to the principles underlying Aikido which is an art built on warlike characteristics or the "Art of War." These principles are transformed in Contact Improvisation to become the art of life[7].

Steve Paxton considers that somatics is inherent to all human beings and is manifested in both Aikido and dance[8]. Paxton describes the origin of this link between somatics and Contact Improvisation based on the evolutionary theory of anatomical conformation of tissues during embryonic development. This explains both the fundamentals of the movements born from the axial axis and the fluid spiral movements of the CI practitioner and *aikidoka*. Paxton in 1986, brings to light a whole process of recapitulation of fundamentals and exercises from the spine that he had experienced within the practice of Contact Improvisation during that decade and a half. This system of spinal exploration is based on two dimensions of movement: forms versus senses-sensations. He calls it "Material for the Spine," a construct or technical approach to improvisational processes. He defines it specifically as a system for both inner and outer exploration of the musculature of the back, which attempts to illuminate the mind from this work of body awareness and compression (see footnote 3).

Section 3. Characteristics of communicative language in the Tuishou

Taijiquan practitioners not only practice forms (*Taolu*) and weapons form (*Qi Xie*), but also push hands (*Tuishou*) as well as scattering (*Sanshou*). Inherited "master-disciple" Taijiquan practice in urban parks is increasingly rare (Ma et al., 2021, p. 2), although in relation to Tuishou, it is more widespread in the West, regardless of the practical context. In the practice of Tuishou, the objective is to avoid being unbalanced and, at the same time, to unbalance the opponent. In this type of dynamic, the aim is to maintain the verticality of the body structure during body contact with the partner with the minimum necessary force. The basic Tuishou work always begins with a series of pre-established exercises to learn not only to move correctly, but also to integrate the non-verbal communication process of active listening. This listening is done by listening to the partner's actions through constant body contact as the best way to connect to one's own body is through contact with another (Huang, 1970, p. 80). This work constitutes a fundamental part of Tuishou training (Gaffney, 2006, p. 40–42). Domaneschi (2019, p. 386)

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4 Smithner et al., 1980.

5 John Cage and Dance, 2022.

6 Salas, 2014.

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7 Paxton, 1980b.

8 McKenna, 2004.

reinforces the concept of this binomial of practice in the Chinese Internal Martial Arts Traditions by alluding to the relationship of their customs, rites, and costumes and the intensification of their traditions.

In the communicative learning process between two people practicing Tuishou, there is a battery of basic exercises that describe circular and infinite trajectories in continuous hand and forearm contact. This is done with fixed feet called "8-disc methods," transmitted in the West through the Canadian master Sam Masich (Mroz, 2011, p. 33). Chen Yanlin was instrumental in this systematization based on the traditional Yang style, applied in a Western way from a somatic perspective (Wolfson, 2007, p. 40; Kauz, 2007, p. 61). Initially, Yanlin[9] describes the traditional systemization of Tuishou communication work based on the acquisition of specific basic skills prior to the acquisition of the so-called "13 techniques" as part of the acquisition of listening skills by both components of the duo. Chen Yanlin's systemization is trained through a sequence of fixed exercises: (a) the one-handed horizontal push and neutralization; (b) the two-handed circle grip; (c) the two-handed push and pull back; (d) a one-handed pull back; (e) a two-handed push and neutralization; (f) the two-handed pull and neutralization; (g) the two-handed folding; and, (h) a one-handed vertical circulation. These types of systematizations are a way of ordering the general principles that are common to all styles. This is the case of Dr. Yang Jwing-Ming (Yang, 1996, p. 30–33), who explained schematically that learning should be "from static to movement mode" (steps), "from slow to fast," "from low to high" or "from expanded to compact" (Figure 3).

The predefined Tuishou exercises are always ordered in such a way that those executed with "fixed feet" give way to more complex ones with increasingly free steps and movements, until reaching the almost total freedom of sparring. On a formal level, Gaffney (2006, p. 40–42), reminds us of the importance of recognizing these phases in the duet system. The reaction forces of the ground change during Tuishou practice, as there is a redistribution in the play of pressures between the practitioners. These exercises constitute one of the experimental improvisation laboratories of the Tuishou practitioner (Wolfson, 2007, p. 37).

In any of the Taijiquan styles we can find the so-called "13 techniques," which include eight qualities or ways of expressing movement (Gaffney, 2006, p. 42). Four would be frontal or "square": *peng* (barding), *lu* (deflecting), *ji* (squeezing) and *an* (pressing) (Wong et al., 2013, p. 400). The other four are called "diagonals" or corners: *cai* (pull down or tear off), *lie* (split), *zhou* (elbow or nudge), and *kao* ("lean," shoulder strike or bump). The remaining "five techniques" refer to orientations in space ("five lines"). They correspond to the transverse directions from the base position: forward, backward, right, left and center. The understanding and mastery of these 13 techniques is sought in Tuishou through exercises of increasing difficulty and

complexity. Each school systematizes it differently, but always in a certain order. In Tuishou, all the work of these "13 techniques" underlies a dynamic of interaction in the duo that can be divided into the following strategies of continuity in the communicative work of physical contact: *Zhan, Nian, Lian, Sui* (stick, adhere, continue, follow). In addition, we find a fundamental quality known as the *Chansi Jin* (coordinated rotation of "reeling silk"). These features of Tuishou are essential elements of Taijiquan, as Tuishou is part of it (Wang, 2009, p. 6–7).

Section 4. Mark Young and Tuishou

Mark Young is a key figure in the history of the development of the Contact Improvisation style technique. This is due to his relationship with the Chinese Internal Martial Arts, with a methodological line of work that tries to complement Taijiquan and Tuishou in order to transfer this combination by evolving toward the Contact Improvisation style. Mark Young trained with first generation representatives of Contact Improvisation such as Karen Nelson, Alito Alessi, or the co-founder Nancy Stark-Smith herself before her near fatal accident in Vancouver (Canada) in 1997 (Gómez-Lozano et al., 2022a). This prior knowledge of the style of Contact Improvisation led her to rescue her practice after the accident. Mark Young's transition and search for the origin of Contact Improvisation brings us back to the somatic relationship with dance. In addition to delving into Taijiquan, Mark Young also delves into *Vipassana* Meditation and in so doing transferred aspects to Contact Improvisation as Steve Paxton had done previously with Aikido and other disciplines (Gómez-Lozano et al., 2022b, p. 9).

In the beginning, many Contact Improvisation practitioners coming from modern dance backgrounds tried to draw inspiration from Asian martial arts, or movement techniques based on kinesiology, rather than from traditional techniques based on expressive vocabularies (Novack, 1990, p. 11). The communicative choreographic language in Contact Improvisation, from its beginnings, has been a system of spirals or sphericity in the interactions of body contact in the duet. In this sense, Young represents a key choreographer in the history of Contact Improvisation as his work is based exclusively on the kinesiological study of the human body: a system of spirals based on the work of Taijiquan (in its forms, *Taoulu*) and Tuishou. These spirals are an amplification of the technique of *Chansi Jin* or coordinated "coiled silk" rotation (Wang, 2009, p. 22). Mark Young uses the radio-ulnar rotation pattern as the motor of movement. Just as Steve Paxton did in analyzing the spiral movement of the body in Aikido, Mark Young designs helical bodies at different spatial levels from the ground in relation to the partner's shoulders. His battery of exercises implies an adaptive evolutionary concept of challenging the laws

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9   Chen, 1943.

FIGURE 3
Tuishou: Nacho de la Encina on the right (Official Representative in Europe of The Line of Zhang Zhijun Chen Shi Taiji) working in pair with Miguel Barberá on the left (Black Belt 1° Dan).

FIGURE 4
Contact Improvisation: Technique for maintaining communication through the spiral between dancers in high level. The Choreographer Mark Young demonstrating in pair; Excerpts from the documentary film "Mark Young in Search of Spirality"' (http://www.flamencoinvestigacion.es/mark-young/).

of gravity in a collaborative way aspiring to a shared elevation (Gómez-Lozano et al., 2022b, p. 11–17) (Figure 4).

In the documentary film on Mark Young's personal story and his own rehabilitation through Contact Improvisation (Gómez-Lozano et al., 2022a), he says (our transcription):

"Steve had this experience in Aikido where he had this spiral movement in his body. The *Aikido roll* is a diagonal roll but there's a twist in the body that's in the spiral. I think that informed his movement - choices, then it became more obvious in Contact Improvisation. It was a long time, maybe more than 10 years of exploring Contact Improvisation and Taijiquan before I realized that we were in - before I encountered spiral rolls as taught by Steve Paxton. It was more than 10 years of practicing Taijiquan and Contact

Improvisation before I knew there was a correlation between the two."

Undoubtedly, not only Steve Paxton, but also Mark Young, deepened both disciplines, Aikido and Taijiquan-Tuishou, which are very interconnected with each other. Common points of technical development were established and applied to the interaction patterns in Contact Improvisation style partner work. Previously, the history of both martial arts had already provided us with these connections between both modalities in which Taoism is considered as one of the pillars from which Aikido is nourished (Protin, 1977, p. 12).

Discussion

Transfer of the communication elements in the language of Aikido and Taijiquan-Tuishou to the duet system of Contact Improvisation

The following elements of communicative interaction are inspired and drawn from *Aikido* and Taijiquan and subsequently transferred by Steve Paxton and Mark Young to the work of Contact Improvisation.

Axial axis and extremities

Aikido aims to align the body axis with the *uke's* axis of motion and gravity, so that the response is executed with minimal use of force or muscle. As a result, both the *uke* and the *uke's* response become invisible, leaving the attacker with the feeling that his target has disappeared into thin air. The practice of *aikido*, therefore, aims to train the formation of the primary axis, to have it aligned for maximum efficiency and effectiveness. *Aikido* makes use of in its practice an awareness training of maintaining the primary axis of the human body running longitudinally from the top of the head to the coccyx. Good *Aikido* practice seeks the integrity of this primary axis (or vertical alignment with the axis of gravity) as a primary and independent foundation for the movement of the limbs. This also happens in face-to-face interactions during *Tuishou* (Wolfson, 2007, p. 37). From this primary axis arises the expansive force of *tori* and the undulatory flexibility of good *uke*. As the primary axis adapts to the vertical, the budding limbs rotate around their own axes to create the spirals of the musculature. This principle carries over into Contact Improvisation duet work where the axis of a partner allows for the spiral adaptation of the partner limbs (Gómez-Lozano et al., 2022b, p. 48). In the phylogenetic development of the human species, the same is true: As the limbs of the human species evolve, they rotate $180°$ around their own axes, causing bones, muscles, and nerves to form spirals. This vital growth force, like the extension of

the *aikidoka's ki* through the fingertips, is what determines the circular and spiral dynamics of interaction in both *Aikido* and Contact Improvisation (see footnote 8). It is very common in the dynamics proposed in his exercise routines by choreographer Mark Young, as there is a constant adaptation of the relationship between the axes of the two practitioners. Both the lower and upper limbs leave space for the contact relationship to predominate between both axes (Gómez-Lozano et al., 2022a). In Steve Paxton's work, the Axis is one of the motor centers where the dance really begins and it constitutes the territory through which he articulates the method of "Material from the Spine" (see footnote 3).

Gravity

At the beginning of the decade, Steve Paxton highlights a subtle piece of information: Experience of gravity, through the so-called "small dance"[10], is where the skeleton balances vertically in the solo form (standing individual) with the minimum of energy needed to sustain the force of gravity with the Earth (Paxton, 2018, p. 36–40). It is through the ground that this experience of the flow of weight through the body occurs, subsequently facilitating the key work in the weight exchange between practitioners during lifts, jumps, holds, or catches, and the feeling of sharing center of balance dynamics with another person in movement[11]. McClure[12] alludes to the fact that gravity for the Contact Improvisation practitioner is like the wind for the sailor that allows us to change course or direction in three-dimensional space. Paxton redefines the concept of Contact Improvisation as the first dance style duet that appears in the life of any human being in the womb (see footnote 6) but in the absence of gravity. Steve Paxton considers gravity the determining and essential factor both in the life of a human and in Contact Improvisation's own style, since from birth, and in the state of extrauterine life, begins what Paxton calls "negotiation" with the gravity factor (Paxton, 2018, p. 5).

This is a new approach in the beginning of Contact Improvisation where it was reflected on how to invite the body into new ways and conditions of relating the body to gravity, the ground and other bodies (see footnote 10). In *Aikido*, the upward thrust of the *aikidoka* is the equal but opposite force of gravity, moving through the fulcrums of weight, into contact with the earth (see footnote 8). It is in the fall, where gravity is sought to go into the void, as a universal concept through which the enemy is accepted and the conflict of confrontation is released "A teacher understands this and expects an imbalance, an opening in the defense of the other. He surrounds with his presence

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10   Paxton, 2004.

11   Stark-Smith, 1980.

12   McClure, 1980.

the void, the negative space in which to trap the spirit and vibration of the enemy." (Saotome, 2013, p. 169). In *Taijiquan-Tuishou,* gravity is a constant allied with the reaction force of the Earth to unbalance the opponent, *Tuishou*, a constant but light contact is sought to maintain control of the redirection of the opponent's forces with the help of that reaction force (Wang et al., 2010, p. 480). According to choreographer Mark Young, in addition to mastering the term grounding with the ground, as an essential parameter in the work of stability in the duet, he challenges the very force of gravity of the earth. Young aspires at all times to elevate verticality through a spiral momentum and the supportive assistance of the partner (Gómez-Lozano et al., 2022a).

Ki and quality of movement in the duo

Aikido training helps us to develop our individual *ki* or energy. It is a form of practice that does not allow us to gain a sense of connection easily with the weight of ourselves (Paxton, 2018, p. 63). *Ki* helps us to focus our mind and helps to replace bound muscle movement with free-flowing energy. By freeing and concentrating our mind and using it in a positive way, it is replenished by life energy. so that there is a vitalizing flow of energy through us. To help extend or send out *ki*, students are taught to use their *hara* or lower abdomen (see footnote 8). This is our physical and energetic center of gravity (see footnote 3). Bringing the mind to the *hara* unifies body, mind, and spirit. Extending *ki* from this center to the periphery, away from the top of the head and fingers, imparts a tensile force to the whole body with the skeleton being the system that provides space for the rest of the tissues (see footnote 8).

When the body and mind are calm, it is much easier to be in harmony with the *ki* of others. By acting, we do not stop or block the flow of someone's *ki* but join with it and guide it to where we want it to go. This is called guiding the *ki* of the partner or the other (see footnote 2). In the early development of Contact Improvisation before performing at the Weber Gallery in NYC in June 1972, 6 months after the "Magnesium" performance, Paxton invited, among others, Lecturer Mary Fulkerson from the University of Rochester who had worked with Release technique, a movement technique based on *anatomical imagery* where she emphasized the softness and this "flow of movement" (Novack, 1990, p. 65). It was known that the "Release Technique" had been influenced by the principles and fundamentals of *Taijiquan*. Undoubtedly Zheng Manqing's presence in New York in the mid-1960s until his return to Taiwan in 1975 influenced the life of New York intellectuals and artists for a decade (Lowenthal, 1993, p. 48). At the same time, Contact Improvisation was also in dialogue with *Taijiquan* and Release Technique in this new way of understanding dance. Most of the dancers who experimented with Paxton in June 2022 practiced both in a Chinatown loft with mats for falling and rolling to find that flow of energy as part of their more primal foundations (Novack, 1990, p. 66). There

are many techniques in *Aikido* that, applied in a natural way following the flow of mind and movement, help to stimulate the flow of *ki* throughout the body (see footnote 2).

Paxton (2018, p. 63) reflects on this concept, alluding to *ki* as a concept that refers to both the quality and potential of connections. Furthermore, he points out that applied to our body and its interactions it allows for flows into relationships with the environment. It seems to be active in an ideokinetic way, as an image-effect that would influence the course in which events unfold. Paxton further remarks that the concept *ki* describes the potential of the principle of extension and the source of energy radiation within the body with the environment where the parts of the body become interconnected. This system relies on the proprioceptive and tactile senses to generate a constant balance and imbalance. The members of the duo transmit information to each other through the skin about each other's movement (Kimmel et al., 2018, p. 4).

Proprioceptive vs. perceptual communication

In *Aikido*, the role of *uke* is an example in this sense when, faced with the threat of being decapitated or killed, *uke* generates a gripping pattern on *tori*'s forearm. In *Aikido* a system of interaction has been developed based on this logic of the weapons carried by the warriors in origin (Westbrook and Ratti, 1970, p. 31). The logic of being in the armed to unarmed state generates a process of proprioceptive communication between *tori* and *uke*. This translates first and foremost into a mastery of listening to the threat of the opponent which first generates the maintenance of the grip with full hand contact on *tori*'s forearm involving the neurological activation of the wrist joints. Second, there is an adaptation of my body to the body of my aggressor. And finally, under a rotational movement of the joint chains, an imbalance is produced as stability is compromised in the face of aggression in order to survive. Active and passive states complement each other, thus creating the duo in an agreed partnership behavior (Sanati et al., 2021, p. 39).

In the dance style of Contact Improvisation, it is transferred in the following way. Steve Paxton describes that during this social system of duets in full kinesthetic communication, certain roles classified as "Active (A), Passive (P), Demanding (d) and Responding (r)" are established. All possible combinations lead to different possible situations in the dynamics of the duo. In order not to block the flow of communication, it is necessary not to "hold on" to these roles but to assume them as an improvised part of this flow (Paxton, 1975, p. 40–42)[13] as is the case in the practice of *Aikido*. This flow of communication is based on a balance of sensitive neuronal afferents and efferent motor neurons that regulate the decisions to activate those fibers

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13   Paxton, 1975.

and inhibit others in the communication of body contact with the partner. The basis of this postural control and constant unstable equilibrium in the duo is governed by the cerebellum. This is the governing organ of the vestibular system, visual system, and proprioceptive system conditioned by a system of duo interaction stimulated by physical sensations through body contact (Juhan, 1987, p. 235). Perhaps of the components of the proprioceptive system, such as the golgi apparatus, free endings, or temperature and pressure nerve receptors, it is the latter that most conditions this two-way afferent and efferent motor communication (Juhan, 1987, p. 29–30). This model of interaction has a key word coined by Erick Hawkins "kinesthetic awareness": the sensation of movement happening in muscles and joints, so that the body can be used efficiently and without tension or stress. At the same time, the dancer should "think-feel," Hawkins' phrase for a state of "intellectual awareness with sensory experience" (Novack, 1990, p. 31). Such an experience is reflected when, in 1977, Steve Paxton was asked what was important in the practice of Contact Improvisation, he replied that the pleasure of using your body was the main thing. He adds that it is also the pleasure of dancing with someone in a spontaneous and unplanned way, where you are free to invent without hindering others, in short, a form of social pleasure (see footnote 11). Each part of the duo improvises freely with the aim of working as easily as possible so that their masses flow in a mutual movement. This attitude manifests itself in the quality of the use of energy. Dancers strategically perceive the possibilities of action, recognize them and exploit them on the fly as happens in other disciplines such as Tango (Kimmel, 2012, p. 76). Steve Paxton focuses on learning in relation to the body's reflexes or reactions to environmental stimuli, which allows learning to be transmitted through interaction and observation with others (Turner, 2010, p. 127).

Point of contact

Balance is established in the relationship of the body to that part which is a useful fulcrum, since in this work a body can be as often on the head as on the feet and in relation to the partner as often as to the ground (see footnote 13). This relationship of balance, often permanently unstable as it happens without physical contact in other more traditional styles (Barba and Savarese, 2009, p. 115–116), leads to a stylization, and to the recognition of the style of Contact Improvisation. It is through this point of body contact that the functioning of the proprioceptive system is activated. This process allows degrees of freedom to be applied to the other articulations which, combined with alternate contact points, form a kinesthetic communication as the basis of this duet system called Contact Improvisation. Paxton explains that it is through the sense of touch that information about the movement of both the other and oneself is transmitted (see footnote 13).

The technical construction of the interaction pattern of physical contact in the Contact style of improvisation, based on the sophistication of rollings, or rolls, aims to create a simple point of contact between two bodies called "rolling point of contact" (Gómez-Lozano et al., 2022a).

Sphericity

In 1972, the first year of Steve Paxton's work, there is a very significant evolution in the assumption of the concept of sphericity. This concept has been present as a routine training for Contact Improvisation practitioners since its inception. Sphericity of movement is evident in the dynamics of *Aikido*, mostly in the rolling falls (Novack, 1990, p. 147). Both in the Documentary film "Chute" (1979)[14] and in "Fall After Newton" (1987)[15] an evolution of the dancers can be observed. In the early phases they concentrated on the internal sensation of movement rather than on the spatial intentionality of their bodies or particular shapes and paths in space. However, the spatial path-trajectories through which the bodies fell and the development of the qualities of movement were different from the piece "Magnesium" in January 1972 in relation to 6 months later in June 1972. In this second phase the patterns in space were schematized by the body and its movement often spiraling through three dimensions. It was often said that Contact Improvisation had to acquire a "spherical sense of space." Steve Paxton reports transforming the "vertical momentum" into a horizontal journey (Novack, 1990, p. 66). A change of plane in which most vertebrates move horizontally in a way that lengthens the segmented vertebral structure and reinforces its spacing function (see footnote 8). In that early 1972 phase, dancers moved and darted through space in many different patterns, usually curved and spiral in nature (Novack, 1990, p. 67).
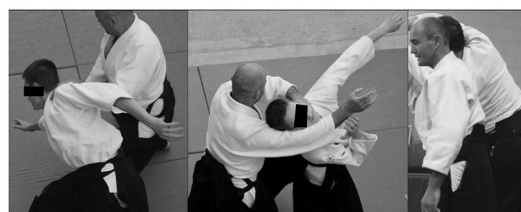
FIGURE 5
Aikido: from Tori's axis looking for the connection of Uke's center generating twists and spirals in Uke's spine. Jesús Arce (Black Belt 5° Dan) in demonstration.

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14   Chute, 1979.

15   Fall After Newton, 1987.

The constant reference to the *hara*, or center of gravity, depending on the eastern or western approach to study, represents the most important energy center in the human body. It is from this point that displacements, movements, and specifically in this art, circular or spherical dynamics are produced (Westbrook and Ratti, 1970, p. 19). The movements of *Aikido* are very fluid. This is precisely because they are mainly circular or spiral in nature, although there is some linear movement (Figure 5).

Circular movement is not only fluid but has a powerful energy (see footnote 2). It is based on the principle of sphericity governed by two fundamental traits: first "centralization," the mental attitude of the *aikidoka* (Szabolcs et al., 2021 p. 11), is strongly centralized in this so-called *hara* (Westbrook and Ratti, 1970, p. 19). Second, feature "extension," the energy required in *Aikido* is extended outward, in a condensed manner and radiated from that center. There are three main types of neutralization circuits, which would be the type of circular trajectory that *uke*'s center of gravity describes when projected around *tori*'s axis of gravity: horizontal, vertical, and diagonal circuits (Westbrook and Ratti, 1970, p. 93).

Rollings, or rolls, belong to the type of "repetitions drills" that are integrated into the warm-up and preparation dynamics across the floor prior to duo work in Contact Improvisation. This design provides curved lines of body contact with other bodies facilitating the spherical nature of partner movement. It also facilitates a kinesthetic understanding of this dual communication as in *Tuishou* partner work where sphericity is present in the relationship between hands, forearms, and hands in contact between practitioners (Dudukchan, 2017, p. 31–32).

Rolls or rollings

There are three general types of rolls in relation to the type of trajectory described by the upper and lower limbs around the center of gravity of the Contact Improvisation practitioner. These rollings generate circular dynamics in the individual and their adaptation to the partner in order to maintain continuity of contact: "*aikido* rolls" (vertical circles, with ascending and descending trajectories around the center of gravity) which, in addition to allowing you to fall without injury, allow you to wrap around the dance partner while maintaining contact; "spiral rolls" (diagonal circuits of spirals around the axis that promote ascending and descending dynamics between Contact Improvisation practitioners) and "crescent rolls" (horizontal circuits that maintain the same level of contact between Contact Improvisation dancers). These roll skills that support body interaction are designed for Contact Improvisation practice. They can be trained alone or in pairs and are grouped into three types: *aikido* rolls (which come directly from *Aikido*), crescent rolls, and helix rolls which come from both the reinterpretation of the fundamentals of *Aikido* and *Taijiquan-Tuishou* (Wang, 2009, p.150–180). In this sense, Mark Young highlights the

usefulness of these patterns by pointing out that they teach us to move through the soft parts of our body without putting pressure on the prominent bony parts such as the hip. Training with these rolls should be done slowly and concentrated on the floor. When we dance, these movements are transferred through partner work because the "muscle has memory," (Gómez-Lozano et al., 2022a).

Aikido rolls

Steve Paxton remarked that in *Aikido*, where there are numerous throwing techniques, it is necessary to learn how to fall without injury. In this way, the art of rolling and falling is taught from the beginning[16], an aspect that he applied in those early stages of exploration in the development of Contact Improvisation (see footnote 14). Steve Paxton picks up on *aikido* roll as a skill of listening to the sensations in the back and neck, to enhance the development of a sensitivity to one's own performance (Turner, 2010, p. 125).

The *aikido* roll is a fluid and graceful way of dealing with loss of balance and falling. The *aikido* roll eventually becomes larger as the *aikidoka* learns to traverse an energetic arc larger than his body. The longitudinal curve of the body becomes a piece of the arc and the *aikidoka* may not actually contact the ground until halfway through a roll (see footnote 8). The principle of relaxation is applied to the transfer of conflict situations in those children who practice *Aikido*. The bodywork tool is part of an alternative methodology to assimilate *Aikido* work in a pleasant way. In the sense that there is a way to handle such compromised situations of confrontation where the resource of rolling becomes an essential resource of application in these conflict situations (see footnote 16).

Aikido roll is a skill used to learn to flow and master this energy when the *aikidoka* uses it as a survival skill in the face of an opponent's projection and has no choice but to fall into the void. This technique is used as a way to understand the path or trajectory (dotted line) on the ground. It is also a technique that can be transferred to the way two spherical bodies in movement and contact can flow. The absence of broken lines allows the permanence of the contact in the duet[17].

Helix rolls

The primary vertical axis extends from the soles of the feet to the top of the head. The opposition between the top and bottom of the vertical axis is a key aspect in the integrity of the *aikidoka*. When this vertical axis aligns with gravity, it allows the possibility of turning forces or moments and spirals to meet the preform in the face of *uke*'s opposition (see footnote 7).

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16   Heckler, 1984.

17   Paxton, 1980a.

The *aikidoka* is able to generate vortices or flows of spherical movements that characterize *Aikido* (see footnote 8). From this basis, Steve Paxton developed the rollings known as helix rolls (see footnote 10). Furthermore, any style of *Taijiquan* has a common element. This is its kinesthetic pattern of radius-ulnar rotation reminds us of those upper limb and hand motor centers of the helix roll where they seem to converge in the same strategy that Steve Paxton uses when performing these "vortex" generating turns or circuits. This is a concept translatable into mathematics tics within fluid dynamics, such as circular, rotating, or spiraling flow of current around an axis (Westbrook and Ratti, 1970, p. 96). Underlying a rival projection are the same dynamic principles whether *Aikido* or *Tuishou*. In the latter modality, rotational dynamics are most visible in the Chen style in certain qualities between opponents of releasing force to unbalance the opponent (Dudukchan, 2017, p. 23). Just as an *aikidoka* blends with the trajectory of an attack to turn it into a circle/sphere/spiral, the contactor can create vortices to give his partner a ride on centrifugal force, or a moment of suspension at the top of an arc of movement (see footnote 8).

The forces applied between *tori* and *uke* are respected in order to maintain the sense of martial origin. The resultant of these two vectors are generators of a spiral movement in both roles more or less visible depending on the technique used. The principle of permanence underlies *Aikido* to maintain the connection and unity between *tori* and *uke*. The spirals allow for such a connection. The same concept underlies Contact Improvisation where spirals allow for permanence in contact in the duo.

The helix roll set is a construction designed with four variants depending on the motor segment leading the movement, the direction of the movement, and the position or reference plane. This type of skill designed by Paxton and developed by Young is based on the same principle of generating energy (*ki*) from the form. It is interesting how the skill of helix rolls helps to sequence the body in movement—a very graphic parallel with the sequence and shape of DNA (deoxyribonucleic acid) designed by Paxton in the helix form in the structure of the human body in movement (see footnote 10) (Figure 6).

The influence in *Aikido*, in the techniques of projection from *tori* to *uke* are very explicit in the way in which Steve Paxton performs the maneuver of execution of the helix roll arms. For his part, Mark Young develops a similar strategy based on one of the movements of the sequence belonging to the *Taijiquan* forms, with a movement of pronation with the palm of the hand upwards and outwards which reminds us, at the same time, of the technical defense gesture of *uke* in relation to *tori* in Aikido. There is no doubt that there are connections both in the styles of both martial arts and in the ways of acting of both choreographers. As well as adding to the knowledge of the technique, they are at the same time complementary and help its development.

Crescent rolls

Finally, we find a set of crescent rolls with four possible variants of execution and training: from the left or right side with the body shape in the curvature of the crescent or waning moon, in addition to the possibility that the motor of the movement is generated in the center or in the extremities. This type of rolling was designed by Simone Forti who describes it as "slow sinuous play arching spine rolling on to back"[18] (Figure 7).

These interaction patterns or rolls are the communicative potential generated in improvised dance between two people. In the Documentary Film: "Mark Young in Search of Spirality. An approach to neurorehabilitation through Contact Improvisation" (Gómez-Lozano et al., 2022a) the following features can be seen:

-   Effectiveness in redirecting movement through the physical contact point as an element of intersection.
-   Constant interaction that allows the couple's situation to be recorded.
-   Spontaneity and adaptability to changes in the postural situation or in the coordinates of the duo.
-   It also provides security, due to the technical mastery of this pattern of interaction with the partner.

Sharing weight and momentum

Stark-Smith (see footnote 11) points out that Contact Improvisation is an activity without a goal, linked to sensations as opposed to achievements. It also emphasizes the freedom to choose any spatial direction and a means of communication through body contact. The dialogue between dancers takes place through the exchange of weight between partners. The duo fine-tunes the physical forces that effect this shared movement between them. In Contact Improvisation, each person needs at least the bodily response of another individual and their own so that a third force can emerge to direct the dance (Novack, 1990, p. 189). The terms of weight sharing, the turning moments due to rotational movements on an individual's axis, as well as the relationship or dialogue of centers of gravity by spatial levels physically determine the spatial dynamics. In Contact Improvisation the shared momentum favors the dynamics of interaction in the duo. It is the imbalance and asymmetry between centers of gravity with a common contact surface that allows the cooperation and collaboration of supports and elements such as lifts and rolls over the partner, inviting risk-taking, reflexes, controlled falls and rises, as well as disorientation, and moving through space together. The
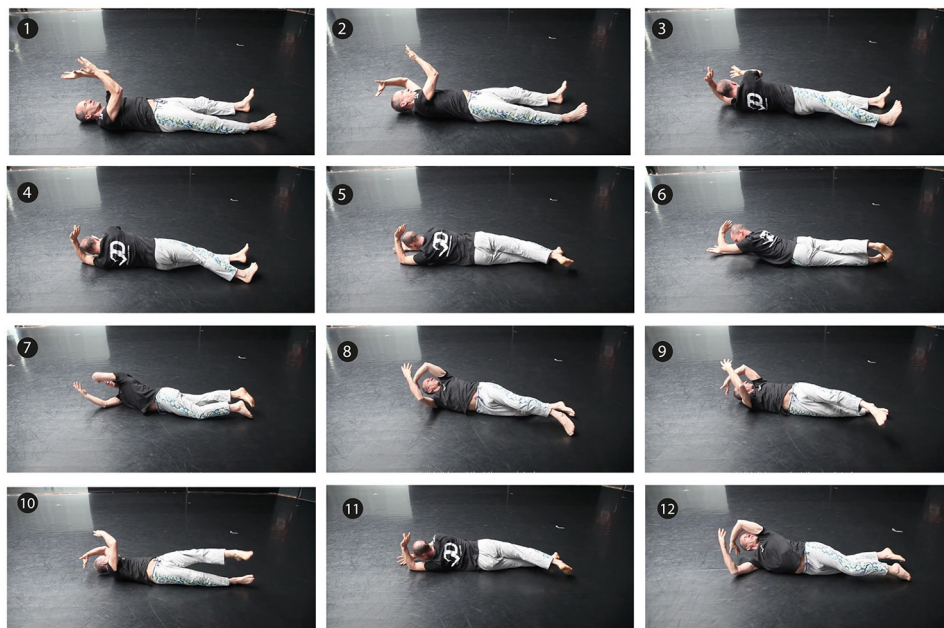
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18   Forti, 1980.

FIGURE 6
Contact Improvisation: Sequence of working floor movement of spirals called "Helix roll" The Choreographer Mark Young in demonstration; Excerpts from the documentary film "Mark Young in Search of Spirality" (http://www.flamencoinvestigacion.es/mark-young/).

FIGURE 7
Contact Improvisation: Sequence of working floor movement called "Crescent roll." The Choreographer Mark Young in demonstration; Excerpts from the documentary film "Mark Young in Search of Spirality," (http://www.flamencoinvestigacion.es/mark-young/).

dynamics are varied in relation to both the speed of interaction and the complexity of the movement or the inclusion of fine motor skills in that duet (Kimmel et al., 2018, p. 4). Spiral and spherical movement in *Aikido* is intended to avoid aggression by generating a shared void between *tori* and *uke* (Saotome, 2013, p. 169). However, in Contact Improvisation style it is about exploring limits, and ranges of movement, as well as alternative loading points and vectors for driving the thrust. In "the Small Dance" awareness of the edges of balance and playing with them, so that we can ride the momentum rolling created by the fall and find suspension again at some new point of balance, rarely centered or upright (Paxton, 2004, p.

14). No position or relationship to another dancer or to the floor is incorrect. Anything is possible and (almost) anything goes. The *aikidoka* mixes with an impulse coming from an unexpected direction, but always with the idea of standing up again. In Contact Improvisation, the feet are only one of the many options of footholds. One is constantly experimenting with new trajectories or thrusts, often through contact with a partner rather than the ground. The extension of the *ki* provides resistance to traction. It widens the periphery of the contactor to generate a more rounded movement and connect it more fully with the partner and the ground. As a dancer's kinesphere expands, so does their ability to follow larger arcs of movement, to take bigger walks and to "take in more air." *Aikido* means "harmony with the *ki* of the universe" In movement, this translates into awareness, connection, and blending. The connection, in both *Aikido* and Contact Improvisation, occurs at the point of physical contact and in the path of movement. In Contact Improvisation, the mantra of the rolling point of contact creates a moving meditation (Gómez-Lozano et al., 2022a). In the same sense the duo in movement is integrated in nature itself, because both participants follow the laws of gravity, of the momentum or inertias of the flow of life (Novack, 1990, p. 185). *Aikido* cultivates living alertness, a presence in the moment with a willingness to respond spontaneously. Unlike Contact Improvisation, most *Aikido* practice is not spontaneous, but an endless repetition of prescribed pathways of movement. Only at the pinnacle of Aikido practice, the *randori* (a more advanced training system used in *Aikido* competition) does the *aikidoka* not know what kind of attack will come, or from where. Not knowing is the basis of Contact Improvisation. It keeps us in the moment. Contact Improvisation works best if we don't plan, don't manipulate, don't try to be clever. The contactor is concerned about where they will be in the next moment. Because the contactor is not concerned about the outcome (such as getting back to vertical or immobilizing the other), they can ride the not knowing into new places and relationships (see footnote 8).

Somatic practices and Contact Improvisation

Somatic practices are also known as "Body Therapies" or "Body Work" (Krasnow, 1997, p.3). Differentiating Contact Improvisation from a somatic practice is a very difficult and painstaking task, since somatic practice may evolve into an improvised dance in pairs, i.e., it converges in the same prism of movement. There are several noteworthy aspects of Somatic Practices and Contact Improvisation:

a) In 1973, Dr. Thomas Hanna (1928–1990), philosopher, somatic educator, and member of the American Council of Learned Societies founded the first postgraduate training

program in Functional Integration, taught by Dr. Moshe Feldenkrais from 1975 to 1977 in San Francisco (Amory, 2010, p. 5). It is known that the pedagogy of Moshe Feldenkrais has spread all over the world, especially in Europe right up to the present day through university academic dance programs. It is Dr. Thomas Hanna who coined the term "Somatic" in 1976. This refers to corporeality, leaving other entities such as the mind out of the term (from the Greek -somatikôs, of the body). The term "Somatic" is developed by Bonnie Bainbrige Cohen (1941 Miami FL United States) in "somatization" as an experience of the body derived from that used by Thomas Hanna as "Soma" (Cohen et al., 2012 p.6).

b) Thomas Hanna differentiates the experienced body in contrast to the objectified body (Amory, 2010, p.6). In other words, somatic practices require an experiential experience based on four pillars between two practitioners: (I) Postural and continuous movement assessment, (II) communication and guidance through touch and words, (III) Experiential anatomy and Imagery, and (IV) "patterning" of new movement options - also known as movement re-education, "movement patterning," or "movement repatterning" (Eddy, 2009, p. 8).

c) The influence of Contact Improvisation with second generation disciplines or teachers of somatic practices has been tangible during the five decades of its history. The close relationship between the postmodern style of Contact Improvisation and Somatic Practices, whose most universalized systematized method was created by Bonnie Bainbridge Cohen, namely, Body-Mind Centering®, is well known. Both styles shared the 1970s as a moment of birth and expansion[19].

d) The martial disciplines *Aikido* and *Taijiquan* themselves have undergone a transformation from their own warlike backgrounds to a path of harmony and well-being, which began in the mid-20th century.

In themselves, both *Taijiquan* and *Aikido* are somatic disciplines in that they convert the martial origins of fighting and lethality into a symbolic resolution of behavior between practitioners "somatic metaphorism" (Foster, 2015, p.179). Non-competitive *Tuishou* is a collaborative somatic listening application of how the full range of possible applications of forces are directed in an attempt to unbalance and defeat the opponent. *Aikido*, according to the foundations of its creator, Morei Ueshiba, not only teaches practitioners to use the energies of an aggressor as a fulcrum of self-defense (Foster, 2015, p.170), but also represents the victory of oneself over the opponent in that acceptance of defeat. Rothman (see footnote 1) points out that in *Aikido* there are modes of attention to oneself and others through tactility and proprioceptive sensitivity. He refers to its principles of

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19 Damian, 2014.

"loving protection" and non-competitiveness to produce a sense of group solidarity. Both *Aikido* and *Tuishou* concur in the same somatic teaching when there is a collaboration of the process of confrontation between rivals.

In both lies the paradox of avoiding lethal confrontation, and the metaphor of transformation is installed (Foster, 2015, p. 179). Notions, such as *Tao* in Chinese culture or *Do* in Japanese culture, have a very similar reading of meanings (Protin, 1977, p. 12). Both expressions integrate the personal search for a state of well-being or psycho-physical balance. These concepts are experienced and transferred in the context of somatic practices integrating art and life. As with all martial arts from a psycho-physical health point of view, they all attempt to train a potential and intrinsic state of the body known in the Chinese tradition as qi. This state is the one we are born into and is present in any healthy and free baby. This word is found, for example, in the discipline of *qigong*, a discipline belonging to the Chinese cultural tradition and internal martial arts that aims to prepare the body in an optimal state of energy mobilization. In the philosophy of applied *Taoism*, the use of *Jing* energy, which comes from the work of conscious *qi* breathing, is distinguished. Mainly distinguished are: *Ting Jing*, the energy of listening; *Hua Jing*, the energy of transformation and *Don Jing*, the energy of understanding (Dreyer, 2017, p. 158). In the *Tuishou* or pushing hands interaction system, these energies (*Jing*) correspond to the tactics employed. These consist respectively of reading the intentions of the opponent through sensitive body contact (listening) in order to adapt to these continuous changes from attack to defense and vice versa according to the situation (transformation), which allows a global perception of the situation (understanding) in the duo, be it in this case of *Tuishou* or of the partner work in dance as in Contact Improvisation. When the *Jing* is rooted in the earth it is named to *Nei Jing*. It gets the *qi* to mobilize with maximum efficiency *wuwei* (Dreyer, 2017, p.60). In this sense we recognize in Western culture a free skeleton (experiential anatomy) in the movements. Energy is then when it can expand in all directions with strength or *Peng Jing*. It is in this way of acting that the experience of a body is strengthened from a somatic conception and applied to dance and the work of Contact Improvisation.

e) It has been the vital moments or crisis situations, such as accidents, injuries, or pathologies, of the leaders or "somatic pioneers," which have triggered a change of consciousness in them to focus the direction of their relationship with their context of bodywork toward an environment of somatic practices:

Irmgard Bartenieff who suffered from childhood polio which led to neuromuscular sequelae created over the course of her life the Bartenieff Fundamentals method. Bartenieff has been the choreographer with the greatest legacy in the history of contemporary dance in the 20th century, together with Rudolf

Von Laban (1879–1969). Moshe Feldenkrais who, after suffering a serious knee pathology from *Jujitsu* and *Judo*, created his own technique called the Feldenkrais method. He is noted for his help in the recovery of children with cerebral palsy. Feldenkrais had two sources of work "Awareness through Movement" & "Functional Integration". Mabel Elsworth Todd, who suffered from idiopathic paralysis or paralysis of unknown origin, was an invalid and unable to walk. Mabel began to work with an "Imagery" method aimed at anatomical muscle balance and neurological recovery. Her method is currently having a great impact on dance in functional capacity training and injury prevention. Such trends in transforming styles and personal events are what create the germ of somatic awareness, which lead the resurgence of somatic methods at the turn of the 20th century (Eddy, 2009, p. 12).

f) Finally, we find a process of "Somatization" of *Aikido* in France in its evolution toward Kinomichi founded by Masamichi Noro (Aomori, Japan 1935-Paris, France 2013) as a discipline originating from *Aikido* in September 1979. It seems that there is a key fact in the creation of *Kinomichi*. Masamichi Noro, a direct disciple of Morei Ueshiba, was involved in a traffic accident in France in 1967. Masamichi Noro's need to create this new style brought together a melting pot of factors: among others, we can mention his adaptation to the Western world since his arrival in France, his opposition to the sportification of *Aikido* in Europe or the close relationship he had acquired with dance. But it was the road accident that triggered his discovery of Western physical therapy methods. He then felt the need to find another discipline that would favor the development and harmonization of *ki*. Curiously, since the 80's, *Kinomichi* has been related to a very useful discipline for contemporary dancers. Toutain[20] stresses that "it is a practice in search of *ki*, an energy of life and not an energy of destruction of oneself and others. Through the search for balance and harmony inherent to this practice, the dancer rediscovers an essence, and finds himself while repairing the "damage" created by certain extreme situations in dance" (p. 72).

Alluding to Eddy and Moradian (2020, p. 1794) we suggest that developing a lifelong somatic relationship with our bodies in movement, through disciplines such as *Taijiquan*, *Aikido*, *Kinomichi* or Contact Improvisation, is a powerful way of reclaiming that integrity that allows us to care for and connect with self and others. Perhaps it was the way Steve Paxton, Mark Young, and Masamichi Noro himself found a way to find their own energy. These disciplines have become interconnected in recent decades, bringing together links that foster an evolution

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20   Toutain, 2005.

of expansion and fusion. In them the human being can establish links of personal growth through the communicative language of interaction between the partners of these disciplines.

Conclusions

Throughout this historical journey, the influence of the construction of Contact Improvisation based on *Aikido* is evident, especially due to the proximity of Steve Paxton in his background as a dancer. Furthermore, the influence of *Taijiquan-Tuishou* seems to be considered as a previous antecedent, but it is not until 1997 with the appearance of the choreographer Mark Young that a system of exercises based on this form of Chinese internal arts is typified. It is perhaps in *Taijiquan-Tuishou* with its kinesthetic pattern of radius-ulnar rotation that converges to those same motor centers that initiate the form of the helix rolls recorded in "Material for the Spine." Concerning Contact Improvisation, from a technical point of view, there are many essential non-verbal communication components in this style construction such as: center of gravity, weight sharing, point of contact, sphericity, rollings, embryonic relationship of axial axis and limbs, *ki* or proprioceptive sense among the most important ones. We must recognize that these factors, often used unconsciously in the teaching of Contact Improvisation, are inherited from martial arts such as *Aikido* and *Taijiquan-Tuishou*. Mark Young undoubtedly follows an evolutionary process inherited from Steve Paxton, perfecting the execution and technical variations of helix rolls in a constructed system of spirals. This choreographer maintains Paxton's legacy of roll technique documented in "Material for the Spine."

Although there is possibly an evolution in the interpretation of the meanings and uses of this dance form, called Contact Improvisation, we can confirm some kinesthetic communication codes and strategies coming from original sources. These sources belong to martial arts such as *Aikido* and *Tuishou* or *Taijiquan* in pairs. These arts are essential in the intercultural communication of the Contact Improvisation duo because they allow the participants to learn fundamentals and principles of non-verbal interaction considered as specific for the mastery of intercorporeality. Moreover, they are already inherent to this dance form, due to its transmission over decades through at least three generations of dancers since its birth from 1972 to the present day.

Somatic practices have been more than just a part of the construction of this style of dance, they have been part of the communication form that has sustained more than 50 years of Contact Improvisation's historical development. This also holds true relative to the elements that have been transferred from both *Aikido* and *Taijiquan-Tuishou*, i.e., center of gravity, weight sharing, point of contact,

sphericity, rollings, spiral movement, embryonic relationship of axial axis and limbs, *ki* or proprioceptive sense. There are exercises or practice routines that help us to incorporate these technical elements from martial arts into the style of Contact Improvisation dance.

Ethics statement

Written informed consent was obtained from the subjects of the photographs for the publication of any potentially identifying images or data contained within the manuscript.

Author contributions

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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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Which "motionese" parameters change with children's age? Disentangling attention-getting from action-structuring modifications

Katharina J. Rohlfing[1]*, Anna-Lisa Vollmer[2], Jannik Fritsch[3] and Britta Wrede[4]

[1]Faculty of Arts and Humanities, Paderborn University, Paderborn, Germany, [2]Medical School OWL, Bielefeld University, Bielefeld, Germany, [3]Faculty of Technology, Bielefeld University, Bielefeld, Germany, [4]Faculty of Computer Science, University of Bremen, Bremen, Germany

Modified action demonstration—dubbed *motionese*—has been proposed as a way to help children recognize the structure and meaning of actions. However, until now, it has been investigated only in young infants. This brief research report presents findings from a cross-sectional study of parental action demonstrations to three groups of 8–11, 12–23, and 24–30-month-old children that applied seven motionese parameters; a second study investigated the youngest group of participants longitudinally to corroborate the cross-sectional results. Results of both studies suggested that four motionese parameters (Motion Pauses, Pace, Velocity, Acceleration) seem to structure the action by organizing it in motion pauses. Whereas these parameters persist over different ages, three other parameters (Demonstration Length, Roundness, and Range) occur predominantly in the younger group and seem to serve to organize infants' attention on the basis of movement. Results are discussed in terms of facilitative vs. pedagogical learning.

Introduction

When addressing children, caregivers modify their behavior in terms of speech (Fernald and Mazzie, 1991; Dominey and Dodane, 2004; Fischer, 2016), gesture (Iverson et al., 1999; Grimminger et al., 2010), and motion (Gogate et al., 2000; Brand et al., 2002). The value of these partner adaptations has been recognized across disciplines (Schober and Brennan, 2003), and they have been discussed as promoting children's recognition of structure and meaning in the input (Zukow-Goldring, 2006; Brand and Tapscott, 2007). Educational studies recommend that caregivers should apply these behavioral modifications to help them attune to children's capabilities and establish a solid basis for learning (Wood et al., 1976; Snow, 1977; Legerstee, 2005). Moreover, studies on the development of artificial systems also use these modifications as strategies for reducing the complexity of input and boosting learning processes by highlighting relevant information (Rohlfing et al., 2006; Nagai and Rohlfing, 2009).

Although these modifications are well-described in speech, their parameters in action are less concrete. Action demonstration—dubbed "motionese" (Brand et al., 2002, p. 72)—is vaguely characterized as "the use of exaggerated and repetitive hand gestures toward infants" (Hirai et al., 2022, p. 1). Being more exact about the parameters, Brand et al. (2002) found that in comparison to adult-directed actions, parents amplify some characteristics such as rate, enthusiasm, or simplifications. Using objective measures, Rohlfing et al. (2006) found that when addressing children, parents' actions were less round (i.e., straight movements) and slower paced (i.e., shorter movement phases with more pauses between each successive single movement) compared to adult-directed actions. However, it is not clear how these parameters might change with children's age and thus developing competencies.

Corroborating the view that the adaptability of communicative behavior is not a uniform process (Brown and Dell, 1987), some approaches view the function of modifications in the ostension as being to attract children's attention (Csibra and Gergely, 2011). Other approaches discuss the structuring function as conveying a better understanding of which parts of a demonstration are relevant (Wood et al., 1976). The structuring function is important because many cultures do not practice explicit teaching. Instead, when an action is structured by "task decomposition" (Sterelny, 2012, p. 35), facilitative teaching takes place, giving children opportunities for learning without being addressed directly (Nakao and Andrews, 2014).

With increasing age, children are more able to perceive a task structure: Lohan et al. (2014) found significant differences between children's age groups (8–11 vs. 25–30 months old) in the likelihood of anticipating the target position of objects. This anticipation, becoming perceivable through children's gaze, can be informative for parents monitoring their children. Pitsch et al. (2014) found that at the age of 8–11 months, 39% of the infants they studied anticipated the goal position of a target object; and during action pauses, 11% anticipated a relevant object for the next action. Crucially, this anticipatory gaze behavior was linked to parental action demonstrations: The infants' anticipation at "checkpoints" (e.g., pauses by the presenter) was "likely to be treated as a display of action understanding," whereas anticipation outside such points, e.g., during subactions, was interpreted as "lack of attention" (Pitsch et al., 2014, p. 88) resulting in a modification of the action range. Checkpoints thus refer to parts of the demonstrated actions that the presenter seems to intend as interim positions—confirming the assumption by Wood et al. (1976) in another context that tutors need to develop a knowledge of the task and its subparts to teach it successfully. At checkpoints, tutor's knowledge about the task is exchanged more closely with the partner, and an agreement is established by partners monitoring each other. Thus, it is not only the parents' intention to teach their children an action that is driving their modifications in

action performance, but rather the close loop between their demonstration and the child's perception and understanding of the task structure (Pitsch et al., 2014).

This report presents two studies aiming to explore whether we can disentangle the ostensive from the task-structuring function by looking at which action parameters change with children's age. We reasoned that some motionese parameters will persist across ages because they are responsible for structuring the task. Following Pitsch et al. (2014), we hypothesized that some parameters such as Roundness and Range would address perceptual skills only in young children.

Study 1

Method

Participants

Parents of 47 children participated in this cross-sectional study. All were identified as Caucasian or European, German-fluent, and the biological parents of first- (53.7%) or second-born children. They had completed formal education with a secondary school diploma (15%) or university-entrance diploma (85%). The different age groups of children (see Supplementary Table A) matched milestones in language development: nonverbal (8–11 months), early-lexical (12–23 months), and advanced lexical (24–30 months).

Parents were recruited in Bielefeld (Germany) and surroundings by newspaper ads and flyers. The original sample contained 90 parents (47 mothers of whom 4 were single parents and 43 fathers) resulting in 90 child-directed (CDA) and 90 adult-directed action (ADA) demonstrations. This dropped to 168 (84 CDA, 84 ADA performed by 43 mothers and 41 fathers), because in 12 either technical or procedural errors occurred.

Stimuli

The following 10 items were objects of demonstrations: a lamp at the beginning; a bell, blocks, cups, stamps, and a sliding door in a second group; and a box with books, box with rings, a bag with a zipper, and a salt shaker in a third group. Items were randomized within the three groups. For the present analysis of action parameters, we chose those items that met both of the following two conditions (see Figure 1): (a) They presented comparable movements in the action demonstrations across tutors; (b) they had a seriating action structure with each action consisting of three separate subactions.

Procedure

Both parents and their child were invited to the DialogLab at Bielefeld University. First, informed consent was obtained from each child's parent. Then, the parent who spent more everyday time with the child was invited to another room and asked to
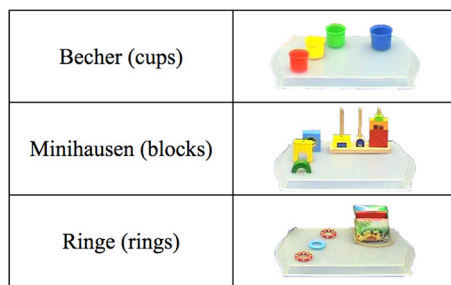
FIGURE 1
The experimental items included in our analysis. *Becher* used different-sized cups with the largest placed to the left of a tray and the other cups on the right-hand side. This tray was placed in front of the presenter who was then asked to stack the cups into each other, beginning with the cup closest to them (green). For *Minihausen*, a wooden construction including three poles was presented in the middle of a tray with three blocks on the side. The presenter was instructed to start with the individual blocks and to put them on the poles one after the other. Finally, for *Ringe*, a box was presented in the middle of the tray that was placed in front of the presenter who was then instructed to put the individual rings into the box, one after the other. These three items were chosen, because each task could be performed by three subactions (see Codings) of taking an object and changing its location.

demonstrate actions with the 10 items to the child sitting across a table. The experimental items were presented successively on a tray on the parent's side of the table so that the child was unable to reach them. The procedure always started with a warm-up item. Two cameras were used: one recording the parent and the other recording the infant, both from the front. Parents were given open instructions before each item: e.g., "Bitte zeigen Sie wie man die Becher ineinander stapelt! Bitte fangen Sie mit dem Körpernächsten an [Please demonstrate how to stack the cups into each other! Please begin with the one closest to you]!" After the instruction, the experimenter hid behind a curtain to one side of the table so as to be out of the child's sight, and the parent demonstrated the actions. The task was completed when all three objects were transported to the goal object (goal position). Next, the parent was asked to demonstrate the actions to the other parent (or to an experimenter in the case of single parents). As a further step, the second parent was asked to demonstrate the actions to the child. Finally, the second parent interacted with another adult (a second experimenter). This addressee was asked to just look at the demonstration, no further action execution was requested, and the objects were out of the addressee's reach. In sum, each participating child was presented with two demonstrations: one from each parent.

Coding

To analyze modifications in the actions performed, data from interactions among adults were collected with the same stimuli. The video data were annotated both manually

and semiautomatically. First, the structure of the parental demonstration and the hand with which each subaction was carried out (either right or left) were annotated manually using the timeline-based annotation software ELAN (Brugman and Russel, 2004). A **subaction** a_i, with $i \in \{1, 2, 3\}$ was defined as beginning exactly in that frame in which the parent had a tight grasp on the i-th object before starting to lift it upward in the next frame. The subaction ended at the time of the exact frame when the parent next released the object to its goal position, meaning the frame in which the parent was still holding the object before releasing it in the next frame.

Second, the motion trajectories of the parent's hands were captured with a semiautomatic 2D motion tracker (Vollmer et al., 2009). This tool records the x and y coordinates for the position of the parent's hands for each frame in the video image. It uses optical flow to estimate the positions of the hands in the next frame, and visualizes them via red and pink dots in the image. The recorded positions were stored in a text file loaded into MATLAB for further analyses. We segmented the trajectory into movements and pauses based on motion speed. If the velocity of the acting hand was below a threshold of 25 pixels/s for longer than three consecutive frames, this part of the trajectory was denoted a **Pause**. All other parts were declared **Movements**.

To analyze the motion from the trajectory segments, we extended previous studies (Brand et al., 2002; Rohlfing et al., 2006; Vollmer et al., 2009) by defining seven objective motion parameters (Table 1). The new parameter Range controls for the distance of the objects and assigns a higher value to an action that was longer than the distance between the objects. When, e.g., two cups were apart from each other, the action path was long; the action's path could also be long when two cups were close to each other, and the action shifted about between them.

Measures were computed for each of the three experimental items and then averaged across items separately for each participant.

Results

Pursuing the question of whether the action parameters (Table 1) of the three analyzed tasks differed when performed toward adults and children of different ages, we applied a 2 (addressee: child or adult as a within-group factor) × 3 (age group as a between-group factor) mixed-design analysis of variance to all parameters. For these analyses, uncorrected alpha was set at 0.05.

With regard to Demonstration Length, there was a main effect of age, $F_{(2,76)} = 7.65$, $p < 0.001$, $\eta_p^2 = 0.17$, showing that the task took longer in Age Group 1 compared to Age Groups 2 ($p < 0.05$) and 3 ($p < 0.01$). Table 2 depicts those Scheffé *post hoc* tests that attained significance. Groups 2 and 3 did not differ significantly ($p = 0.75$). We also found a large main effect of addressee, $F_{(1,76)} = 64.19$, $p < 0.001$, $\eta_p^2 = 0.46$,

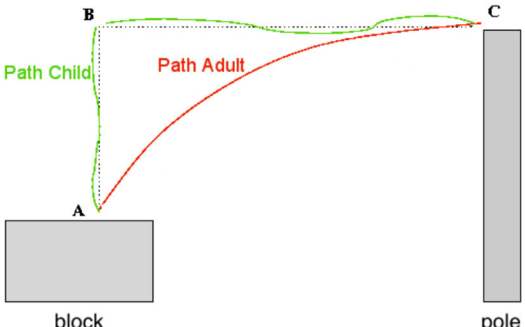TABLE 1   The dependent measures—i.e., the parameters of action modification.

Example of an action: Putting a block on a pole (Minihausen)

Parameter	Measurement unit	Definition
Demonstration length	s	Time in s from the beginning of the first subaction (a1) of a demonstration to the end of the last subaction (a3). This measure does not use any information about pauses or movements during the demonstration: The higher the value, the longer the demonstration. In the example with the block and the pole (see first row), the child-directed action of putting a block on a pole follows a path consisting of AB and BC, which is longer than AC (an adult-directed action).
Roundness	Pixels/pixels	The roundness of an action is calculated as the average roundness of all its movements. The roundness of a movement is calculated by dividing the traveled path [pixels] between movement on- and offset by the distance [pixels] (measured in a straight line) between movement on- and off-set. This measure results in a low value when the movement is particularly square with pauses at the vertices; in contrast, it results in high values when the movement is round. In the example in which a block is put on a pole, the action follows a round path (red line) that is rounder than the child-directed path (green line).
Range	Pixels/pixels	In contrast to Roundness, Range is calculated for each subaction demonstration and does not use the division into movements and pauses. It reflects a relation between the length of a path [pixels] divided by the distance [pixels] between the subaction's on- and offset. When the average of the quotients obtained has a high value, the action is being performed with a longer path traveled in relation to the distance of path on- and offset.
Pace	Frames/frames	The average of all quotients obtained by dividing the duration of each movement [frames] by the duration of its preceding pause [frames]. This denotes the quotient of movement duration and pause duration for an action. High values indicate that the action is performed with long movement phases and relatively short pauses.
Motion pauses	% of action in s	The total length of all motion pauses in an action by calculating the percentage of pauses of an action. More and (or) longer pauses are performed when the number is high. In the example above, it can be seen that the pause (B) is performed during the execution of child-directed movement.
Velocity	Pixels/s	Computed in [pixels/s] only for all movement parts of an action. Movement of the action is faster when the number is high.
Acceleration	Pixels/s^2	Calculated in [pixels/s^2] for all movement parts of an action. The movement accelerates more when the number is high.

TABLE 2 Results from Study 1 along the parameters for action modifications conveying means, *SDs*, and significant effects ($^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$).

	Age group						Effects found in	
	1 (8–11 months, $M = 10.2\ SD = 1.2$) 7 girls, 9 boys		**2** (12–23 months, $M = 18.9\ SD = 3.1$) 7 girls, 9 boys		**3** (24–30 months, $M = 27.1\ SD = 2.1$) 10 girls, 5 boys		**Age**	**Addressee**
	CDA	**ADA**	**CDA**	**ADA**	**CDA**	**ADA**		
Demonstration length (s)	13.29	6.63	9.47	5.1	8.45	4.61	$1 > 2^*$	In all groups:
	(7.06)	(3.1)	(4.79)	(2.16)	(3.57)	(2.01)	$1 > 3^*$	CDA > ADA**
Roundness (pixels/pixels)	4.59	8.18	6.16	6.92	12.26	9.21	Interaction: age × addressee	
	(3.56)	(5.55)	(3.96)	(3.89)	(10.84)	(3.37)	Group 1: CDA < ADA***	
Range (pixels/pixels)	2.98	2.19	2.61	1.98	1.75	1.64	$1 > 3^*$	In all groups:
	(1.46)	(0.81)	(2.21)	(0.6)	(0.84)	(0.53)		CDA > ADA**
Pace (frames/frames)	11.08	40.11	21.13	33.11	21.11	49.51		In all groups:
	(14.18)	(24.86)	(27.5)	(21.51)	(38.29)	(27.4)		CDA < ADA***
Motion pauses (% of action in s)	20.17	6.82	18.13	7.11	15.89	4.12		In all groups:
	(11.31)	(5.87)	(12.44)	(7.85)	(8.37)	(5.04)		CDA > ADA***
Velocity (pixels/s)	148.85	231.33	169.98	229.68	162.96	247.75		In all groups:
	(34.33)	(51.61)	(41.86)	(66.62)	(57.08)	(65.41)		CDA < ADA***
Acceleration (pixels/s^2)	42.07	59.78	41.93	60.25	37.7	65.21		In all groups:
	(12.20)	(17.8)	(11.29)	(22.56)	(16.52)	(21.03)		CDA < ADA***

indicating that demonstrations were significantly longer when performed toward a child (CDA) rather than an adult (ADA) across age groups.

In terms of Roundness, the data revealed an intermediate interaction effect, $F_{(2,75)} = 5.84$, $p < 0.01$, $\eta_p^2 = 0.14$, and Scheffé *post hoc* tests indicated a significant difference between CDA and ADA only in Group 1, $t(30) = -3.35$, $p < 0.01$, meaning that actions were performed less roundly for young children.

For the parameter Range, we found intermediate main effects of age, $F_{(2,75)} = 4.79$, $p < 0.05$, $\eta_p^2 = 0.11$, and addressee, $F_{(1,75)} = 8.53$, $p < 0.05$, $\eta_p^2 = 0.10$, indicating that CDAs were performed with a significantly greater range (i.e., more distance between movement on- and offset) than ADAs across age groups, and that actions were performed with significantly greater range in Group 1 than in Group 3 ($p < 0.05$ according to a Scheffé *post hoc* test). Groups 1 and 2 ($p = 0.55$) and Groups 2 and 3 ($p = 0.14$) did not differ significantly.

Looking at the parameter Pace, CDA and ADA differed significantly in all age groups as suggested by the large main effect of addressee, $F_{(1,76)} = 37.46$, $p < 0.001$, $\eta_p^2 = 0.33$. Accordingly, CDA was performed with less pace than ADA. In other words, in CDA, comparatively short movements were paired with relatively long pauses.

We also found a large main effect of addressee for the parameter Motion Pauses, $F_{(1,76)} = 88.23$, $p < 0.001$, $\eta_p^2 = 0.54$. In all age groups, parents produced significantly more pauses toward their children than toward other adults.

We also found a strong main effect of addressee for Velocity, $F_{(1,76)} = 146.07$, $p < 0.001$, $\eta_p^2 = 0.66$, and Acceleration, $F_{(1,75)} = 96.54$, $p < 0.001$, $\eta_p^2 = 0.56$, revealing that in all age groups, CDA were significantly slower and less accelerated than ADA.

In summary, we obtained results suggesting that the action parameters Pace, Motion Pauses, Velocity, and Acceleration were equally present in all age groups, whereas the parameters Roundness, Range, and Demonstration Length seem to be modified primarily toward younger children.

Study 2

In the following second study, the youngest group was investigated longitudinally to corroborate the findings obtained cross-sectionally.

Method

This longitudinal study focused on nine mothers and nine fathers. This sample size was a product of the necessary data reduction due to technical issues in recording and processing (data of one child excluded). All participants were German-fluent and the biological parents of first- (to 50%) or second-born children (see Supplementary Table B). They had completed formal education with either a secondary school diploma (6.2%)

TABLE 3 Results from Study 2 along the parameters for action modifications conveying means, *SDs*, and significant effects ($^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$).

	Data point (age of children)				Effects found in	
	1st 8–11 months (*M* = 10, *SD* = 1.1), 3 girls and 6 boys		2nd 12–23 months (*M* = 17.5, *SD* = 2.4), 3 girls and 6 boys		Age	Addressee
	CDA	ADA	CDA	ADA		
Demonstration length (s)	11.02 (6.00)	6.56 (3.23)	8.51 (4.03)	4.58 (1.41)	1 > 2*	CDA > ADA***
Roundness (pixels/pixels)	4.94 (3.84)	9.4 (7.2)	6.97 (5.3)	6.16 (2.11)		Interaction: age × addressee
						Time 1: CDA < ADA*
Range (pixels/pixels)	2.5 (1.01)	2.28 (0.98)	2.28 (0.98)	2.11 (0.47)		CDA > ADA*
Pace (frames/frames)	8.6 (9.01)	42.56 (22.87)	16.2 (19.56)	37.36 (19.6)		Interaction: age x addressee
						Time 1: CDA < ADA***
						Time 2: CDA < ADA**
						CDA: Time 1 < Time 2*
Motion pauses (% of action in s)	18.7 (10.9)	5.43 (4.66)	15.14 (8.32)	5.57 (5.43)		CDA > ADA***
Velocity (pixels/s)	0.15 (0.035)	0.24 (0.05)	0.16 (0.03)	0.21 (0.04)		Interaction: age × addressee
						Time 1: CDA < ADA***
						Time 2: CDA < ADA***
						ADA: Time 1 > Time 2*
Acceleration (pixels/s^2)	0.04 (0.01)	0.06 (0.02)	0.04 (0.01)	0.06 (0.02)		CDA < ADA**

or a university-entrance diploma (93.7%). All participants were identified as Caucasian or European.

The stimuli and procedure were the same as in Study 1, with the second assessment being carried out after about 8 months.

Results

To investigate longitudinal effects in parental action modifications toward children, we applied a 2 (children's age: Time 1 and Time 2) × 2 (addressee: child vs. adult) repeated measure analysis of variance to all parameters (Table 3).

With regard to Demonstration Length, we found a significant main effect of age, $F_{(1,17)} = 6.83$, $p < 0.05$, $\eta_p^2 = 0.29$, and a large main effect of addressee, $F(1, 17) = 21.59$, $p < 0.001$, $\eta_p^2 = 0.56$. Both effects indicate that demonstrations were longer when performed at Time 1 than Time 2, but that demonstrations toward children were longer than toward adults across both times.

In terms of Roundness,[1] we found a significant interaction effect, $F_{(1,16)} = 4.82$, $p < 0.05$, $\eta_p^2 = 0.23$. Bonferroni-corrected

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1 For this parameter, we identified one univariate outlier (with a standardized *z* score of 3.99) with a value greater than the mean plus two times the standard deviation that we deleted from the data set (Tabachnick and Fidell, 2001).

post hoc analyses with a significance level of 0.025 indicated a significant difference between CDA and ADA only for Time 1, $F_{(1,16)} = 4.83$, $p < 0.05$, $\eta_p^2 = 0.23$. This result is in line with findings from Study 1. Accordingly, ADA for younger children was performed with rounder movements than CDA.

For the parameter Range, we found a main effect of addressee, $F_{(1,17)} = 7.94$, $p < 0.05$, $\eta_p^2 = 0.32$, according to which CDA was performed with a greater range, i.e., more distance between the on- and offsets of actions.

We found a significant interaction effect for the parameter Pace, $F_{(1,17)} = 4.88$, $p < .05$, $\eta_p^2 = .22$, and a significant main effect for addressee, $F_{(1,17)} = 37.14$, $p < .001$, $\eta_p^2 = 0.69$, indicating that at both time points, CDA was performed with greater pace than ADA: Time 1, $F_{(1,17)} = 35.48$, $p < 0.001$, $\eta_p^2 = 0.68$; Time 2, $F_{(1,17)} = 8.72$, $p < 0.01$, $\eta_p^2 = 0.34$, with Bonferroni correction). However, between time points, Pace seemed to increase for CDA but not for ADA: $F_{(1,17)} = 4.59$, $p < 0.05$, $\eta_p^2 = 0.21$, Bonferroni-corrected for CDA.

For the parameter Motion Pauses, there was a large main effect of addressee, $F_{(1,17)} = 30.09$, $p < 0.001$, $\eta_p^2 = 0.64$. Accordingly, ADA was performed with fewer pauses than CDA.

We also found an interaction effect and a main effect of addressee for the parameter Velocity, $F_{(1,11)} = 31.33$, $p < 0.01$, $\eta_p^2 = 0.74$, according to which CDAs were slower than ADAs across both time points: Time 1, $F_{(1,17)} = 51.7$, $p < 0.001$, $\eta_p^2 = 0.75$; Time 2, $F_{(1,17)} = 31.28$, $p < 0.001$ $\eta_p^2 = 0.65$, with

Bonferroni correction. Additionally, ADAs were slower at Time 2 than Time 1, $F_{(1,17)} = 6.88$, $p < 0.05$, $\eta_p^2 = 0.29$.

For Acceleration, we found a main effect of addressee, $F_{(1,17)} = 34.58$, $p < 0.001$, $\eta_p^2 = 0.67$, indicating that parents accelerated their movements less when demonstrating actions to children than when demonstrating to adults.

In summary, our results suggest that the action parameters Range, Pace, Motion Pauses, Velocity, and Acceleration were equally present across both time points, whereas the parameters Roundness and Demonstration Length were salient toward younger children.

Discussion

Our research analyzed parental demonstrations of actions to children of different ages and compared these to action demonstrations addressing another adult. Our first study took a cross-sectional approach. Extending available measurements, we applied seven action parameters that assess motionese, and we explored whether and to what degree action modifications persist across three groups of children aged 8–11, 12–23, and 24–30 months. We found main effects of addressee for the parameters Pace, Motion Pauses, Velocity, and Acceleration suggesting that for all age groups, actions were performed differently in an interaction with a child than with an adult: Adult-directed actions (ADA) were performed with accelerated, long movements and at a higher velocity, and these were followed immediately by both shorter and fewer pauses. This finding is in line with previous work suggesting that these parameters persist as an action modification across development, regardless of how the interaction partner will react to them. A study by Herberg (2008) showed that adult participants performed a different kind of action toward a picture of a computer than a picture of another adult. This suggests that some modifications will appear without any need for interactive feedback from an interaction partner.

In contrast to Herberg's (2008) study, which was based on only one time point, our longitudinal study found that ADA performance decreased in Velocity from Time 1 to Time 2. Making similar observations for the other parameters in the result plots, we interpret this effect as a familiarization with the study design, with parents at Time 2 mimicking how they demonstrated the actions to their children because, at Time 2, the tasks were all known. This effect can also be interpreted as reflecting a stronger orientation toward the recipient (Clark and Krych, 2004), i.e., movements are adjusted to what the partner already knows about the task (Brown and Dell, 1987).

As to why these parameters persist over different ages, we argue that they seem to structure the action by organizing it through motion pauses. Those pauses, negatively correlating

with Roundness in CDA, might constitute "checkpoints" at which it is possible for interaction partners to display common understanding in the construction of the task. In other words, such checkpoints provide an opportunity for children to anticipate further action and to display understanding of or just readiness for the action demonstration. Pitsch et al. (2014) have remarked that caregivers interpret infants' anticipation outside such points as a lack of interest and attention to the task. However, it is important to note that the idea of checkpoints is still under development, and we cannot state whether every pause during an action demonstration is relevant. We speculate that only pauses related to the presenter's knowledge about the task (Wood et al., 1976) will qualify as checkpoints. Certainly, there is a need to determine more objective measures for them.

When we analyzed the parameters Demonstration Length, Roundness, and Range, we were able to replicate the effect of age group longitudinally, thereby revealing that these parameters were modified in parental behavior: in other words, longer demonstrations consisting of less round movements when performed toward infants at the age of 10 months compared to 17.5 months. The analysis of Range further indicated that this parameter remains a part of parental modifications till the age of 17.5 months but fades away by the age of 24 months.

The function of these parameters when addressing young children might be to increase the salience of the actions: Overall longer performance that has a wider range and is less round suggests the aim of engaging children's attention, because the individual movements appear dynamic and exaggerated, and therefore more salient than a round and more direct motion. In line with this dynamics, Matatyaho and Gogate (2008) showed that parents perform actions such as shaking or looming to highlight some aspects in natural interactions. In addition, if they lose children's interest, caregivers modify their action range in an effort to regain infants' attention to the task (Pitsch et al., 2014). It thus seems that these parameters may be adjusted particularly to younger children's perception of action. Young infants at the age of 6–11 months have been shown to prefer such modified actions (Brand and Shallcross, 2008). Thus, modifications might result from or characterize repairs within an interaction that are needed more often in interaction with young children. One further possible explanation is that motion parameters observable in interactions with young children become replaced with other means such as language. It is reasonable to assume that parents of children who understand aspects of action manner and goal might guide their children more by means of language and less by means of action. A study by Gerson and Woodward (2014) used labeling to support infants' sensitivity to the goal structure of others' actions. Their results strongly suggested that language facilitated infants' understanding of a novel action as being goal-directed. In the course of development, language thus seems

to become a more powerful means of expanding knowledge about actions.

Together, our results suggest that motionese parameters related to the tempo of the demonstrations such as Pace, Motion Pauses, Velocity, and Acceleration persist in child-directed actions (CDA) over different ages and appear to structure the action by organizing it with motion pauses. Other parameters such as Demonstration Length, Roundness, and Range result in longer demonstrations with less round and longer movements (higher Range) within the subactions and are pronounced when addressing young children and probably serve attention organization.

One limitation to our investigation is that we did not focus on the interaction loop. Fukuyama et al. (2014) have shown that parents change their way of demonstrating depending on their 11- to 13-month-old infants' ability to reproduce the movements. In line with this interactional loop, Koterba and Iverson (2009) already demonstrated that 8- to 10-month-old infants' manipulation and exploration of objects change depending on how the action is demonstrated. Another crucial limitation is the setting involving a task that was (too) easy for the adults. Even though participants were asked to demonstrate actions with the simple toys, they might have just performed the motions without trying to convey any information. Because the addressee's knowledge has been found to crucially influence the speaker's way of communication, even among adults (Brown and Dell, 1987), it is possible that the difference between CDA and ADA revealed in our data actually reflects teaching vs. nonteaching behavior. Nonetheless, even with this limitation, our results focus on audience-designed differences in nonverbal behavior performed by parents across different ages, and show that the intensity of the difference can change depending on the child's age as was the case for Demonstration Length and Roundness.

Beside these limitations, our research provides further important impulses for future studies on motionese: Because infants' preference for motionese has been documented (Brand and Shallcross, 2008) without specifying which parameters infants are attracted to, we now need to disentangle whether the preference for motionese is based on the attention-getting parameters of motion (Demonstration Length, Roundness, and Range), the action-structuring parameters, or all parameters together. Studys on different populations could clarify whether children vary in the way they perceive the two motionese parameter groups (attention getting vs. action structuring).

Data availability statement

The original data presented in the study are summarized in the article (Tables 2, 3), further inquiries can be directed to the corresponding author. The data are not publicly available because the informed consent form did not include this possibility.

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

KR, JF, and BW: conceptualization and supervision. KR and BW: methodology. KR and JF: data acquisition. A-LV, JF, and KR: data analysis. KR and A-LV: original draft preparation. KR, A-LV, and BW: funding acquisition. All authors have read and agreed to 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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Supplementary material

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| Frontiers in Communication

Mapping musical dynamics in space. A qualitative analysis of conductors' movements in orchestra rehearsals

Katharina Meissl[1]*, Paul Sambre[2] and Kurt Feyaerts[1]

[1]Department of Linguistics, Faculty of Arts, University of Leuven, Leuven, Belgium, [2]Department of Linguistics, Faculty of Arts, University of Leuven, Antwerp, Belgium

In this contribution, we examine the way in which orchestra conductors use the space around them to convey aspects of musical dynamics. In music, *dynamics* refers to the intensity of volume of notes and sounds and its interpretation is highly context-bound. We approach dynamics as a phenomenon of emergent and construed meaning in interaction, induced by the music score and the interpretation *in situ* by musicians and the conductor. Conductors' movement-based instructions on dynamics result in highly complex usage events. This study aims at disentangling these instances by asking how conductors move and use the space around them to instruct on (un)desired aspects of musical dynamics, zooming in on movement direction as a central formal feature. We find ourselves at the crossroads of cognitive and interactional linguistics, aligning with existing studies on the interactional and contextually embedded nature of music interaction. From a cognitive linguistic perspective, this endeavor translates as the identification of the construal mechanisms (metaphor, specificity and viewpoint) that underlie and therefore motivate movement directions in the specific instances under examination. The analysis is based on 10h of video data from a corpus recorded during rehearsals of five conductors instructing their respective orchestras in Dutch. Our data reveal that conductors use different movement patterns, some of which appear to involve opposite movement directions for expressing a similar music dynamical aspect, e.g., depending on the usage event, a vertical upward movement can mean both a request for playing louder and softer. By taking into account different construal mechanisms, we are able to provide an encompassing multimodal analysis, in which these allegedly deviating oppositional movements appear as consistently motivated (metaphorical) expressions, which profile a similar target concept involving different viewpoints.

Introduction

In Western-European classical music, the role of the conductor is a quite unique one, given that conductors are the only performers who do not actively produce musical sound (Schuldt-Jensen, 2015, p. 386). This fact creates the paradox of conductors coordinating the musical performance without actually having its production in their own hands (Watson, 2012, p. 18). Their responsibilities are manifold: on a very basic level, they need to "direct the musical traffic" (Boyes Braem and Bräm, 2000, p. 146), thus indicating when (parts of) the orchestra should start and stop playing as well as beating time, which is conventionalized to a higher degree in specific beat patterns than other aspects of conducting. On a higher level, the conductor has to conceptualize the complete sounding realization of a musical piece as an interplay of the composer's aspirations as noted in the score, their own interpretation of it as well as the musicians' performance (Schuldt-Jensen, 2015, p. 386). Underlying this complex task is a broad set of expertise, ranging from musical knowledge to leadership and communicative skills (Watson, 2012, p. 18–19).

Among the many aspects that conductors express communicatively toward the orchestra is *dynamics*, which is the focus of this contribution. In music, the term *dynamics* relates to "the intensity of volume with which notes and sounds are expressed" and is "one of the fundamental parameters of composition which function interdependently to create musical meaning and structure" (Thiemel, 2001). Other parameters relevant for performance also conveyed by conductors include rhythm, tempo, phrasing, articulation, timbre and balance. These parameters can, but do not necessarily have to be, noted in the score.

In the score, different aspects of dynamics can be indicated through measures such as *piano*, *forte* and degrees thereof, e.g., *mezzo-piano* and *fortissimo*. Changes in volume can be indicated as gradual in nature, increasing (*crescendo*), decreasing (*diminuendo/decrescendo*), or abrupt as in the case of accent and *sforzato*. Terms referring to dynamics should always be regarded as relative, not as absolute (Gehrkens, 2006, p. 56). While indications of (changes in) volume can be louder or softer in relation to others, their exact loudness is not determined. "Thus *dynamics*, perhaps even more than tempo, will be seen to depend on the taste of the performer or conductor" (Gehrkens, 2006, p. 56).

This context-boundness of the interpretation of dynamics (Weeks, 1996, p. 248) is in line with a usage-based linguistic perspective on both processes of meaning making (Barlow and Kemmer, 2000) and musical performance. We view the conceptualization of musical dynamics as a phenomenon of emergent and construed meaning in interaction (Zima and Brône, 2015), induced both by the normative basis of the music score and the interpretation *in situ* by the conductor and musicians in an evolving joint practice. In a usage-based

model of language analysis, discursive practices associated with orchestral conducting emerge spontaneously and, in the context of a rehearsal, are dynamically updated by participants.

The current paper is structured as follows: In Section *Theoretical rationale and research aims*, we discuss the integration of multimodal interaction analysis of musical settings (Veronesi and Pasquandrea, 2014; Hsu et al., 2021) and cognitive linguistics (Dancygier, 2017) as well as kinesemiotic characteristics of conductors' movements (Maiorani, 2020). This rationale results in the formulation of our research aim to identify construal mechanisms underlying movement direction patterns in situationally embedded instructions. Section *Materials and method* provides information about the video corpus and the method adopted for this contribution. The analysis of seven authentic examples follows in Section *Analysis*. In Section *Summary*, we summarize our analysis on movement direction patterns pertaining to dynamics, construal mechanisms and especially viewpoint phenomena. The findings are discussed in Section *Discussion*.

Theoretical rationale and research aims

With regard to mapping the kinesemiotic alignment of usage events in which conductors instruct their orchestra about the way in which certain phenomena in the domain of musical dynamics are (not) to be performed, our multimodal analysis is inspired by both an interactional and a cognitive approach. We highlight the complementarity of both paradigms as our analysis reveals the importance of situationally embedded and interactionally driven resources as well as the identification of cognitive construal mechanisms along whose lines the kinesemiotic alignment of the movements under scrutiny may be motivated.

Interactional studies on orchestra conducting

We align ourselves with existing studies that regard orchestral interaction as shaped significantly by its situatedness, being embedded in a very specific physical context and embodied in the sense that music-making and conducting rely on the use of the body (Parton, 2014, p. 405). A range of work from a conversation analytical and interactional linguistic perspective scrutinize interaction in different musical (instructional) settings (Szczepek Reed et al., 2013; Tolins, 2013; Veronesi and Pasquandrea, 2014; Sambre and Feyaerts, 2017; Hsu et al., 2021; Ivaldi et al., 2021; Sambre, 2021), focusing on different aspects of embodiment and multimodality as well as the expression and negotiation of instructions. For orchestra rehearsals specifically, the communicative repertoire

of conductors and interaction in the rehearsal setting has been studied with regard to its sequential and multimodal organization (Meissl et al., Submitted; Weeks, 1985, 1996; Veronesi, 2014; Stoeckl and Messner, 2021), conducting gestures (Boyes Braem and Bräm, 2000; Parton and Edwards, 2009), facial expressions used by conductors (Poggi, 2002), vocalized and sung instructions (Messner, 2020) as well as the negotiation of epistemic stance (Parton, 2014).

Similar to other instructional settings, the rehearsal process aims at improving the collective performance of the orchestra, mostly working toward a concert. Rehearsals are institutionalized to a high degree and are thus shaped by a hierarchical distribution of participant roles, in which the conductor, as a default, has the right to speak, while musicians' turns, either to speak or to make music, are prompted either by the conductor or the musical score (Stoeckl and Messner, 2021, p. 2). The degree to which this hierarchy is adhered to, however, varies with each individual conductor-ensemble constellation (Schuldt-Jensen, 2015, p. 388). Next to the relatively stable participant roles, there is a common sequential order for rehearsals. They generally consist of alternating sequences of play and interruption of play. The former are marked by music-making and conducting or so-called instructions "on the fly" by the conductor, while the latter usually contain instructions and discussions of the music just played or to be played next (Messner, 2020, p. 318). Within these larger sequences, several activities on different levels take place, including evaluating, locating, demonstrating, clarifying, describing and signaling (Stoeckl and Messner, 2021, p. 6). The coordination of different activities linked to conducting as well as the progression of the rehearsal combined with the one-to-many constellation makes orchestra conducting a multi-activity (Haddington et al., 2014) par excellence. Conductors need to constantly shift their focus of attention to different aspects of performance and also physically re-orient toward different participants. This results in the gesture space of the conductor shifting constantly due to the affordances (Gibson, 1979) of the physical constellation and the tasks at hand.

For the communication with the orchestra, conductors use spoken or sung language as well as their whole body, drawing upon manual gesture, torso and head movement, body posture, facial expressions and gaze, and sometimes also movement of the legs. Traditionally, there is a division of labor between each of the conductor's hands, according to which the right, or dominant, one is responsible for the beforementioned coordination of tempo and rhythm, while the left, or non-dominant, hand is used for adding information about sound colors, musical phrasings or dynamics (Boyes Braem and Bräm, 2000, p. 245). In this division, the movement of the right hand is more conventionalized, while the use of the left hand appears to be used more for expressing individual interpretation. However, the degree to which this tradition is adhered to is highly dependent on individual conductors. A large part of the art of conducting

remains, as Watson (2012, p. 22) puts it, intangible and is often attributed to "personality, charisma and power of persuasin."

However, certain patterns that shape a conductor's communicative repertoire are identifiable and have been studied from different perspectives. Spoken as well as sung or vocalized instructions constitute an important part of rehearsal work (Weeks, 1996; Messner, 2020), but they often co-occur with other semiotic resources. For example, Stoeckl and Messner (2021, p. 12) identify speech, gesture and gaze in combination as frequent and generic in conductors' instructions, often complemented seamlessly by vocalizations when musical passages or sound qualities are depicted (Clark, 2016). Gaze as well as body position and movement are, according to Stoeckl and Messner (2021, p. 12), primarily used for addressing and orienting[1]. Facial expressions in conducting have been found to be not merely idiosyncratic but systematic in use by Poggi (2002) who describes "the lexicon of a conductor's face." The notion to create grammars or vocabularies of conducting movement is also present in a study by Boyes Braem and Bräm (2000) who attribute metaphorical meanings to certain types of gestures used by conductors. Some of the gestures described in that study, however, also occur in the data set of this contribution with different meanings and nuances. For example, a conductor touching or pointing at their own ear is described as asking for correct intonation by Boyes Braem and Bräm (2000, p. 159), but can also refer to *balance*, an aspect of dynamics, as surfaces in the data set we study. This leads us to conclude that the communicational repertoire of conductors is not that fixed.

Conducting instructions pertaining to dynamics have been studied both from a more quantitative approach by Opazo (2018) as well as qualitatively by Poggi and Ansani (2016) and Poggi (2017). In these studies, video data were analyzed focusing on specific aspects of musical dynamics: *piano, forte, crescendo, diminuendo*, and in the case of Opazo (2018) also the more fine-grained *pianissimo* and *fortissimo*. For instructions on these aspects, a combination of different characteristics was studied: formal features of manual gestures (e.g., handshape, orientation, location), movement parameters (direction, velocity, duration) as well as parameters of expressivity (amplitude, tension, fluidity). Next to certain common handshapes and orientations, such as the fist for loud sounds or a flat hand palm down for soft sounds, tension has been shown to be higher for louder and lower for instructions on softer sounds (Poggi, 2017, p. 41–42; Opazo, 2018, p. 110–111). Movement amplitude is another important parameter for sound volume, with evidence that the larger the movement amplitude, the higher the sound volume that is expressed (Poggi, 2017, p. 41, 43). Similar to the amplitude

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1   However, our forthcoming study on so-called "contrast pairs" (Weeks, 1996) suggests that body movement does indeed play an important role in the expression of instructions about music and sound quality, similar to facial expressions (Meissl et al., Submitted).

of conducting gestures, upward movement to express loud(er) sounds and downward movement for soft(er) sounds have been described in the studies listed above, see also Section *Meaning construal*. However, an aspect which, to our knowledge, has not been studied systematically so far concerns the question whether conductors' dynamics-oriented movements reveal any co-occurrence patterns, along the lines of which certain aspects of musical dynamics are preferably expressed by a specific movement direction on a spatial axis (vertical, horizontal or sagittal). In case direction patterns should emerge, it will be investigated to what extent they can be motivated by situated phenomena of the interaction and/or underlying cognitive construal mechanisms.

Therefore, before formulating our research aims and embarking on the analysis of our data, we take a step back from the specific musical setting in order to familiarize ourselves with more general concepts proposed in cognitive linguistics regarding the construal of meaning.

Meaning construal

Beyond the interactional linguistic perspective, through which we integrate local and situational resources in the analysis, the present study also adopts a cognitive linguistic perspective on the process of musical meaning making (Cox, 2016; Zbikowski, 2017; Spitzer, 2018; Antović, 2019). Choosing a usage-based approach, we view interaction as the integration of all available semiotic resources used for linguistic meaning-making including bodily, visual and acoustic features as they unfold over time (Langacker, 2008, p. 73; Langacker, 2010, p. 90–95; Ladewig, 2020, p. 179), thus extending the phonological pole of a construct (Langacker, 2008, p. 457).

Casad (1995, p. 23) rightly points out that an interactant's "ability to conceptualize situations in a variety of ways is, in fact, the foundation of cognitive semantics." To achieve their communicative purpose, interlocutors have a wide range of so-called construal mechanisms at their disposal. Several typologies of construal operations[2] have already been proposed, e.g., by Langacker (1987, 1991), Taylor (2002), Talmy (2003). Croft and Cruse (2004, p. 45) present an overview of the relevant literature on construal and propose a typology of construal operations, grouped along the general categories of attention and salience, comparison, perspective and viewpoint, and Gestalt (Feyaerts, 2013, p. 207–209). Along the lines of these construal operations, language users may decide to share their experiences in a variety of ways, for instance by conceptualizing the lower parts of a mountain in terms of its *foot*, or by referring to the change of seasons in terms of travel-like movements as in *Spring is approaching fast* or

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2 We use the terms of construal "operations" and "mechanisms" interchangeably.

Finally we can leave Winter behind, etc. Taking a multimodal perspective on interaction, these construal mechanisms can surface not only in speech but also in other semiotic resources (Cienki, 2022).

For our present purpose, we focus our attention on the impact of metaphor, specificity and viewpoint as the most prominent construal mechanisms underlying the expression of (un)desired realizations of musical dynamics.

Firstly, we consider *metaphor*, whose ubiquity has been abundantly described in studies situated within the framework of Conceptual Metaphor Theory (CMT, Lakoff and Johnson, 1980; Lakoff, 1987; Kövecses, 2015; Kok and Cienki, 2016). CMT defines metaphors as systematic cognitive mappings between two conceptual domains. One of these domains, which is complex but not necessarily abstract is called the target. The inner logic of the target domain is represented in terms of the inner logic of another domain, the source, based on some sort of similarity relation. Such metaphorical mappings structure our experience as well as the communication about our experiences (Prové and Feyaerts, 2022). In the present study, we investigate by what imagery aspects of musical dynamics are construed metaphorically in terms of movement in 3D space. In line with previous studies of the spatial hence metaphorical mapping of the concept of musical pitch in terms of verbal expressions of verticality, according to which we speak of *high* and *low* tones, *climbing* and *falling* arpeggios, etc. (Zbikowski, 2002; Shayan et al., 2011; Cox, 2016; Prové and Feyaerts, 2022, among others) we expect to find co-occurring gestural resources for the metaphorical expression of musical dynamics as well. As observed by Eitan (2013, p. 173–176) the domain of verticality or height does not only serve the metaphorical structuring of pitch, as also loudness relations appear to be categorized along the same lines of vertical logic. The mapping of sound volume as size, thus, LOUDER IS BIGGER and SOFTER IS SMALLER as well as the vertical mapping of LOUDER IS UP and SOFTER IS DOWN have already been identified as highly salient in conductors' instructions on musical dynamics (Opazo, 2018, p. 113–114). What qualifies these metaphorical structures as 'patterns' is the systematic, non-arbitrary mapping of the target concept onto a specific alignment of the source concept. Hence, the concept of increasing volume cannot be represented by just any concept in the domain of verticality. Instead, only expressions referring to tall or big objects (*make this a huge forte!*) or upward processes (*climb to that forte!*) can be used to profile increasing loudness. Considering our focus on sound volume and intensity, the current study pays specific attention to metaphors expressed in specific movement patterns used by conductors, according to which, for instance, increasing loudness can be expected to be represented visually by an increasing, growing gestural movement situated on (a combination of) the vertical, horizontal and sagittal axis. Such metaphorical mappings may be grounded in spatial gestalts and force dynamics, relating to both natural or humanly exerted

force (Talmy, 1988)³. Larson (2012, p. 23, 329) demonstrates that notions such as gravity, attraction or other aspects of physical force structure the experience of musical concepts such as melody, meter, rhythm, and tempo in terms of movement in space (Feldman et al., 1992; Johnson and Larson, 2003, p. 75). On a gestural level, metaphorical mapping onto movement in space surfaces in hand or movement shapes revealing SOURCE-PATH-GOAL, CONTAINMENT or other spatial gestalts (Mittelberg, 2018). Characteristics of conceptual PATHS, such as their *directionality*, serve as observable structures which in language and discourse act as interface between sensorimotor experience and conceptualization (Johnson, 2017, p. 86). Instructional conducting movements clearly exploit the spatiotemporal experiential basis of force and movement in space, as, for example, with a downward hitting gesture for a hard sound quality (Boyes Braem and Bräm, 2000, p. 154).

Secondly, the construal operation of *specificity* is omnipresent as it pertains to the level of granularity at which we conceptualize and communicate our experiences (Cienki, 2022, p. 4). For various communicative reasons (expressivity, euphemism, accuracy, humor, etc.) we may decide to use more (or less) detailed descriptions to refer to objects, properties, processes, etc. or to express a stance toward them. In a medical situation, for instance, depending on situational factors like age, previously shared knowledge, relationship and emotional state between the patient and the interlocutor, a doctor may decide to refer to a patient's deadly disease in more general, euphemistic terms like *autoimmune* or *lingering* or *chronical disease*, rather than using a more specific terminology like *lung cancer*. Conversely, along the lines of the same construal mechanism, in their report about the result of a championship's race, a journalist is expected to communicate which medal a race favorite has won, a *golden, silver* or *bronze medal*. However, in their interview, the athlete finishing third may express their joy about having won a *medal* without specifying its color. With respect to the overarching phenomenon of *musical dynamics* as the topic of the present study, more specifically, partially overlapping categorizations like *loudness, intensity, diminuendo, crescendo, accent*, etc. may be used for different communicative reasons and at the same time trigger different verbal and gestural metaphors.

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3 Closely related to metaphorical mappings are so-called *force dynamics* (Talmy, 1988), another construal mechanism that allows us to conceptualize abstract and complex knowledge structures. Force dynamics is a system to express experiences of force exertion, opposition or resistance and overcoming (Talmy, 2003, p. 232) and similarly to image schemas can surface on different levels of metaphorical reasoning (Mittelberg, 2017). These embodied schemas derive directly from our non-mediated bodily experience with the world and organize our experience and comprehension (Johnson, 1987, 29).

As a third construal mechanism, our analysis takes *viewpoint* into account, which pertains to the inherent perspective through which any conceptualization is determined (Sweetser, 2012; Cienki, 2022). In line with a socio-cognitive account of meaning, we understand viewpoint in terms of one's personal perspective on a certain issue, expressed in an intersubjective stance-taking act, which emerges in a constant coordination process of perspective-taking and mentalizing among different interlocutors (Feyaerts et al., 2017). With this view, we side with the Theory of Mind (Whiten, 1991; Tomasello, 1999; Givón, 2005), which identifies our ability to conceptualize thoughts, ideas, emotions, attitudes, beliefs, etc. in other people's mind as a unique human capacity (Brône, 2010, p. 91–92). While interacting, participants imagine what they assume to be in the minds of their conversational partners aligning their construal with it so that, ultimately, conversation emerges as a "process that requires constant alignment and negotiation among *intersubjective* viewpoints" (Feyaerts and Oben, 2014, p. 277–278; Verhagen, 2015, p. 238–240). As already mentioned with regard to the application of metaphor, language users also get to decide from which viewpoint an action or situation will be communicated. "Even if viewpointing is not consciously intentional, linguistic constructions are infused with viewpoint […] to the point where these are conventionalized" for speakers/signers and addressees so that the latter make inferences about the viewpoint of the former, resulting in "joint construal intersubjectively" (Janzen, 2022, p. 6; referring to Traugott and Dasher, 2001). Locating Mary's house, for instance, may be formulated using an external viewpoint as in *Mary lives on the left bank of the river* or by using an internal viewpoint as in *Mary lives across the river*, etc. The choice of the latter variant nicely illustrates the intersubjective dimension of operating viewpoint as a construal mechanism, as it subsumes that the producer of the utterance assumes their interlocutor(s) awareness of the producer's location vis-à-vis the river.

Related to viewpoint, Sweetser (2012, p. 1) highlights the relevance of embodied experience as well as spatiality in reference to gesturing bodies (Sweetser and Sizemore, 2008). Also in Kinesemiotics (Maiorani, 2020), the interplay between the human body and space for the process of meaning-making is foregrounded. In this paradigm, the relation between body and space is regarded as a dual one: physically, a body is located relative to other bodies and it is subject to physical laws of nature. Contextually, or culturally, "a body occupies space as a semiotic dimension, a three-dimensional map of meaningful areas" (Maiorani, 2020, p. 26–27). Not movement of the body as such is inherently meaningful, but rather the projections it makes onto space relative to other participants or objects. In the case of conductors, they are both physically and culturally placed in the center of attention, immediately rendering the space between them and the musicians semiotically charged.

Research aims

At this point, we are well-positioned to formulate the main research aims underlying the present study. At the most general level, we study the question how conductors move and use the space around them to instruct on (un)desired aspects of musical dynamics. In order to highlight the salience of the interaction between moving bodies and 3D space, we isolate movement direction as a formal parameter to identify patterns in conductors' instructions, along the three major dimensional axes: verticality, horizontality and sagittality. In line with existing research on verbal metaphorical patterns in the domain of musical experience (see Section *Meaning construal*), the present study zooms in on co-occurrence patterns, in which certain aspects of musical dynamics are represented by specific movement directions along these spatial axes. Along with the identification of these co-occurrences, we will investigate what motivates them, cognitively and interactionally.

On the level of a cognitive linguistic analysis of the selected usage events, this endeavor translates as the description of the construal mechanisms that underlie directional patterns and systematically surface in the instances under concern. Lastly, we aim to shed light on the benefits of enriching studies of human face-to-face interaction by taking into account metaphor, specificity and viewpoint phenomena in relation to both the spatial arrangement of participants and the object of conceptualization, in this case, musical dynamics. With this research focus, we side with Cienki (2022, p. 12), advocating the study of movement and gesture as "an inherently spatial medium of expression, [which] can allow future empirical research in cognitive science […] concerning spatial cognition as being a fundamental basis for how we conceptualize more abstract domains."

Materials and methods

We use video recordings of five different conductors during rehearsal with their respective wind and brass orchestras in Flanders, Belgium (Simon and Feyaerts, 2020). The conductors did not receive any specific instructions other than to go about the rehearsals as they usually would with the amateur or youth ensembles. In the course of several weeks, three rehearsals per conductor were filmed resulting in about 30 h of material. During recording, the camera was placed behind the musicians in a way that only the conductor is fully visible in the video frame. An additional microphone was placed on the stand in front of the conductor to ensure proper recording of verbal instructions and vocalizations; the language used in the corpus is Dutch. For this contribution, a sub-corpus of one rehearsal per

conductor was delimited for reasons of feasibility, amounting to about 10 h of data.

To identify audible and visual instructions pertaining to musical dynamics, we used the annotation software ELAN (Wittenburg et al., 2006). We included the following usage events in this process, regardless of whether they are produced while the orchestra is playing or while playing is interrupted: (1) verbal utterances referring to sound volume and intensity or changes in volume, e.g., "crescendo," "really fortissimo and then back," "here it's far too loud," (2) vocalizations and singing in proximity to either a verbal utterance referring to dynamics or accompanied by movement and (3) movement-based communication pertaining to volume and intensity (a) along-side verbal utterances, (b) along-side vocalizations and singing, or by (c) movement only.

For movements to be taken into account, they have to noticeably deviate from the regular beating of time in their close sequential surroundings. As soon as the beating of time is temporarily either accompanied or replaced by different movements with any body part which seem to refer to an aspect of musical dynamics, this movement was noted. When beating time remains consistent in shape but changes significantly in amplitude, this was noted as well. Importantly, the 'default' conducting movement is an idiosyncratic value which varies significantly across conductors and largely depends on the different musical pieces being performed and was therefore established on an individual basis.

Four aspects were considered to verify whether instructions refer (primarily) to musical dynamics. First, we checked for verbal utterances which explicitly refer to dynamics during or sequentially close to movements. Secondly, non-lexical vocalizations such as singing or 'shushing' at certain acoustic volumes aided the disambiguation. Thirdly, similar to the next-turn proof procedure in conversation analysis (Hutchby and Wooffitt, 2008, p. 13), we took into account how musicians audibly adjust their performance in response to the instructions at hand. The notion of an embodied next turn proof procedure, where understanding is signaled not only after, but already during a turn, as discussed by Goodwin and Salomon (2019, p. 5) was useful to interactionally frame what happens during conducted orchestra performance, in which instruction and performance occur almost simultaneously to each other. Lastly, highly conventionalized gestural movements were categorized accordingly, as when an extended index finger held in front of the mouth signals silence. In other words, the segmentation of instructions pertaining to dynamics, following a usage-based approach, was based on visual and acoustic cues in the video data and not on the musical score. We decided to focus on what the conductors make relevant in interaction through multimodal practices (Mondada, 2019a) in order not to miss cases, either, where there are

indications of dynamics in the score but the conductor does not convey them through movement, or, where there are no specific indications noted but the conductor does perform relevant instructions.

This segmentation of instructions pertaining to musical dynamics resulted in roughly 1,100 units, which served as a first overview and allowed us to get acquainted with the variety of the cases under scrutiny. In these segments, when present, speech was transcribed based on the concept of intonation units (Chafe, 1994, p. 93). However, as the focus for this contribution lies on movement-based communication, verbal instructions lacking any other semiotic resources were not included in the closer selection.

To analyze movement-based instructions, we chose "Gesture Units" as the unit of analysis, spanning "from the moment the hands leave rest until the hands return to rest" (Rohrer et al., 2020, p. 13), where "rest" is to be regarded as relative and can differ in the degree of relaxation of hand and/or arms depending on different factors such individual styles, handling of objects or environmental conditions. For this contribution, possible rest positions may include interlacing the hand in front of the body, or having them at the side of the body or also the default of beating of time which in essence does not pertain to musical dynamics.

Although conducting movement cannot be fully equated with co-speech gesture, regarding conducting as gesture units and the division into movement phases along with the annotation of formal gestural features facilitate an accurate analysis of complex movements (Ladewig and Bressem, 2013; Rohrer et al., 2020). Importantly, we do not aim at performing a formally strict gesture analysis. Rather, we adopt certain practices to aid our study on movement directional patterns. Consequently, conducting movement was divided into gesture phases, in order to identify salient parts of the previously segmented units. For strokes, movement directions were noted along the vertical, sagittal and horizontal axis, which served the identification of movement patterns linked to musical dynamics, according to common practice in metaphor analysis (Cienki, 2017). Such patterns are, for example, vertically upward and/or sagittally forward movement to express louder sounds, and thus, a value on one or several spatial axes corresponding to a specific meaning. Several patterns of that kind will be discussed in Section *Analysis*. For this contribution, we considered (combinations) of movement directions as patterns when they occurred across all five conductors in our corpus.

In light of the fact that visual access to the conductors' actions is confined to one single camera perspective, which is behind the orchestra, right opposite to the conductor's forward-looking position, determining a movement's alignment along one or more of the spatial axes requires special attention in terms of assuming a flexible analytical perspective along the conductor's constantly shifting orientation toward individuals or (sub)groups across the orchestra.

Analysis

In the following sections, we describe our findings guided by seven authentic corpus examples[4], which were chosen as prototypical instances of the patterns emerging in our data. Rather than structuring our analysis along the different construal mechanisms, we depart from the spatial dimension with regard to movement direction. In Section *Mapping the prototype: Increasing intensity as expanding size*, we scrutinize patterns that have been identified as predominant in previous literature. We enrich these findings by focusing on the interplay of metaphor, specificity and viewpoint. In Section *Complicating the picture: Specificity and viewpoint*, we show alternative ways for construing aspects of musical dynamics in our data and how they can be motivated both cognitively and interactionally. Each example will be examined along the following lines: first, we provide an observational description of the video fragments, focusing on movement directions, which is then followed by a discussion of the construal mechanisms mentioned above.

Mapping the prototype: Increasing intensity as expanding size

Previous work has uncovered several conceptual metaphors serving the purpose of representing the acoustic experience of music and sound in general, one of the most predominant ones being the mapping of VERTICALITY or SIZE onto LOUDNESS. These are highly schematic, so-called generalized metaphors, which can be elaborated in more specific metaphorical imagery like *climbing a ladder* or *producing a big, overwhelming sound*, respectively. In the specific setting of conducting (see Section *Interactional studies on orchestra conducting*), a general observation concerns the amplitude of the beating of time performed by a conductor. Amplitude can be an indicator of the preferred sound intensity at that moment, as described by Watson (2019) and which is also reflected in conducting manuals (for a summary, see Sousa, 1988, p. 34). Indeed, general sound volume as well as a more global atmosphere of (parts of) musical pieces can often be deduced from the size of the movements conductors make. Beating of time with a small amplitude is likely to suggest a low sound volume while a larger amplitude of motion can suggest more intensity. These observations have been confirmed by Poggi (2017) and Opazo (2018) and they also hold for our data set.

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4   The transcripts below are based on the conventions for transcribing multimodal data as suggested by Mondada (2019b). Arrows were added onto stills when considered an added value. Conductors' manual gestures are marked with *, body and head movements with $. Actions from the orchestra are marked with &.

However, amplitude alone is by far not the only possible resource to indicate aspects of dynamics. In order to be able to zoom in on the ways in which conductors exploit the space around them to conceptualize their interpretation of the music played, we will further explore the spatial alignment of these movements along the vertical, horizontal and/or sagittal axis including their directionality on each of these axes.

Along the vertical axis, we see a pattern of loud(er) sounds being depicted as higher up than soft(er) sounds, based on the metaphor LOUDER IS UP and SOFTER IS DOWN. The excerpt in Figure 1A shows this tendency quite clearly[5].
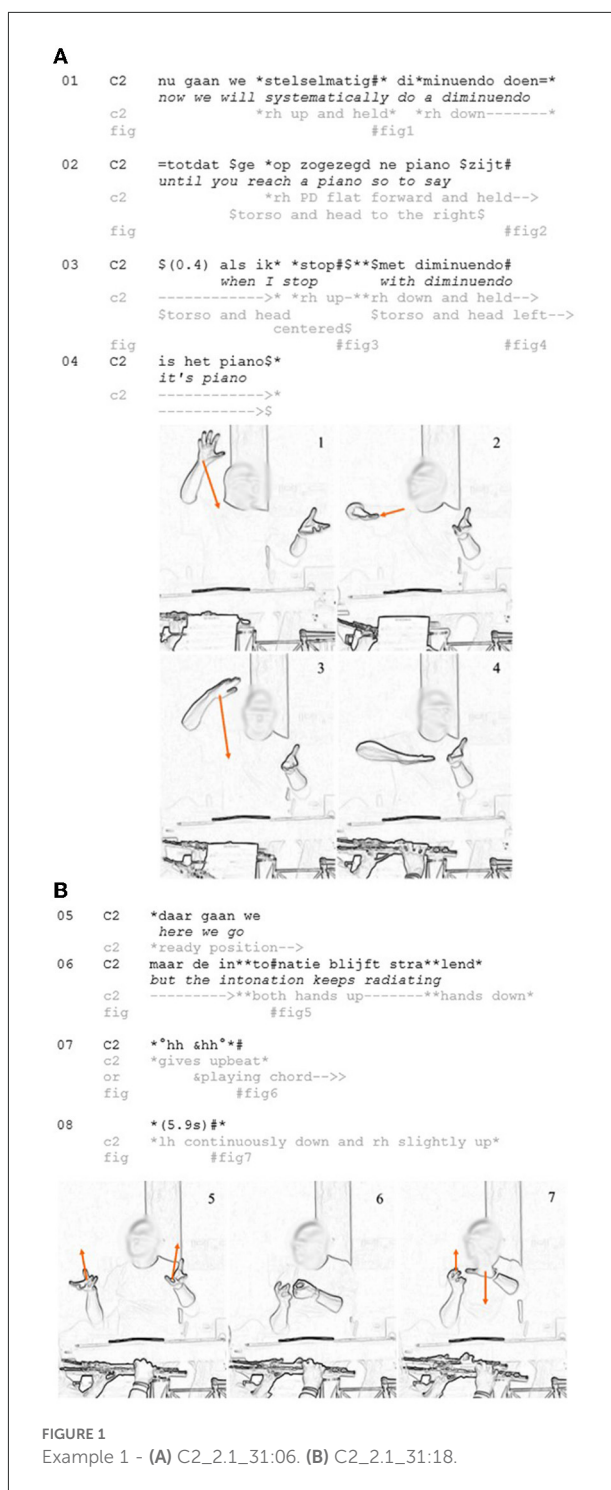
Just before this example, the conductor has been working on intonation across different instrument sections in order to reach clean relative pitches. He has taken up a ready-position for conducting with both hands, signaling that he is about to start another playing sequence. However, before starting, he instructs the musicians to continuously decrease the sound volume (line 01), while they play the respective notes. The conductor raises his right hand over head height in preparation for the stroke of the gesture, a continuous downward movement along a vertical axis, representing a decrease in sound volume (*diminuendo*). After this downward movement, his flat hand is facing palm down and he moves it as if flattening a surface, that is the volume to be reached, namely a piano (line 02). Directly after, he raises his hand to head height again to repeat the downward movement, this time more quickly and holding his hand in the final position at chest height (line 03).

In this example, louder sounds are conceptualized as vertically higher up than softer sounds, which corresponds to findings in earlier studies on orchestra conducting such as Boyes Braem and Bräm (2000, p. 159) and maps onto the VERTICALITY metaphor. The combination of the palm-down orientation with a flat hand and downward movement to signal softer sounds, used by the conductor in this example, has also been observed by Poggi (2017, p. 43–44) and Opazo (2018, p. 79–80).

Additionally, the movement in this excerpt qualifies as the instantiation of the SOURCE-PATH-GOAL metaphor, involving a clear end point, marked by the movement that we described above as flattening a surface. This gesture, as well as the hold after the second and quicker downward movement the conductor makes with his right hand, can be regarded as delimiting the desired scope of intensity. The conductor's left hand is kept in place, still at the originally assumed ready-position and thus serving as a reference point in the gesture space.

Regarding viewpoint, we see that, although the use of different personal pronouns (*we, you, I, it*) marks lexical viewpoint switches, the performed gesture does not impact the perspectivized relation among the participants. Throughout the

FIGURE 1
Example 1 - **(A)** C2_2.1_31:06. **(B)** C2_2.1_31:18.

excerpt, the imagined sound quality is depicted from an external perspective, rather than from an internal one, which could be either the conductor's or the musicians' perspective.

As mentioned in Section *Meaning construal*, VERTICALITY can also serve as source domain for the concept of pitch. To illustrate how verticality may serve the metaphorical structuring

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5 The video clips of all examples can be found in the Supplementary material.

of dynamics and pitch as two different target concepts, even simultaneously, we analyze Figure 1B, which contains the playing sequence following the instruction on *diminuendo* described in Figure 1A.
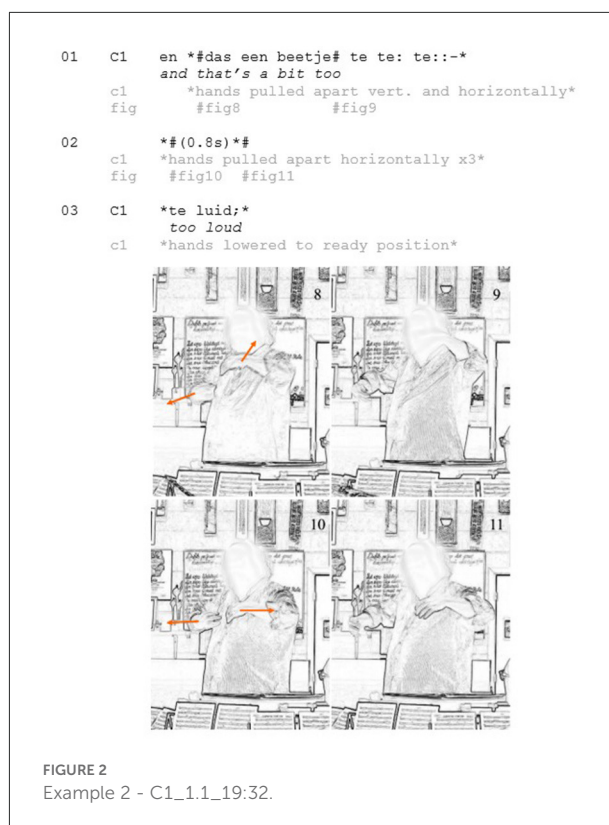
After the excerpt in Figure 1A, the conductor reassumes a ready position, but decides to add another instruction, this time referring to pitch. He says the intonation should "keep radiating" (line 02) and lifts both of his hands to head height facing palm up. At the same time, the conductor tilts his head back and directs his gaze up while raising his eyebrows. He initiates the playing sequence by giving the upbeat, and then holds both of his hands at a central position in his gesture space while the musicians play one single chord. The conductor lifts his left hand up to head height and extends it toward the musicians, the palm facing diagonally toward them and down. He moves his left hand downwards in a continuous motion, thus depicting the systematic *diminuendo* described in Figure 1A. As soon as his left hand has reached about half of the downward path, he raises his right hand facing the other way to chin height, again slightly tilting his head back and raising his eyebrows. This second action refers to the radiating sound quality the conductor asked for and has also been identified as expressing a "radiating" sound quality by Boyes Braem and Bräm (2000, p. 159).

In this example, the two target domains of dynamics and pitch are simultaneously conceptualized along a vertical axis, the depiction of each being attributed to a different hand, thus displaying a complex multi-activity of both monitoring and instructing on different performance aspects.

The complexity of this example also reveals a layering of different viewpoints when looking at both the form of the conductor's right hand gesture and his facial expression. While the gesture is related to the imagined sound quality, the facial expression depicts the way in which an instrument has to be played in order to reach a higher pitch or rising intonation[6]. Thus, the internal viewpoint of the conductor conceptualizing the sound in front of his body is blended with the assumed viewpoint of the addressed musicians who need to produce a slightly higher pitched note in a single integrated scene. Most interestingly, both aspects and viewpoints are metaphorically motivated by essentially the same directionality on the vertical axis.

Like verticality serving as the source domain for different concepts in musical interaction, dynamics as a target domain is also metaphorically structured along the lines of other spatial dimensions, which are still very much in line with the LOUDNESS IS SIZE metaphor. The movements in example 2 critically evolve around the horizontal axis.


```
01    C1    en *#das een beetje# te te: te::-*
      c1       and that's a bit too
      fig      #fig8        #fig9

02          *#(0.8s)*#
      c1    *hands pulled apart horizontally x3*
      fig   #fig10  #fig11

03    C1    *te luid;*
      c1     too loud
      c1    *hands lowered to ready position*
```

FIGURE 2
Example 2 - C1_1.1_19:32.

Before the excerpt in Figure 2 starts, the conductor is working on intonation and has asked individual musicians one after the other to play a single note and to do so very softly. In the example, one musician plays the note in question, but significantly louder than instructed. The conductor comments on this performance by saying "and this is a bit too too too" (line 01) and gestures while trying to retrieve the right word to finish his utterance. He repeatedly pulls both of his arms outward from his body, the palms facing each other. After a short pause in his speech and three more repetitions of the outward movement he says "too loud" (line 03).

What we observe here, suggested by the orientation of the palms facing each other, is the basic conceptualization of a sound as an OBJECT or CONTAINER (Mittelberg, 2018, p. 12) expanding in size with increasing intensity in reference to the conductor's body and gesture space, in which the center marks softer sounds and movement toward the periphery marks louder sounds. The gesture in Figure 2 is therefore also linked to the LOUDNESS IS SIZE metaphor and corresponds to the conceptualization of sounds as "thick" or "thin"[7].

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6   Importantly, the ensembles in the corpus consist of wind and brass instruments for the most part. In this excerpt, the conductor addresses musicians who produce sound with their instrument using air flow through their mouths.

7   It should be noted here, that when referring to thickness of notes, there is often overlap with rhythm and thus the length of notes. Pitch is also conceptualized as thick and thin in some languages, e.g. Farsi (Dolscheid et al., 2013).

Regarding viewpoint, in this example there seems to be a clear involvement of the conductor's own body, from which the imagined sounds travel outwards, hence suggesting an internal, participant's viewpoint, in contrast to the stable external viewpoint described for Figure 1A. It may not be entirely clear whether this scene expresses the conductor mirroring the sound as it travels away from the musician producing it, thus assuming the latter's viewpoint, or, alternatively, the sound as experienced by the conductor himself, from his own perspective, independent of the musician. However, given that the conductor is offering an evaluation of the quality of the note just played, we may assume that it is indeed the musicians' viewpoint from which the sound is mapped in space.

While in the second part of the example in Figure 2, the movement is primarily performed on the horizontal axis, the first few repetitions of the expanding motion also involve some verticality, as the sound is being conceptualized as growing in height, as well as expanding away from the conductor's body sagittally, which leads us to the third spatial axis as yet another dimension of the LOUDNESS IS SIZE metaphor.

In the excerpt in Figure 3, the conductor is talking about the last note in a fragment that has been dealt with just before in the rehearsal. He asked the musicians to play an accent on each beat, which, however, resulted in them also performing an accent on the last note of the passage. Since this is not what the conductor had instructed them to do, he clarifies his request by first depicting the desired version (line 02). To that end, he vocalizes the last five notes of the fragment in question with a decrease in volume while simultaneously pulling his right hand toward his right shoulder. In doing so, the decreasing volume is mapped along a sagittal axis toward the conductor's body. In the second part of the sequence, he offers a depiction of the faulted version as previously played by the musicians (line 04). This time, the conductor vocalizes the same five notes, however, he increases the volume, ending quite loudly on the last note in relation to the previous depiction. Also, toward the last note of the vocalization, he pushes his right hand away from his body in a more intense forward motion while forming a fist[8].

The underlying construal mechanism can in part still be linked to the LOUDNESS IS SIZE metaphor in the sense that louder sounds are construed as further away from the conductor's body than softer sounds. However, a strict interpretation of this metaphor does not suffice to account for

the movement pattern at hand. The production of a louder sound by the musicians is depicted by the conductor with a forward motion away from his body, as if depicting the sound traveling away from its source. However, the retracting motion toward his own body cannot be interpreted based on the same logic. A softer sound, based on the metaphor of LOUDNESS IS SIZE, would have to be expressed in the same direction but with a smaller amplitude. However, this is not the construal operated by the conductor, which, rather, is a construal *ex-negativo*. The motivation of the retracting movement to depict playing softer derives only from its being opposed to the well-established metaphorical mapping of forward-motion expressing increasing loudness.

Whereas, in the previous examples, we witnessed a straightforward metaphorical construal of loudness along the lines of more or less isolated spatial dimensions, the present example reveals a much more complex construal involving not only a subtle interplay between various spatial axes, but also a shift from the conductor's viewpoint to the musicians', most clearly marked by the forward moving fist gesture[9]. This forward movement instantiates the construal of a force being exerted to project an objectified sound out of one's body. Crucially this movement only makes sense by taking into account a construed viewpoint switch, in which the conductor adopts the musicians' perspective of sound being produced by the interplay between their body and the wind instrument.

The analysis of the example in Figure 3 feeds into the critical understanding that the typical construal (and understanding) of musical dynamics (represented here as LOUDNESS) may not be restricted to the isolated metaphorical construal of that target concept in terms of the spatial logic as it occurs along either the vertical, horizontal and sagittal axis. It appears, instead, that the spatial mapping of various aspects of LOUDNESS in conductors' movements typically involve more than one or even all dimensions of spatial orientation. This finding is in line with the observation made by Schuldt-Jensen (2015, p. 395), who notes that the three-dimensionality of conducting movements has received little focus so far in teaching materials for aspiring conductors. Thus, scrutinizing the combination of movement directions seems crucial for an accurate analysis of both conceptual and interactional aspects of conducting.

The following two examples, expressing an intense *crescendo* and a *diminuendo*, respectively, require all three directional aspects in analyzing their metaphorical construal of musical dynamics. Notably, while the instructions in Figures 1–3 were given during an interruption of play, Figures 4, 5 are given on the fly, as the orchestra is performing.

In the excerpt in Figure 4, the conductor is already beating time at a relatively big amplitude and the general sound volume is quite high. Just before the music reaches a climax, he stands

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8 The fist as a handshape has been described by Bressem and Müller (2014; p. 1584) as a recurrent gesture for German, with as its semantic core "strength, force and power" and an assertive quality, used for example to emphasize parts of utterances or signal emotional involvement. Analogously, musical dynamics as force, especially related to louder sound volume and higher intensity is mirrored in the use of the fist in Figure 3. As mentioned in Section *Interactional studies on orchestra conducting*, the fist has been shown to be a typical handshape for *forte* by Poggi (2017, p. 41) and Opazo (2018, p. 67).

---

9 Movement toward the musicians is also noted by Poggi (2017, p. 39) as an indication to play *forte*.

```
01    C4    en de *laatste noot*#
            and the last note
      c4          *rh raised to head height*
      fig                    #fig12

02    C4    ((vocalizing)*ndaheehadee#dam*
            (vocalizing)
      c4                 *rh forward and backward*
      fig                        #fig13

03    C4    en #niet
            and not
      fig      #fig14

04    C4    ((vocalizing)*dadeedadeeDAM$#)*$
            (vocalizing)
      c4                 *rh down and pushed forward*
                            $torso and head left$
      fig                        #fig15
```
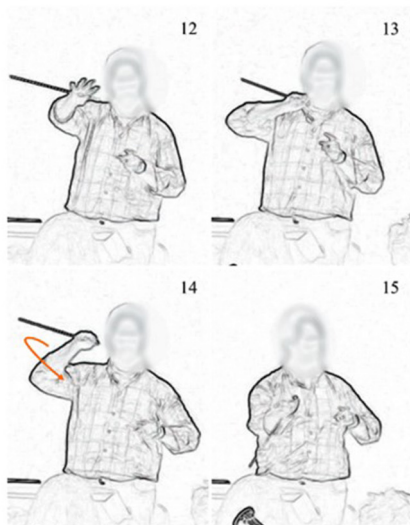

FIGURE 3
Example 3 - C4_1.1_05:52.

```
01        *(2.1s)*    *$#(0.8s)$*
      c2  *rh beating *hands lifted above head height*
              time*
                    $stands up$
      or    >>playing-->>
      fig               #fig16

02        *$#(0.2s)$* *$#(0.4s)$*
      c2  *hands down**hands up, forward and outward*
          $torso      $torso
           lowered$    lifted$
      fig  #fig17      #fig18
```
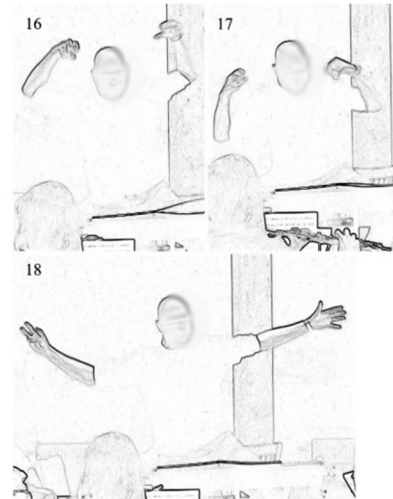

FIGURE 4
Example 4 - C2_2.2_32:56.

```
01        *#(0.5s)$*  *#(1.0s)#*
      c3  >>rh beating time-->>
          *1h lifted* *1h down, towards body and right*
      or    >>playing-->>
      fig   #fig19       #fig20 #fig21
```


FIGURE 5
Example 5 - C3_1.1_4:57.

up from his chair, builds up tension by pulling both arms up and toward himself to then lower them slightly and release the tension right at the point of climax with a composite movement upward, forward and outward thus depicting an intense increase in volume.

Figure 5 shows the instruction for a *diminuendo*, using the opposite movement directions along all axes.

Orienting toward an instrument section to his left, the conductor extends his left arm away from his body in preparation with a flat hand facing palm down. He then moves it downward, toward himself sagittally and to the right horizontally, thus representing a coordinated movement along all three axes metaphorically expressing a decrease in volume. At the same time, he continues to beat time with his right hand, which lets us deduce the salience of the movement with the left hand for dynamics as a specific instruction embedded into the broader activity of conducting.

Regarding viewpoint, Figures 4, 5 display similar aspects we already identified in previous fragments. In both examples the

conductor's body is a point of reference for the trajectory of the depicted sound. While in Figure 4, sound is like an OBJECT expanding, almost bursting out and thus moving away in all directions from the conductor, Figure 5 contains the *ex-negativo* meaning construal (see Figure 3), depicting a softer sound as traveling toward the conductor's body.

In this section, we have shown how the much-discussed conceptualization of dynamics (often conceived of as LOUDNESS) as expansion in SIZE can be nuanced with aspects of force and different viewpoint phenomena. While the

mapping of increasing intensity onto the expansion in space away from the conductor's body forms a clear pattern in our data, we now turn to some excerpts, whose gestural imagery does not seem to fit the construal patterns identified thus far.

Complicating the picture: Specificity and viewpoint

Next to the mapping of increasing intensity as movement away from the conductor's body along the vertical, horizontal and sagittal axis, either in isolation or in compound movements, some examples in our data urge for a more nuanced analysis of the metaphorical projections and interactional phenomena at play in orchestra instruction.

For instance, when looking at movement produced along the vertical axis, in certain cases, musical notes which need to be played more strongly and loudly are marked gesturally by a vertically downward movement, which appears to be the exact opposite to the patterns described in the previous section. This, then, raises the question whether these examples are to be categorized as exceptions.

With the following example, we will demonstrate that a more fine-grained analysis of the target domain in terms of more specific (sub)concepts allows to qualify these 'deviant' cases as instantiations of a coherent construal pattern all the same, situated along the very same vertical axis.

In the course of the rehearsal, Figure 6 directly precedes Figure 3 discussed in the previous section. In Figure 6, the conductor suggests an adjustment to a previously performed musical passage, asking the musicians to play a small accent on each beat (line 01), in this case the first of four notes, of the bars in question. This accent is conceptualized visually by pointing the right index finger down onto the extended left index. Following his verbal instruction, the conductor depicts the musical passage by vocalizing the sequence (line 02), audibly stressing each beat while simultaneously repeatedly moving his right index down with each of these vocalized accents. He initiates a playing sequence (line 03) for this fragment and repeats the previous movement on the fly, this time accompanied by audible exhalations with each accent (line 04).

The example raises our interest in several respects. Increasing intensity is conceptualized as a downward instead of an upward movement as observed in Figure 5. To our knowledge, in the above-mentioned studies on musical dynamics in conducting, the depiction of increasing volume with this directionality has not been described as a pattern. We suspect that one reason for this might be that Poggi (2017) and Opazo (2018) explicitly did not include accents as a subcategory of their target domain. Watson (2012, p. 170), however, in a case study on one conductor, identifies a lifted hand that is then dropped to signal a rapid increase in volume.
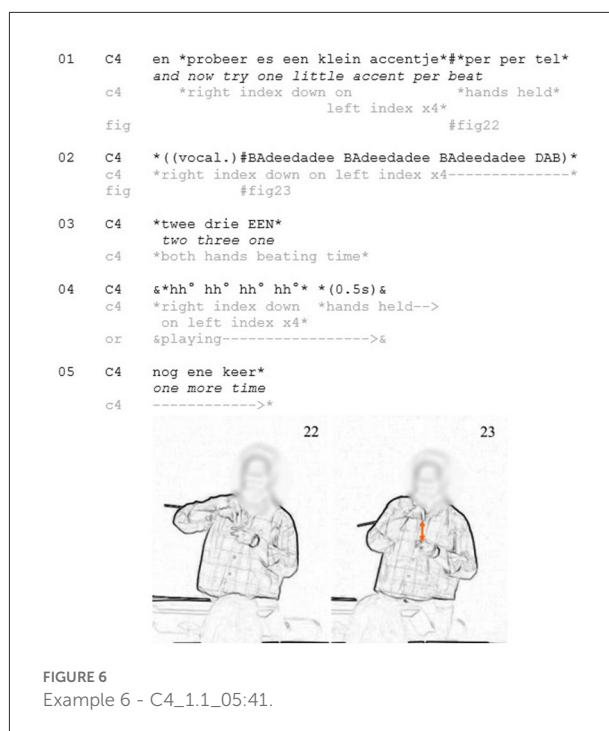


```
01     C4     en *probeer es een klein accentje*#*per per tel*
               and now try one little accent per beat
       c4          *right index down on        *hands held*
                                left index x4*
       fig                            #fig22

02     C4     *((vocal.)#BAdeedadee BAdeedadee BAdeedadee DAB)*
       c4     *right index down on left index x4--------------*
       fig                #fig23

03     C4     *twee drie EEN*
                two three one
       c4     *both hands beating time*

04     C4     &*hh° hh° hh° hh°* *(0.5s)&
       c4     *right index down  *hands held-->
                on left index x4*
       or     &playing--------------->&

05     C4     nog ene keer*
               one more time
       c4     ------------>*
```

FIGURE 6
Example 6 - C4_1.1_05:41.

Comparing Figure 6 to Figures 1, 4, 5, it appears that the directionality of the movement being depicted along a vertical PATH, is reversed. This construal of accentuation raises the grounding image of a force representing gravity or another downward force, as it is exerted upon an object, as noted by Boyes Braem and Bräm (2000, p. 155). Hence, a musical accent, which typically stands out by a sudden in- and decrease of volume and intensity, tends to be metaphorically construed by a rapid downward movement of the conductor's hand. This construal of downward forces, often in combination with a forward directionality, seems very much at odds with the LOUDNESS IS SIZE metaphor described in most of the examples above, where a gradually increasing sound volume tends to be depicted as an object increasing in size.

In light of the laws of physics and the corresponding logic applied by force metaphors, the depiction of softer, unaccentuated sounds as located spatially higher than louder, accentuated sounds is also visible in Figure 6, when the conductor repeatedly pulls his right index finger up in between the downward accents. In general, when a note is accentuated, this implies the notes after it are to be played at a lower intensity, unless indicated otherwise. So, inherently, by contrast, the note immediately following an accent, will sound softer and less intense, which can be mirrored visually as a bouncing back or retracting motion by the conductor. Immediately following Figure 6, in Figure 3, we observe a retracting movement of that kind as a way to conceptualize softer sounds. When taking another look, we can see that, within seconds, the conductor

changes the movement axes along which he conceptualizes similar aspects of dynamics. While in Figure 6, he uses a straight downward movement to depict an accent, just seconds later, to highlight an aspect of the previous performance, he shifts to the more sagittal movement as shown in Figure 3, away from his body for an accent and toward his body for a *diminuendo*. The construal of force is still present in Figure 3, where the movement toward the conductor's body is performed at shoulder height, while the accent is being depicted by a more rapid movement leading away from the body along a downward gravitational path.
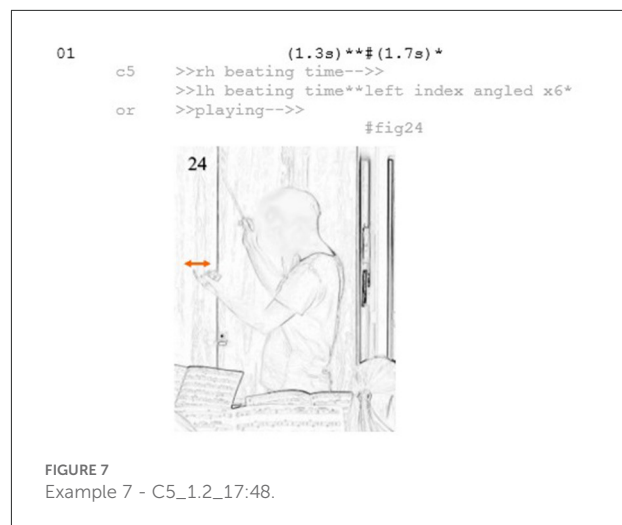
In contrast to Figure 3, Figure 6 also contains a change in viewpoint for the way sound volume is conceptualized in relation to the conductor's body. In Figures 2–5, sound is depicted as if traveling away or expanding more or less away from the conductor. However, in Figure 6, as in Figure 1, we see the notes depicted from an external viewpoint, not relating to the conductor's body as an imagined origin of sound. Therefore, we can see that the conductor's body is not always the point of reference for sound traveling in space. The conductor's gesture space still serves as the point of reference, purely due to the affordances (Gibson, 1979) of the human body. However, sound is depicted as an independent value vis-à-vis the conductor's body as center.

Looking back on Figures 1–6, it seems that while the direction on the vertical axis is interchangeable, a sagittal movement toward the conductor's body in combination with either vertical direction will mostly refer to the performance of a softer sound or a decrease in volume, while a movement away from the conductor's body will mostly refer to a louder sound or an increase in volume. However, there seems to be at least one notable exception to this pattern.

To close off the empirical part of this contribution, we turn our attention to a last excerpt, in which the direction of the sagittal movement seems to run counter to the construal patterns described above, again foregrounding the importance of taking into account viewpoint phenomena.

The example in Figure 7 contains an instruction on the fly, directed at a specific part of the orchestra. In relation to the default conducting position, the conductor's body is rotated to the right, so that he is not facing the camera. At first, the conductor beats time with both hands, but then, as he directs his gaze to a particular subsection of the orchestra, only his right hand continues to beat time. His left hand is directed toward the same subsection, facing palm up with the index finger extended. The conductor then repeatedly pulls his index toward himself, as if asking the musicians to move toward him.

This type of gesture occurs in different variations in our corpus, sometimes involving more than one finger being angled toward the conductor's body or showing an oscillation on the wrist. The latter is also described by Poggi (2017, p. 40) in relation to its meaning in everyday Italian communication,

```
01                            (1.3s)**‡(1.7s)*
     c5   >>rh beating time-->>
          >>lh beating time**left index angled x6*
     or   >>playing-->>
                                       #fig24
```

FIGURE 7
Example 7 - C5_1.2_17:48.

where it is used to encourage someone to approach the gesturer. In orchestra conducting, this movement is attributed a specific local meaning, namely to increase sound volume, and therefore for musicians to 'come forward' with their sound production in relation to others. The underlying metaphor in this case would be related to physical proximity in the sense that something that approaches you becomes louder (Cox, 2016, p. 98). Although in this example the metaphorical construal of objectified sound traveling along a SOURCE-PATH-GOAL schema remains intact, the depicted directionality of the conceptualized movement is reversed on the sagittal axis. In the gesture in Figure 7, the source of the sound is conceptualized as the musicians producing the sound situated on a path leading toward the conductor who represents the goal.

By producing this wave-like gesture, the conductor exploits his unique aural experience, as the only member of the orchestra who, standing in this central position, can hear the full breadth and depth of the sound (Parton, 2014, p. 408). Therefore, a specific sub-concept of dynamics is put in focus, namely the notion of *balance*, which pertains to the relative sound volume of different individuals and subgroups across the orchestra. This, crucially, implies a viewpoint shift. In Figures 2–5 the aspects of musical dynamics under concern are being construed from the assumed internal perspective of the musicians, using the conductor's body as the reference point for depicting the trajectory of the objectified sound traveling through space. Alternatively, as demonstrated in Figures 1, 6, aspects of dynamics may be construed from an external viewpoint. What makes excerpt 7 stand out against all previous examples is the conductor unambiguously performing a movement from his own viewpoint being physically and prototypically located in front of the orchestra. What this example demonstrates, is the need to actively integrate the construal mechanism of viewpoint in the analysis of this and other examples in order to obtain a

fully motivated account of the visual component structuring this instructional usage event.

The excerpt in Figure 7 very much puts the notion of intersubjective construal on display, featuring the conductor as playing with various viewpoint options during rehearsal, while at the same time—relying on various elements of common ground (Clark, 1996)—assuming the musicians to be able to successfully interpret his various, sometimes fast-changing construal options.

The opposite of this wave-like gesture toward the conductor, which would be a movement away from the conductor or a gesture that stops the imagined approach of sound toward the conductor to indicate a softer or more restrained sound production, did not emerge as a clear pattern in our data. However, another study presents empirical evidence for this variant in the form of a flat hand with the palm facing the musicians and moving toward them instructing them to hold back (Poggi, 2017, p. 42) which suggests that the adoption of this viewpoint also holds for both movement directions on the sagittal axis.

Zooming out, our analysis has demonstrated that a coherent systematic account of a conductor's movements representing aspects of musical dynamics requires taking into account interactional, situationally grounded resources such as the spatial setting and placement of (sub)groups of musicians, as well as (pre-)conceptual and intersubjectively aligned construal mechanisms such as different types of metaphorical mappings and perspectival projections.

Summary

In this contribution we analyzed conductors' movements as they are used to express aspects of musical dynamics, thereby scrutinizing the use of space and spatial relations between conductor and orchestra. Movement direction along three axes was the ultimate analytical focus of this endeavor. We will summarize our findings in terms of the identified movement direction patterns as they can be motivated by underlying construal mechanisms.

With reference to the vertical axis, we can say that the conceptualization of louder sounds as up and softer sounds as down is a clear pattern in our data (Figures 1, 4, 5), confirming earlier studies (Poggi, 2017; Opazo, 2018). However, we also found instances of louder sounds being depicted by conductors in a downward movement just like the representation of softer sounds in an upward movement (Figures 3, 6). We argue that this may relate to different qualitative features of the acoustic experiences under concern, thus rendering them inequivalent target concepts within the overarching domain of musical dynamics. It appears, for example, that instances of a rapid, accent-like increase in volume tend to be depicted more often with a downward movement. On the sagittal axis, most often, movement away from the conductor translates to louder sounds, whereas movement toward the conductor indicates softer sounds (Figures 3–5). Here as well, our data provide instances in which the opposite directionality, expressed by a wave-like gesture moving toward the conductor, co-occurs with the conductor requesting musicians to play a louder sound (Figure 7). On the horizonal axis, finally, we have found that movement outward from the conductor refers to louder sounds and inward movement to softer sounds (Figures 2, 4, 5). For this axis, more than for the other two, the constant situational re-orientation of the conductor's body as well as the overlap with other aspects that may be conceptualized horizontally (e.g., the sequentiality of the written score) didn't allow us to identify other patterns that would suggest opposite directionality.

Importantly, we see that in no way a one-on-one mapping of a musical dynamic meaning onto a particular axis (horizontal, vertical, sagittal) or even a directionality (up vs. down, away from vs. toward body) on one specific axis could be identified. Depending on the type of experienced loudness, be it a gradual increase or a sudden accent, the movement's directionality, even on the same axis, may alter. Still, the directional co-occurrence patterns we were able to identify allow us to draw conclusions about some of the construal mechanisms underlying these multimodal instructions regarding sound volume and intensity.

The metaphorical mapping LOUDNESS IS SIZE is a dominant pattern, as shown in previous studies. Applying this metaphor, louder sounds are depicted as higher up vertically (Figures 1A,B) and further away from the body both horizontally (Figure 2) and sagittally (Figures 3, 4). Oftentimes, the conductor's body serves as a point of reference from which increasing sound is depicted as traveling further into space, away from the body. Importantly, we observe that the instances of movement toward the conductor's body or center of their gesture space in order to express softer sounds (Figures 3, 5) can only be understood *ex-negativo* on the background of the dominant co-occurrence pattern of outward movement being used to represent increasingly louder sounds.

The structural impact of the schematic SOURCE-PATH-GOAL metaphor is apparent in movements expressed on both the vertical (Figure 1) and sagittal axis (Figure 3), whose directionality may also be reversed (Figure 7). Depending on the viewpoint being adopted, different starting and end points of the traveling sound, either integrating the conductor's and the musicians' bodies or not, may be conceptualized. Our analysis has also revealed that the metaphorical conceptualization of sound as an object facilitates the representation of aspects of musical dynamics as a growing or shrinking movement along two or three spatial axes (Figures 2, 4, 5).

Force metaphors surface in different ways when it comes to musical dynamics. There is the notion of hitting or pushing an imaginary object sagittally away from the conductor's body (Figure 3) to conceptualize louder sounds, as a force created

through physical motion. Gravity as omnipresent force of nature also influences the conceptualization of sounds along the vertical axis, depicting louder sounds as downward falling, softer sounds as upward rising movements (Figure 6).

With regard to the construal mechanism of specificity, the examples above demonstrate that varied metaphorical structures that surface in supposedly opposite movement directions ask for a more fine-grained differentiation of the target concept under scrutiny. We have observed that a metaphorical analysis linking all mappings from a source concept to a static schematic target concept like LOUDNESS cannot account for all the gestural imagery in this subdomain of musical dynamics. Accordingly, we have uncovered allegedly conflicting gestural imagery involving the representation of growing sound volume or intensity by means of either an upward (Figure 4) or a downward vertical movement (Figure 6). Yet, when taking LOUDNESS into account as a dynamically construed target concept, which may be specified on multiple levels of granularity, the allegedly opposing metaphors suddenly make sense vis-à-vis one another. It appears then, for instance, that if we consider the factor of temporality as part of the target structure INCREASING LOUDNESS in order to distinguish between a sudden, accent-like increase from a gradual increase of volume, the sudden downward vertical movement corresponds to the former target specification, whereas the upward vertical movement represents the gradual *crescendo*-type of increase of volume.

As mentioned above, the viewpoint from which instructions on dynamics are conceptualized has a direct impact on the depicted directionality. In general, two kinds of viewpoints can be distinguished in our data when it comes to the depiction of musical dynamics. A first option is taking an external perspective, from which sound is depicted as occurring more or less independently from the participants' bodies—always taking into account the affordances and constraints that the human body imposes on movement and gestures. The second option concerns taking the internal viewpoint of a participant. The application of an external viewpoint is expressed in Figures 1, 6, whereas all other examples depict sound in relation to the conductor's (i.e., the gesturer's) body. Within these participant viewpoints further distinctions can be made, since they can either be ascribed to the conductors themselves or (parts) of the orchestra when it comes to the imagined source of sounds traveling through space. However, often it is not clear whether conductors conceptualize their own body as the imagined source of the sound, therefore mirroring the musicians as the actual source of the sound, or if the conductors merely depict the sound as they themselves envision it, irrespective of it originating from a specific location. It is hard to tell whether it is the conductor's own viewpoint or rather that of the musicians assumed by the conductor in a process of intersubjective coordination. To disambiguate these possibilities, the interactional context or iconic movement for playing a certain instrument can help.

In one type of movement that we described above, conductors unambiguously adopt their own viewpoint in instructions on musical dynamics (Figure 7). With this wave-like gesture, as if inviting the musicians to approach the conductor, which has been described in earlier studies, sound is clearly conceptualized as traveling from the musicians toward the conductor.

Although the different possibilities to perform instructions about musical dynamics are complex and not always clearly distinguishable, their interpretation apparently does not seem to pose any problems to musicians during rehearsal. Rather, there are several factors that contribute to the interpretation of a movement and aid the process of disambiguation. On the one hand, there is the musical score that serves as a reference for participants. On the other hand, additional formal aspects of movement such as handshape and orientation of the hand or qualities such as amplitude or tension feed into the interpretation of movements as part of the usage event. Also, as Poggi (2017, p. 39) notes, aspects of musical dynamics can be expressed either as "global gestures" or by a single parameter within one movement.

Even if, as in our corpus, we cannot exactly monitor or test musicians' reactions to or understanding of these instructions, the observation whether and, if so, how certain passages are repeated or resumed may provide an indication as to whether previous instructions might have been unclear. Additionally, a perception study on instructions about musical dynamics has shown that there is no significant difference in understanding of these movements between participants with and without musical experience (Poggi et al., 2021, p. 1493). An expert group was able to give more fine-grained interpretations (e.g., between a *crescendo* and a *forte*), but general patterns (*louder, softer*) were equally recognized by non-experts. This confirms the observation we make, that deeply embodied metaphorical mappings underlie the instructions on musical dynamics, as proven in their local occurrence in our data.

With regard to the method adopted in this study, there are several adjustments that would improve future research. First of all, the segmentation of cases could be conducted from a more economical vantage point, stopping annotation with the first occurrence of a specific movement direction connected to a certain aspect of dynamics across conductors instead of marking all cases of dynamics instructions. Secondly, integrating the musical score could add another layer to the analysis, which we explicitly excluded for this contribution (see Section *Materials and method*). Lastly, inter-coder-agreement tests could enhance the reliability of annotations. However, the goal of this contribution was not an exhaustive account of all occurrences of instructions pertaining to dynamics in our data set, enabling us to generalize our findings. Rather, we aimed at addressing mechanisms underlying movement patterns that surface in our data to enhance our understanding of movement-based communication.

Discussion

Zooming out to a higher level of both methodology and description, finally, this study presents a clear case of the way in which a multimodal analysis of face-to-face interaction—in our case conductors communicating with their orchestra during rehearsal—benefits from a combined analytical approach, in which both cognitive construal mechanisms and situationally bound interactional resources are taken into account (see, among others, Deppermann, 2012; Zima and Brône, 2015). More strongly even, our study has shown that an adequate analysis of the movements made by conductors in depicting aspects of musical dynamics requires an integrated account of both perspectives. Although not the main focus of our current analysis, several of the discussed examples have revealed the relevance of the situational setting of the conductor vis-à-vis the orchestra just as well as the temporal sequence of the actions and usage events as important interactional resources, capable of (co)motivating the kinesemiotic characteristics of the movements expressing aspects of musical dynamics. With regard to the spatial elaboration of a movement, accordingly, it does matter which (sub)sections of the orchestra the conductor is addressing, how deep and broad the rehearsal room is, or which movement a conductor has performed during a preceding interactional sequence, etc.

In this contribution, our main focus has been on the identification of movement direction patterns and the discussion of multiple construal mechanisms underlying and motivating them. By focusing our analysis on the three spatial axes (vertical, horizontal, and sagittal) along with the directionality of the movement on either of them, our empirical analysis has contributed to a better and motivated understanding of the spatial dimensions used to depict elements of musical dynamics. As we scanned our corpus for multimodal (verbal and gestural) instructions pertaining to musical dynamics, we were able to identify three major construal mechanisms (metaphor, specificity, and viewpoint) underlying them. As such, uncovering the power of these construal mechanisms reveals the ways in which locally situated interaction may be embedded in schematic patterns of embodied conceptualization. Yet, in our study we have moved beyond the scope of a metaphorical analysis of multimodal musical expressions anchored to a generalized conceptual metaphor(s) like LOUDNESS IS SIZE, which may be found to subsume the verbal and gestural variations in the corpus. As a matter of fact, our analysis has revealed and overcome two issues, which may render a traditional conceptual metaphor analysis, if taken by itself, rather idle.

The first issue concerns the coarse-grained level of description, at which metaphor analyses sometimes aim to identify a relevant target concept or domain (like LOUDNESS), for which then structural mappings from specific source domains are being described. As we have shown in our analysis, the frequently quoted, highly schematic concept of LOUDNESS may not be the optimal level of description on which one starts looking for systematic metaphorical mappings in both verbal and gestural expressions. The key to a motivated understanding of the allegedly opposing metaphorical construals serving the same schematic target concept lies in the levels of granularity at which a target concept may be construed and analyzed. In our case, a static and rather schematic representation of the target concept as MUSICAL DYNAMICS or LOUDNESS does not render an accurate and consistent analysis on the part of the source concepts being metaphorically projected. What is required, then, is a dynamic and more fine-grained specification of the target concept, for example, by taking the parameter of suddenness into account when qualifying the experience of an increase in a sound's strength or loudness. Along these lines, the different metaphorical construals of a gradual *crescendo* involving a vertical upward movement, on the one hand, and a suddenly increased volume and intensity in accentuation represented by a downward movement, on the other, can be perfectly motivated. Generally speaking, this means that an accurate analysis of metaphorical construal requires research scrutiny of both the source and target domain thus integrating the construal mechanism of specificity with respect to the target concept in the methodological apparatus.

The second issue pertains to the crucial integration of the analysis of metaphor with the aspect of viewpoint as an intersubjective construal operation thus acknowledging concepts like the theory of mind, intersubjectivity and common ground as core mechanisms in the process of meaning making and, by doing so, bringing the interactional dimension of perspectivization at the core of the construal analysis. In order to arrive at an analysis capable of motivating the directionality of certain movements on a spatial axis, taking into account the viewpoint is a crucial analytical aspect. As we have demonstrated above, a conductor's gestural act to invite a (sub)group of musicians to play louder may result in opposing movements on the sagittal axis, a movement toward the conductor or a movement leading outwards, depending on the adopted viewpoint. Whereas the former originates in the genuine conductor's perspective, the latter, outward movement implies the conductor assuming the musicians' viewpoint, which seems like a reasonable, affordance-related thing to do. Beyond the choice to take either of the interactants' viewpoints, a conductor may also decide to adopt an external perspective, thus representing the entire interaction unfolding in the gesture space in front of them. Crucially, the integration of viewpoint as an omnipresent intersubjective construal operation, enables a motivated and versatile analysis of musical dynamics in terms of its gestural depiction involving different directionalities on various spatial dimensions.

It goes without saying that several conceptual dimensions and interactional resources, like the role of metonymic projections, but also the hand shape, movement of the fingers, etc. have been left out of the current analysis. Yet, as our major point, we hope to have made clear with the excerpts discussed in this paper, the analytical necessity of integrating both interactional and conceptual aspects of the usage event under concern in order to arrive at an even more encompassing multimodal interaction analysis.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: the raw video data used in this study cannot be made available for privacy reasons. Anonymized fragments referred to in the analysis are available in the Supplementary material. Requests to access these datasets should be directed to KM, katharina.meissl@kuleuven.be.

Ethics statement

The studies involving human participants were reviewed and approved by Social and Societal Ethics Committee - KU Leuven. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

KM, PS, and KF conceptualized the study, contributed to the design of the article and the analysis, wrote parts of the theoretical background, and revised the manuscript. KM annotated the data, selected the excerpts from the corpus, wrote the introduction and the first version of the paper, and wrote the methods section. KM and KF wrote the analysis and the discussion. 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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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2022.986733/full#supplementary-material

SUPPLEMENTARY VIDEO
Example 1a, Example 1b, Example 2, Example 3, Example 4, Example 5, Example 6, Example 7 - respectively for the videos.

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| Frontiers in Communication

*CORRESPONDENCE
Axel Schmidt
✉ axel.schmidt@ids-mannheim.de

Showing and telling—How directors combine embodied demonstrations and verbal descriptions to instruct in theater rehearsals

Axel Schmidt* and Arnulf Deppermann

Pragmatics Department, Leibniz-Institute for the German Language, Mannheim, Germany

In theater as a bodily-spatial art form, much emphasis is placed on the way actors perform movements in space as an important multimodal resource for creating meaning. In theater rehearsals, movements are created in series of directors' instructions and actors' implementations. Directors' instructions on how to conduct a movement often draw on embodied demonstrations in contrast to verbal descriptions. For instance, to instruct an actress to act like a school girl a director can use depictive (he demonstrates the expected behavior) instead of descriptive ("can you act like a school girl") means. Drawing on a corpus of 400 h video recordings of rehearsal interactions in three German professional theater productions, from which we selected 265 cases, we examine ways to instruct movement-based actions in theater rehearsals. Using a multimodally extended ethnomethodological-conversation analytical approach, we focus on the multimodal details that constitute demonstrations as complex action types. For the present article, we have chosen nine instances, through which we aim to illuminate (1) The difference in using embodied demonstrations versus verbal descriptions to instruct; (2) typical ways directors combine verbal descriptions with embodied demonstrations in their instructions. First, we ask what constitutes a demonstration and what it achieves in comparison to verbal descriptions. Using a typical case, we illustrate four characteristics of demonstrations that all of the cases we studied share. Demonstrations (1) are embedded in instructional activities; (2) show and do not tell; (3) are responded to by emulating what was shown; (4) are rhetorically shaped to convey the instruction's focus. However, none of the 265 demonstrations we investigated were produced without verbal descriptions. In a second step we therefore ask in which typical ways verbal descriptions accompany embodied demonstrations when directors instruct actors how to play a scene. We distinguish four basic types. Verbal descriptions can be used (1) to build the demonstration itself; (2) to delineate a demonstration verbally within an instruction; (3) to indicate positive (what should be done) and negative (what should be avoided) versions of demonstrations; (4) as an independent means to describe the instruction's focus in addition to

the demonstration. Our study contributes to research on how embodied resources are used to create meaning and how they combine with and depend on verbal resources.

1. Introduction

Movements in theater plays are rehearsed compositions, emerging over a course of rehearsals that last for several weeks or months. Depending on the form of theater, they are constrained by a script and/or the director's aesthetic concept,[1] which are to be embodied in the actors' play. Movements are the results of agreements of a temporary community of practice (the ensemble) concerning how to perform play actions on stage for an audience. Being workplace interactions, theater rehearsals follow an institutional routine. In the three productions we studied, scenes are developed by directors giving actors open instructions on how to play (aspects of) a scene. The director in turn builds on the actors' performances to give more refined and concrete instructions. Unlike movements in everyday life, which are usually unscripted and uninstructed, many movements in theater rehearsals are instructed, evaluated, and corrected (by reference to prior instructions), and possibly further negotiated. In this way, scenes adopt their shape over series of sequences of directors' (mainly) verbal instructions and actors' embodied implementations.

In this paper, we analyze directors' use of demonstrations in instructions in terms of how they are constructed, what actions they perform, and how they relate to verbal instructions.[2] Our

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1 Aesthetic concepts are frameworks (often developed and communicated in advance) to which the entire production is oriented (e.g., a "comic" or "dark" mood of the play, which can manifest itself in dimensions as diverse as the acting, the lighting design, or the costumes). See Deppermann and Schmidt (2021) on the development of an unknown aesthetic concept during rehearsals.

2 We use the terms "verbal means/descriptions" and "language" synonymously to emphasize the dependence of descriptions on a code system whose specific properties (arbitrariness, based on discrete categories, conventionality etc.) categorically distinguishes its use from the use of non-linguistic means of meaning production, typically generated by body movements. Of course, speech can be used depictively, i.e., iconically, as in ideophones (Dingemanse, 2013; Clark, 2019) and the body can be used descriptively, i.e., symbolically, as in sign language or by using gestural emblems (Ekman and Friesen, 1969). In addition, language can be (part of) a demonstration (e.g., in the form of quotations) and embodied depictive means can be used in verbal descriptions (e.g., as in accompanying iconic gestures).

study does not have longitudinal claims, which would require a different collection design (Wagner et al., 2018) and present a different kind of research question, namely how ideas are collectively developed over time (for this, see Murphy, 2005; Yasui, 2013; Hsu et al., 2021a; Norrthon and Schmidt, in press; Schmidt and Deppermann, in press). When directors instruct a certain idea, e.g., "acting like a school girl," they can use verbal descriptions of various levels of detail (e.g., "act like a school girl" or "speak in soft sweet voice" etc.), or they can show what they expect an actor to do by demonstrating the behavior in question. In this sense, directors' instructions always have a conceptual ("school girl") and a procedural ("how to act as a school girl") aspect (s. Szczepek Reed, 2021).

Our study will address the following research questions:

- How are demonstrations designed and what are their main features?
- What do demonstrations achieve in comparison to verbal descriptions?
- Which role do linguistic resources typically play in instructions including demonstrations?
- How are demonstrations combined with verbal descriptions to convey directors' ideas in their instructions?

In what follows, we first distinguish between descriptions and depictions as two fundamentally different *modes* of meaning making (2.1) and discuss their differences in the context of instructional activities (2.2). In this context, depictions can be realized by illustrations (e.g., moving up the hands to illustrate a higher voice) or demonstrations (e.g., enacting a higher voice). While the former are not meant to be imitated, the latter are.

After an introduction to our data and approach (3), we show on a typical case how demonstrations that are to be imitated are constructed (4). In a second analytical part, we focus on how language figures in instructions using demonstrations (5). Language can be part of the demonstration itself, as when lines from the script text are quoted (5.1); it can delineate, introduce and embed demonstrations within the instruction (5.2); it can clarify the status of demonstrations as a quote of previous mistakes or as a model of desired behavior (5.4); or, most frequently, it can describe an idea verbally (5.4).

2. State of the art

We first address studies on descriptions and depictions as two different methods of meaning making in general (2.1), and then turn to instructional contexts in particular (2.2).

2.1. Descriptions versus depictions

The difference between depicting or showing, and describing or telling as basic modes of communication can be traced back to ancient Greek philosophy. Plato distinguished between *mimesis* and *diegesis* as two fundamentally different methods of representation in art and literature (Klauk and Köppe, 2014, p. 3; see also Halliwell, 2013). Mimesis, typically realized in fine arts, imitates the world, while diegesis, typically accomplished in literature, describes the world.

> "In the showing mode, the narrative evokes in readers the impression that they are shown the events of the story or that they somehow witness them, while in the telling mode, the narrative evokes in readers the impression that they are told about the events" (ibid.: 1).

Clark and Gerrig (1990), Wade and Clark (1993), and Clark (1996, 2016, 2019), following Peirce (1994, 1931–1958), distinguish three basic modes of communication, which use different principles: *Indexing* (such as pointing), resting on physical connectedness, refers to events by locating them; *describing* refers to events with signs based on conventions (typically language); *depicting* shows events and rests on resemblance. Depictions "are physical scenes that people stage for others to use in imagining the scenes they depict" (Clark, 2016, p. 325). In this way, depictions create "physical analogs" (ibid.: 327) which do not rest on concepts (as e.g., words do) but on percepts. Not all aspects of instances of depictions serve a depictive function. Clark and Gerrig (1990) distinguish between (1) depictive aspects (serve to depict), (2) annotative aspects (comment on the depiction), (3) supportive aspects (makes the depiction possible), and (4) incidental aspects (no specific function). In order to identify what is being depicted (the "demonstration proper," Clark and Gerrig, 1990, p. 769), recipients must recognize which aspects are meant to be depictive and which are not.

Clark and Gerrig (1990) understand demonstrations in a similar way to quotations, since demonstrations, as quotations, cite one's own or others' behavior, e.g., demonstrating how a friend eats spaghetti means quoting his behavior. In later publications, Clark (2016, 2019) uses "depiction" as an umbrella term, covering all means of meaning-making that use iconic methods and rest on principles of perceptual resemblance (s. Clark, 2019, p. 236). His focus is on "performed depictions" (Clark, 2016, p. 324) as opposed to "exhibited depictions" (ibid.)

(e.g., a painting). In contrast to the latter, performed depictions "are created *and* displayed by a single person, (…), at a *single* place and time in a *single* set of actions with a *single* set of goals. It is performed depictions that are integral to language use" (s. Clark, 2019, p. 236).

Clark (2016, p. 326 et seq.) differentiates five forms of depicting studied in different traditions: In addition to *illustrative/iconic gestures* (cf. e.g., McNeill, 1992; Kendon, 2004, p. 84–107), *facial gestures* (cf. e.g., Ekman and Friesen, 1969), *spoken quotations* (cf. e.g., Wade and Clark, 1993; Günthner, 1999), and *make-believe play* (cf. e.g., Goffman, 1974; Sawyer, 1993), he lists "*full-scale-demonstrations*" (ibid.: 327; e.g., showing how to play a piece on the piano) as a subcategory of depictions. Clark (2016, p. 325 et seq.) distinguishes "adjunct," "indexed," "embedded," and "independent" depictions; the former is "concurrent" (Clark and Gerrig, 1990, p. 766), the three latter are "component" (ibid.) parts of surrounding discourse (see Hsu et al., 2021a for a critique). Depiction as iconic gestures usually accompany talk, adding meaning to simultaneously produced parts of talk ("lexical affiliates," Schegloff, 1984, p. 276; Kendon, 2004, p. 127–157; Streeck, 2009, ch. 6). As components parts, depictions can be indexed by talk (e.g., by demonstratives such as "like this," Streeck, 2002; Stukenbrock, 2014) or embedded in talk (replacing linguistic projected units such as NPs or adjectives) building "syntactic-bodily gestalts" (Keevallik, 2010, p. 309). Finally, depictions can be independent parts of the discourse serving as actions or turns in their own right. Demonstrations are often indexed by, embedded in, or independent of verbal descriptions, while illustrative/iconic gestures are often concurrent parts of composite utterances (Enfield, 2009), depicting what is talked about.

Demonstrations use specific methods to represent what they depict. Kendon (2004, p. 160) distinguishes three representational methods (common to what he takes as iconic gestures) which are (a) *modeling* (using body parts to stand in for an object), (b) *enactment* (similar to pantomime), and (c) *depiction* (similar to tracing/painting an object in the air). Streeck elaborates depiction methods further, distinguishing "mimetic gesturing" (Streeck, 2009, p. 144) and "depicting action" (ibid.). Streeck (2009, p. 146) explicitly stresses the latter's proximity to theater: "ordinary conversational re-enactments bear the seed of performance art, of stagecraft," which can "also be elaborated into pantomime and caricature" (ibid.). In this paper we use Clark's (2016, 2019) notion of "depiction" as an umbrella term for iconic modes of meaning making. The demonstrations we are studying (see below) are "enactments," as "body parts engage in a pattern of action that has features in common with some actual pattern of action that is being referred to" (Kendon, 2004, p. 160), mimicking them for instructional or "modeling" (Szczepek Reed, 2021, p. 3) purposes. They do not quote or "replay" (Goffman, 1974, p. 506) past behavior (except for showing actors' previous mistakes), but "pre-play"

(Stukenbrock, 2017, p. 238) future behavior as a candidate solution for actors' performance.

Depictions are multimodally laminated phenomena (Cantarutti, 2020, ch. 2.3; Löfgren and Hofstetter, 2021, p. 7–10). In theater, they include a great variety of resources, e.g., gesture, verbal quotes from the script and choreographic elements, props, music, costumes, a certain use of space, and inventing "subtext" (s. ex. 5, 6, and 7 below). When directors instruct by demonstrating, all resources are organized in ways that help actors to understand the instructions and, most importantly, to identify which parts should be imitated and which should not (s. Section 4 for a step-by-step analysis of the construction of instructive demonstrations).

Demonstrations are not carried out for their own sake but for other purposes, e.g., demonstrating how a friend eats spaghetti to make fun of him (Goffman, 1974). Such footing shifts (Goffman, 1981) of embedding a figure within one's own speech (Goffman, 1974) are usually indicated by changes in perspective and deixis (Auer, 1988; Streeck, 2002; Ehmer, 2011; Stukenbrock, 2015). Demonstrations serve to make recipients recognize the demonstrator's intention to stage a scene (Clark, 2016).

2.2. Two kinds of depictions: Demonstrations versus illustrations

Many studies on demonstrating one's own or others behavior deal with referring to real events in the past. While studies on reported speech and direct quotes (Günthner, 1999; Holt and Clift, 2007) focus on verbal-vocal means, studies on reenactments include other multimodal resources, such as gestures, gaze, and body postures (Sidnell, 2006; Ehmer, 2011; Tutt and Hindmarsh, 2011; Thompson and Suzuki, 2014; Pfeiffer and Weiss, 2022).

In contrast to reenactments, demonstrations in instructional contexts show how certain behaviors are to be executed in the future. This is even true for "body quotes" (Keevallik, 2010), which can be used for exposing flaws in an instructee's previous performance they should avoid in the future. Thus, demonstrations are deployed here as a method of conveying embodied knowledge (Ehmer and Brône, 2021). In contrast to verbal descriptions, demonstrations convey a vivid picture of bodily movements, because most embodied knowledge is ineffable and can only partially be translated into conceptual categories (Ryle, 1949; Polanyi, 1966; Ehmer and Brône, 2021).

The use of demonstrations for instructional purposes has been investigated in a variety of different settings in which teaching, learning and developing bodily skills are in focus, e.g., in music and singing (Weeks, 1985, 1996;

Haviland, 2007; Szczepek Reed et al., 2013; Tolins, 2013; Reed and Szczepek Reed, 2014; Emerson et al., 2017, 2019; Szczepek Reed, 2021), dance (Keevallik, 2013, 2015; Broth and Keevallik, 2014; Albert, 2015; Ehmer, 2021), theater and opera (Hazel, 2015, 2018; Lefebvre, 2018; Schmidt, 2018; Norrthon, 2019, 2021; Löfgren and Hofstetter, 2021), sports (Evans and Reynolds, 2016; Råman and Haddington, 2018; Råman, 2019; Evans and Lindwall, 2020), cooking (Mondada, 2014a), handy craft (Ekström and Lindwall, 2012, 2014), driving/flying lessons (Melander and Sahlström, 2009; De Stefani and Gazin, 2012; Deppermann, 2018) as well as medical training and surgery (Hindmarsh et al., 2011; Mondada, 2011a, 2014b; Zemel and Koschmann, 2014; Heath and Luff, 2021). In instructional activities, knowledge is not just conveyed monologically (as in manuals or lectures, for example), but developed dialogically in pairs of instructions and instructed actions (Arnold, 2012; Mondada, 2014b; Stukenbrock, 2014). In particular, when embodied skills are instructed, instructees display their understanding *in situ* when they implement the instructions, which allows instructors to correct directly if necessary (Hindmarsh et al., 2011; Mondada, 2011b; Zemel and Koschmann, 2014).

Szczepek Reed (2021) distinguishes "body-focused demonstrations" (p. 4), which are expected to be imitated (e.g., adopting a straighter body posture while singing), from "concept-focused depictions" (p. 6), which are not expected to be imitated but rather to be interpreted as illustrations of verbal descriptions to make the instruction more comprehensible (e.g., showing deeper breathing by using both hands to depict the movement of the chest while breathing). Combining Clark (2016, 2019) and Szczepek Reed (2021), we distinguish between *demonstrative depictions,* which convey how something should (not) be done and are expected to be imitated, and *illustrative depictions,* which convey how something should be interpreted and which are not expected to be imitated.

3. Data and method

Our study rests on 400 h of video recordings from three different professional theater productions in Germany in the years 2013–2019. Participants mainly speak German, although in one production they occasionally use English. The first production, "Der mündliche Verrat" (MV, "The Oral Betrayal") written by Kagel (1983), is an absurd music theater play, in which sentences about the devil from different historical periods are spoken by three performers, accompanied by an orchestra generating experimental music and sounds. Although the play has a libretto, the lines of text are not structured as dialogue; yet they are performed on stage in distributed roles. The second production, "Nothing twice," (NT), is a devised theater play (Perry, 2010), based on dance

and graffiti. The performance features two professionals and four teenage amateurs. The third production is Tennessee Williams' (1947) drama "a Streetcar named Desire" ("Endstation Sehnsucht," ES), which involves a staff of thirty members and was performed on the main stage of a major theater ("National Theater Mannheim"). Although the three productions are very different in terms of directing style, dramatic basis, size and prestige of production, degree of professionalism, genre of play, and degree of reliance on a script, the demonstrations we found are comparable in important respects.

We selected 265 instances in which directors use depictive means to instruct. In all instances, the depictive means are embedded in a director's instruction, which includes descriptive and depictive parts and which is sooner or later implemented by the actors.

We excluded cases in which demonstrations are not used to instruct but for other purposes, such as when

- actors use demonstrations to convey how they understood directors' instructions or how they would implement their instructions;
- directors use demonstrations to argue with actors but not to instruct them[3];
- demonstrations are used to locate to which part of the script an instruction refers, e.g., singing a part of the score to identify a location in the play (see Ivaldi et al., 2021, p. 10 on "location cues," Löfgren and Hofstetter, 2021, p. 8 on "location indexing depiction").

In our collection, we first distinguished instructions in which depictive means were used only to *illustrate* what was said (e.g., instructing actors to accelerate their turn-taking, accompanied by a cyclic hand gesture illustrating "accelerating;" see 5.4.2, ex. 9) from instructions in which depictive means were also used to *demonstrate* what actors should do or modify to improve their performance (e.g., when an actress is shown how to swing a hammer; see 4, ex. 1).

Using the method of multimodal Conversation Analysis (Deppermann, 2013; Mondada, 2013), we produced detailed multimodal transcripts (Mondada, 2019a) to study how embodied demonstrations of directors are (a) sequentially incorporated in instructional activities, (b) how verbal and embodied means are coordinated temporally and (c) how they are responded to by actors. Multimodal transcripts

are indispensable for showing the temporal progression of demonstrations concerning their onset, climax, and withdrawal (see Kendon, 2004, p. 108–127 on gestural phases). The form and meaning of demonstrations are furthermore described in detail in the corresponding analysis. We use still images to give an impression of the apex of demonstrations (see Stukenbrock, 2009 on the use of still images).

In most of our cases, a variety of meaning making means is combined to build instructions. $N = 105/265$ instances are merely or overwhelmingly illustrative.[4] The remaining almost two thirds (160 cases) are instructions which rely essentially on demonstrations to instruct. We selected one case to show basic features common to all 160 demonstrations in our sample (4). On the basis of eight further cases, we show typical ways in which directors combine descriptive and demonstrative means when instructing actors (5).
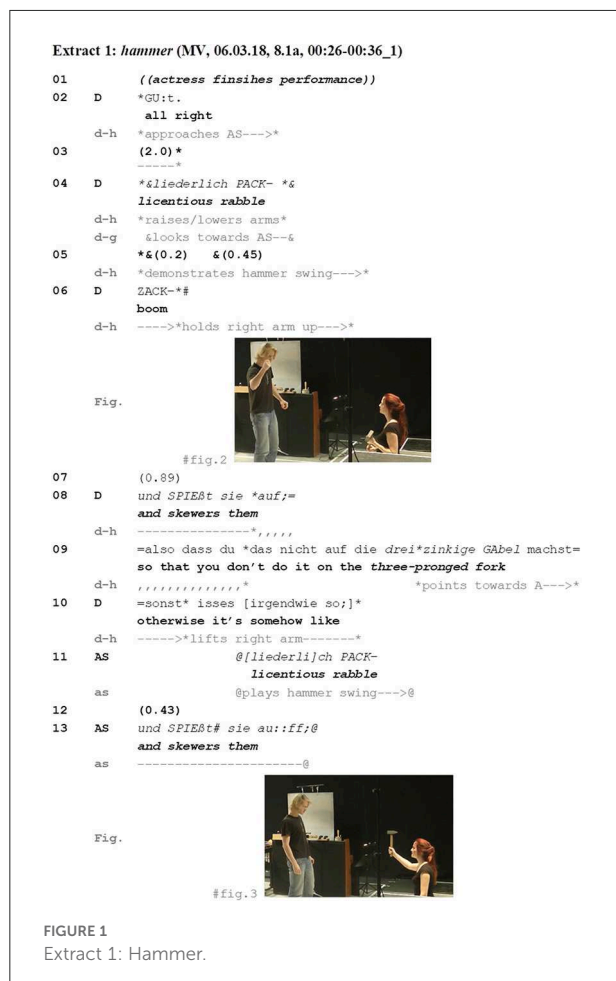
4. Analysis part I: Basic features of demonstrations in theater rehearsals

What action is accomplished by some behavior can only be inferred when taking the context in which it is performed into account. This holds in particular for embodied actions that are only recognizable as demonstrations within their sequential context (Keevallik, 2010, p. 424). The sequential environment in which they are produced plays an important role. Both previous actions they respond to and subsequent actions are interpretative resources for participants and analysts alike to identify what actions were performed (Schegloff, 2007).

In theater rehearsals, participants develop a performance together, usually based on written sources (e.g., a dramatic script). The core of the rehearsals is the alternation between director's instructions and actors' implementations of these instructions on stage. In their instructions, directors usually instruct actors in how they may improve previous parts of their performance in subsequent repetitions. To this end, director's instructions often include demonstrations of how certain parts of the performance could be improved, which are expected to be taken up subsequently. The following extract (1) (Figure 1) epitomizes this core structure. After the actress (AS) finishes her performance (line 1), the director (D) provides a demonstration (lines 4–8), followed by a brief description (lines 9/10) of how

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3 Demonstrations used for argumentation purposes show what a behavior would look like if it were performed. The main purpose here is to convince actors that choosing the demonstrated behavior is useful. These demonstrations are usually not responded to by imitations, but by agreement, disagreement, or counter-proposals.

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4 Directors often combine illustrative and demonstrative means in their instructions. We counted cases as "overwhelmingly illustrative" in which the focus of the instructions is on explaining and illustrating concepts rather than demonstrating how to perform them.

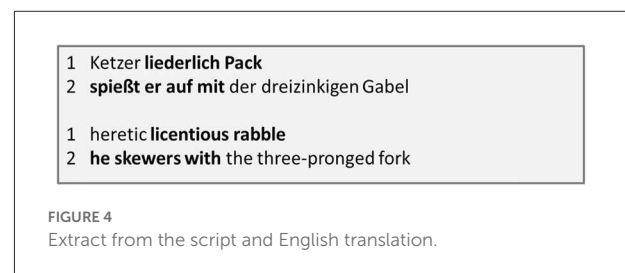she should improve her performance, which she immediately implements (lines 11–13).[5]

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Extract 1: hammer (MV, 06.03.18, 8.1a, 00:26-00:36_1)
01       ((actress finsihes performance))
02   D   *GU:t.
          all right
     d-h  *approaches AS--->*
03       (2.0)*
          -----*
04   D   *&liederlich PACK- *&
          licentious rabble
     d-h  *raises/lowers arms*
     d-g   &looks towards AS--&
05       *&(0.2)    &(0.45)
     d-h  *demonstrates hammer swing--->*
06   D   ZACK-*#
          boom
     d-h  ---->*holds right arm up--->*


     Fig.



              #fig.2
07       (0.89)
08   D   und SPIEßt sie *auf;=
          and skewers them
     d-h  --------------*,,,,,
09       =also dass du *das nicht auf die drei*zinkige GAbel machst=
          so that you don't do it on the three-pronged fork
     d-h  ,,,,,,,,,,,,,,*         *points towards A--->*
10   D   =sonst* isses [irgendwie so;]*
          otherwise it's somehow like
     d-h  ----->*lifts right arm------*
11   AS          @[liederli]ch PACK-
                    licentious rabble
     as          @plays hammer swing--->@
12       (0.43)
13   AS   und SPIEßt# sie au::ff;@
          and skewers them
     as   ----------------------@


     Fig.



              #fig.3
```

FIGURE 1
Extract 1: Hammer.

When AS reaches the end of her performance (line 1), D approaches her and marks the end of the play phase and the transition to a discussion phase with a generic evaluation term ("*all right*" in line 2, see Reed, 2019).[6] In discussion phases, directors give feedback to actors based on what the actors have just shown on stage in the play phase (see 4.1 for a more comprehensive account of play and discussion phases in rehearsals). In extract 1, D begins his feedback with a demonstration. He repeats part of the actress's performance (her

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5   Verbal conduct is transcribed according to GAT2 (Selting et al., 2011), embodied conduct according to Mondada (2019a). If necessary, embodied conduct is separated in gaze (abbreviated with "g") and gestures/hand movement (abbreviated with "h"). Lines from the script are rendered in *italics*.

6   Quotations from the script are indicated by single quotation marks and italics and are in English. The German wording can be taken from the transcript. Transcript lines are referred to with "line + number."

performance is not part of ex. 1), a hammer swing (Figure 2) together with the script text (lines 4–8). He adds a description (line 9: "*so that you don't do it on the three-pronged fork*"), which clarifies the focus of his instruction: he expects from the actress a more precise coordination of her embodied behavior (a hammer swing, Figure 3) and the spoken lines. The hammer swing is to occur in a pause between two lines[7] at a fast tempo.

> 1   Ketzer **liederlich Pack**
> 2   **spießt er auf mit** der dreizinkigen Gabel
>
> 1   heretic **licentious rabble**
> 2   **he skewers with** the three-pronged fork

FIGURE 4
Extract from the script and English translation.

In D's instruction, embodied demonstration and verbal description are neatly coordinated. The description, realized as a complement clause, begins with *so dass, "that"* (line 9) and articulates a negative consequence that would be avoided if the actress follows his demonstration. In the description, he uses a pronoun (*"it"*) to refer to the hammer swing that was part of both her performance and his demonstration. In this way, embodied demonstration and verbal description amount to the instruction "do the performance in a way (=demonstration) that you don't do the hammer swing on the next text line."

Before we have a closer look at D's demonstration itself and its features, we take a look at how it is embedded sequentially.

4.1. Sequential environment

In theater rehearsals, demonstrations are embedded in instructional activities, which are the primary means for developing a performance. The structure of instructional sequences is crucial for understanding D's movements as a demonstration. In the case discussed above, three *similar movement patterns* are produced in fast succession by different participants—the hammer swing and corresponding script text occurred first in the actress' performance (not part of ex. 1), subsequently in D's demonstration (line 4–8) and finally in AS's implementation (line 11–13). By virtue of their sequential placement, these similar movements accomplish different actions. Produced in the performance, they are part of the rehearsed play; as a part of D's corrective instruction, they are a demonstration; and in the actress's modified repetition, they are an implementation.

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7   Figure 4 shows the script text, quoted parts are marked in boldface.

The three movements belong to a *three-part sequence*, which is constitutive of instructional activities: A part of the rehearsed performance (1) is retrospectively made relevant by D's corrective instruction (including a demonstration), (2) which is treated by AS as a directive to implement the corrected version (3).[8]

The demonstrations we focus on below are understood as instructions to improve yet-to-be-produced performance parts in the future, based on performance parts presented in the past. Therefore, our demonstrations must be interpreted in the context of the instructions in which they are embedded, and the instructions in turn must be interpreted in the sequential environment of an instructional activity aimed at developing a performance. Only in this context are certain movements and behaviors of directors understandable as demonstrations.

We now have a closer look at the demonstration itself.

4.2. Demonstrations instruct by showing not telling

The demonstration itself (lines 4–8) is a body movement designed to be recognizable as part of the performance. This is achieved by quoting lines from the script (lines 4/8) and by reproducing a choreographed movement (the hammer swing; Figure 2). Both are part of the participants' common ground concerning this particular production (see Deppermann and Schmidt, 2021). The director's demonstration integrates several multimodal resources into a *gestalt* (Ehmer and Brône, 2021; Stukenbrock, 2021), which exhibits a particular procedural structure (first a certain text line, then the hammer swing, then the next line), projecting and constraining certain next features within the *gestalt* (Deppermann and Günthner, 2015; Mondada, 2019b).

In contrast to the verbal description in lines 9/10, by his demonstration, he does *not tell* the actress, but *shows* her what to change. In contrast to verbal descriptions, which use "strings of arbitrary symbols to denote categories" (Clark, 2016, p. 342), demonstrations rest on iconic relations drawing on resemblance (Stoeckl, 2004; Clark, 2016, 2019).[9] They depict

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8 Such sequences share features with initiative-response-evaluation sequences in learning settings (McHoul, 1978; Mehan, 1979). However, see Schmidt and Deppermann (2021) on how instructional sequences in creative settings, such as theater, differ from them.

9 The notion of resemblance has been prominently criticized by Goodman (1968; see also Streeck, 2008, 2009). He argues that an apparently iconic representation (e.g., a painted bird) does not refer to a represented object (e.g., a bird) on the basis of resemblance, but on the basis of convention. Proponents counter that the relationship is not completely arbitrary (as with symbols), but is based at least on *some* similarities (e.g., the color or shape of the bird is emulated).

and do not describe. To which part of the scene he is referring and what he expects AS to do does not rest on a detailed description but on reproducing some of its features. He swings his arm in a similar fashion and animates the corresponding script text. Since his instructional purpose concerns the precise temporal coordination between swinging the hammer and the speaking of the lines, the timing of embodied and verbal means is crucial.

Since demonstrations present scenes audio-visually, they rely on being watched by recipients. Demonstrators, therefore, often try to secure their co-participants attention and position themselves in space in a way that their demonstrations can be easily observed (Keevallik, 2010). In extract 1, in order to make his demonstration salient, the director approaches AS (line 2) until he reaches a facing formation and looks directly at her. Only then does he begin his demonstration, which AS follows closely, gazing at him throughout.

4.3. Demonstrations are expected to be imitated

The use of depictive means to refer to events and objects can be done in different ways. Typical and widely described means in the literature are iconic (also illustrative, imagistic, depictive or imitative) gestures [s. Kendon (2004, p. 84–107) for a review of gesture classification; see also McNeill, 1992; Streeck, 2009, ch. 6; Müller, 2010; Clark, 2016, p. 327; Urbanik and Svennevig, 2021] and direct reported speech (e.g., Clark and Gerrig, 1990; Keevallik, 2010) or reenactments (Sidnell, 2006; Pfeiffer and Weiss, 2022). However, unlike iconic gestures and unlike quotations or reenactments (e.g., in narratives), demonstrations in instructional environments are directive rather than assertive actions. They do not *represent* a past, anticipated or hypothetical event (see Niemelä, 2010; Cantarutti, 2020, ch. 2.2), but attempt to *control* a future event. Demonstrations are designed to be taken over (Szczepek Reed, 2021). When the director demonstrates the hammer swing, he shows a behavior which he expects the actress to do in the future.

That D's behavior in lines 4–8 is expected to be taken over (in part) is clear from his own subsequent description (line 9), which re-frames his performance as something

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Furthermore, the referents of most depictions are only recognizable if the referent is already known (Goodwin, 2011). The current paper shares this view, as certain features of the performance are recognizably imitated in demonstrations (drawing on resemblance) and not just described (drawing on convention). In all cases, to what the directors' depictions refer is clear either from its reference to the play/script and/or his descriptions.

that should (not) be done by the actress: "*that you don't do* …." The actress immediately reproduces (lines 11–13; Figure 3) what the director has shown before (lines 5–8; Figure 2) and thus treats his behavior as a demonstration that is to be reproduced by her. However, a closer look reveals that not all parts of the demonstration are meant to be taken over. Rather, the demonstration is rhetorically shaped to convey how it is to be interpreted in order to understand what the director is focusing on in his instruction.

4.4. Rhetorical shape of demonstrations

Demonstrations include features that have rhetorical rather than depictive functions in order to make them understandable and to adapt them to the demonstrator's current purposes (see Clark and Gerrig, 1990; Clark, 2016 and Section 2 above). These features should not be seen "as something that the recipients have to discard in order to recognize only the depictive aspects (…), they should be seen as constitutive of the action" (Keevallik, 2010, p. 419). Demonstrations in theater are used by directors to convey something specific in the context of an instruction. Directors select *certain* aspects of a to-be-represented behavior and add others used as rhetorical techniques. Clark and Gerrig (1990) call them "annotative aspects" (see Section 2.1). These emphasize the focus of the demonstrations, often a corrective purpose (Weeks, 1990; Messner, 2020; Wessel, 2020; Stoeckl and Messner, 2021).

In extract 1, D adds aspects in his demonstration that are not to be taken over to clarify the focus of his instruction. He accompanies the hammer swing with the conventionalized sound quotation (cf. Clark and Gerrig, 1990, p. 788 et. seq.) "*boom*" (line 6) to emphasize both the focus of his instruction, namely the timing of the hammer swing, and one of its qualities, the suddenness and fast pace at which he expects it to be executed (see Keevallik, 2021 on the use of vocalizations to comment on simultaneous body movements in teaching dance). Although the expression "*boom*" itself draws on depictive means to generate meaning, it is not meant to be taken over in the actress's subsequent performance. Rather, in his demonstration, "*boom*" serves as a rhetorical technique or an "annotative aspect" (Clark and Gerrig, 1990, p. 768). In contrast, other aspects of the expected performance are left out, e.g., D does not kneel as AS does and he does not have a hammer (compare Figures 2, 3). By performing his demonstration without the prop (the hammer), D can execute it directly after AS has finished her performance without having to organize a prop exchange beforehand. In Clark and Gerrig (1990, p. 768) terminology, this serves as a "supportive aspect" of the immediacy of his demonstration. Other aspects of his demonstration are just "incidental" (ibid.; s.a. Section 2.1), e.g., his pose while standing.

This example nicely illustrates the two principles Clark and Gerrig (1990) and Clark (2016, 2019) formulated for all depictions including demonstrations: the *partiality principle*, according to which only parts of demonstrations are depictive and the *selectivity principle*, according to which demonstrations depict only selected aspects. Only the selected depictive aspects build the "demonstration proper" (Clark and Gerrig, 1990, p. 769), i.e., the intended referent of the depiction. Demonstrations can be more or less accurate or stylized (Wessel, 2020; see also Gullberg, 1998 on transitions between gestures and pantomime). The rhetorical shape of a demonstration results from what is selected, what is left out, and what is added. The "depictive aspects" that form the "demonstration proper" are not determined by semiotic criteria alone—action-related criteria must also be taken into account, i.e., as Clark and Gerrig (1990, p. 769) put it, what "the point of the demo" is. If the focus is on demonstrations (as opposed to illustrations), the "demonstration proper" includes the aspects that are meant to be taken over. As the case above shows, depictive and descriptive resources of meaning-making can be part of both the "demonstration proper" (e.g.: depictive: hammer swing; descriptive: imitated script text) and the annotative aspects (e.g.: depictive: "boom;" descriptive: conventionalized lexical meaning of "boom").[10]

It is clear from AS's reaction that she is immediately able to make these distinctions. She neither reproduces D's posture (she remains kneeling and does not adopt a standing posture like D) nor his verbal comment (*"boom"*). Yet, she executes her re-performance with the hammer. The ways in which she implements the instruction indexes common ground stemming from different resources. "*Boom,*" for instance, is not part of the script. Concerning the hammer, D does not necessarily need the same equipment (here the hammer prop) to instruct by demonstrating, unless the prop itself would be in focus.

Following Clark (2016, p. 327–328), depictions (and also demonstrations) are characterized by two further principles— they are not what they depict ("*pas une pipe principle*") and they have two realities, its raw execution ("base") and its appearance, i.e., what is intended to be depictive ("*double-reality principle*"). Therefore, every demonstration consists of a "base scene" (its raw, observable execution), a "proximal scene" (its appearance or intended depiction) and a "distal scene" (what is depicted in a there-and-then). In the case above, the director combines a variety of perceivable multimodal resources (in Clark's terminology the "base scene") to enact a scene to

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10 Quotations for instance, treated as a canonical case of demonstration (Clark and Gerrig, 1990), are considered as "depictions of descriptive speech" (Hsu et al., 2021a, p. 11).

be imagined (the "proximal scene") as a model for a future implementation by the actress (the "distal scene").[11]

Since every "base scene" is construed according to an "interpretive framework" (Clark, 2016, p. 328), "there is no such thing as a depiction simpliciter" (ibid.), i.e., "one cannot know what a base scene depicts without knowing or inferring what its creator intended it to depict" (ibid.). What a demonstration demonstrates has to be inferred. In the case above, the director's interpretative framework is indicated by annotative elements ("*boom,*" for instance, highlights the place where the hammer swing should take place) and his following verbal description ("do not do X"). Instead of showing the actress exactly how to perform the part in question, the director embodies in his demonstration primarily what his instruction focuses on.[12] This is in line with Streeck (2008, p. 286) who claims "(…) that the gesture that depicts an object or process of any kind offers a *construal* or *analysis* of the signified, an 'active' organization."

None of the 160 cases we studied, in which the director uses demonstrations to instruct, is produced without verbal means. Thus, the combination of descriptive (telling) and demonstrative (showing) means in directors' instructions in rehearsals is the only practice in our data. In the following section, we provide an overview of different ways in which language figures in demonstrations and we show how language is coordinated with demonstrative means in directors' instructions.

5. Analysis part II: Verbal and demonstrative means in instructions in theater rehearsals

As in extract 1, all demonstrations in theater rehearsals in our data are embedded in instructions that draw on descriptive

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11 Representations in rehearsals are always representations of representations (e.g., the hammer swing in the rehearsal demonstrates a depicted hammer swing in a performance on stage), which can be viewed either from "inside" (e.g., used in rehearsals for instructions) or from "outside" (e.g., created to evoke certain effects in an audience). Löfgren and Hofstetter (2021) speak of "introversive" and "extroversive semiosis" (2). Since we focus exclusively on "introversive semiosis" in our analysis (i.e., how demonstrations are used in the practical context of rehearsals to build instructions), we consider the "distal scene" as a model for future implementations by actors rather than as a representation on stage "externally referencing to prototypes of mundane behavior" (ibid.: 2).

12 Another detail supporting this point is that the director does not quote the script exactly—instead of saying *he skewers with* (see script/Figure 4, line 2), he says *and skewers them* (ex. 1, line 8). Interestingly, in line 13, the actress, does not quote the correct line, either, but repeats the director's words ("*and skewers them*"). The focus here is not on the reproduction or animation of the script, but on the temporal refinement of the hammer swing in relation to speaking the lines.

means, typically language. In the following we take a closer look at how and for what purposes directors combine descriptive and demonstrative means in their instructions. We ask: What are the contributions by the descriptive and by the demonstrating parts and what is achieved by combining them in certain ways? A closer look reveals that language in instructions including demonstrations can have very different statuses. It can be used to

- build the demonstration itself (5.1),
- delineate the demonstration and integrate it in the overall instruction (5.2),
- distinguish positive (how to do something) and negative (how not to do something) versions of demonstrations (5.3),
- provide verbal descriptions of the instructional purpose of demonstrations (5.4).

5.1. Language as part of the demonstration itself

Since drama involves speech, language use can be the focus of the demonstration proper. Then language is used in a quotation function (Clark and Gerrig, 1990) as is typical for reported speech (Holt and Clift, 2007). Alternatively, language can be used to frame, comment on or explain a demonstration. Then it is not part of the demonstration. Consider extract 1 again (here reproduced as ex. 2, Figure 5):

```
Extract 2: hammer (MV, 06.03.18, 8.1a, 00:26-00:36_1)

01          ((actress finsihes performance))
02    D     *GU:t.
            all right
      d-h   *approaches AS--->*
03          (2.0)*
            -----*
04    D     *&liederlich PACK- *&
            licentious rabble
      d-h   *raises/lowers arms*
      d-g    &looks towards AS--&
05          *&(0.2)    & (0.45)
      d-h   *demonstrates hammer swing--->*
06    D     ZACK-*
            boom
      d-h   ---->*holds right arm up--->*
07          (0.89)
08    D     und SPIEßt sie *auf;=
            and skewers them
      d-h   ---------------*;,,,,
09          =also dass du *das nicht auf die drei*zinkige GAbel machst=
            so that you don't do it on the three-pronged fork
      d-h   ;,,,,,,,,,,,,*           *points towards A--->*
10    D     =sonst* isses [irgendwie so;]*
            otherwise it's somehow like
      d-h   ----->*lifts right arm------->*
11    AS                  @[liederli]ch PACK-
                          licentious rabble
      as                  @plays hammer swing--->@
12          (0.43)
13    AS     und SPIEßt sie au::ff;@
            and skewers them
      as     --------------------@
```

FIGURE 5
Extract 2: Hammer-replication.

D here uses language to build his demonstration. In line 4 ("*licentious rabble*") and line 8 ("*and skewers them*"), he quotes text from the script (see Figure 4), contextualized as part of the demonstration by theatrical standard pronunciation (significantly louder and more articulate). Similar to singing (Stevanovic and Frick, 2014), the animation of scripted text draws on "a composition, which has been created by someone else" (p. 4), clearly indicating a shift in authorship. Language taken from the script together with certain parts of D's embodied behavior is integrated into a multimodal gestalt understood by AS as a demonstration of how the shown part should be played instead.

Although D also cites the noun phrase "*three-pronged fork*" (line 9), which is part of the script as well (Figure 4), it is not understood as part of his demonstration. In her subsequent implementation (lines 11–13), AS repeats exactly the lines that D has used in his previous demonstration (lines 11/13 repeat lines 4/8), stopping after "*auf*" (line 13) and before "*with the three-pronged fork,*" which would be the next words in the script (Figure 4). Quoting from the script here serves different purposes. On the one hand it feeds into a demonstration showing how to coordinate body movements and speaking the script, which is meant to be imitated; on the other hand it is used to refer metonymically to a certain line of the script (saying "*on the three-pronged fork*" quotes the noun phrase "*three-pronged fork*" to indicate "*on*" which text line she is not to perform the hammer swing), which is not understood as a demonstration to be imitated.

5.2. Language as verbally delineating and embedding demonstrations

When language is not an integral part of the actual demonstration, it is often used to identify parts of the instruction as a demonstration. A basic interactional task when using demonstrations is to make clear which parts of an instruction are to be understood as demonstrating and which are not. In addition to recognizably reproducing parts of the performance or using lines from the script, certain segments of behavior are often verbally framed as demonstration (Keevallik, 2010, 2015; Cantarutti, 2020, p. 134–167).

In extract 3 (Figure 6), a director (D) and an actor (A) discuss a scene in which the actor combines dance moves with reciting a poem. At several points, the actor should stop and adopt a thinking posture. They are discussing how to make these postures. So far, the actor has adopted the pose only in one way (sitting). D now demonstrates that A could also do the pose lying down. The transcript starts with D suggesting verbally that A could vary the shape of the pose (line 1: "*but it can also be another shape*").

FIGURE 6
Extract 3: Thinking posture.

D introduces his following demonstration not by describing the posture in detail. Saying "*but it can also be another shape (…) that just…that… just like that*" (lines 1–6), he prospectively frames it generically as something additional ("*another shape*"). When he twice starts a complement clause (line 3: "*that just,*" line 4: "*that*"), which he finally abandons, he projects something to follow (a verbal specification of "*another shape*"). At the same time, his self-repairs delay his verbal conduct, which allows him to prepare his following demonstration, getting up from his chair and sitting on the floor, which is the starting position of the actor's thinking pose and his demonstration (Figure 7).[13] Immediately after saying the second time "*that*" (line 4), he begins to change his position from sitting to lying down on the floor. The process of adopting the pose is accompanied by another referential verbal framing ("*just like that,*" line 6). By the delays, he adapts his unfolding verbal description to the embodied affordances of producing the projected posture (see Mondada, 2009). In regards to dance instruction, Keevallik (2015) has referred to this as "scrolling" (321), i.e., matching temporalities afforded by language to those afforded by embodied demonstrations. The posture itself and its demonstrated possible shape is referred to by pronominal (prospectively in line 1: "*it*") and demonstrative

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13 The preparation phase of movements is indicated by dots ("…"), the duration of the demonstration by hyphens ("—"), and the retraction phase by commas (",,,") (s. Kendon, 2004, 108–127; Mondada, 2019a).

means (overlappingly in line 6: "*that*"), whereby D assumes common ground of what is salient (the thinking posture).

Following Clark (2016, p. 325), quotes, depictions and demonstrations can be embedded or indexed by language. In this extract both methods are recognizable. First, D provides a demonstration to continue a complement clause (lines 1–4: "*but it can also be another shape, that just...*" X is done = "demonstrating the pose"). With this he *embeds* his demonstration in a syntactic frame. Keevallik (2015) calls such constructions "syntactic-bodily gestalts" (309): a verbal fragment (in this case "*that just*") is complemented by embodied conduct (the demonstration of the pose) to form an intelligible action. Secondly, D uses the modal deictic "so" ("*just like that,*" line 6; Stukenbrock, 2014, 2021) to point to his pose. The deictic phrase draws A's attention to the pose D is demonstrating. While the provision of a generic category (l1: "*another shape*") describes what his demonstration represents, the use of a "syntactic-bodily gestalt" including a modal deictic item indexes his demonstration. The latter specifically requires the recipient to attend to the visual modality—only if one sees the demonstration is the deictic expression comprehensible (Stukenbrock, 2014). In addition, D stretches "*so*" while he is lying on the floor, making the process of adopting the pose more salient.

In extract 3, language is used to foreshadow ("*another shape*"), embed (demonstration complements sentence), bracket (verbal introduction at the beginning and referring to the demonstration in parallel at the end), and index ("*like that*") those parts of his composite action which are to be understood as a demonstration (see also Cantarutti, 2020, p. 134–167). As in reenactments, usually left brackets, the onsets of a depiction, are marked more explicitly by verbal introduction (as in this case: "*another shape that just… just like that*"), whereas the right brackets, marking where a depiction ends, are often left more fuzzy, usually only signaled by a reorientation of speakers' gaze to their addressees (Sidnell, 2006). Similarly, in extract 3, D holds the pose for half a second (line 7), until A displays understanding (line 8: "*yes.…*"); only then does he return to a sitting position and redirects his gaze to A.

5.3. Contrast pairs: Verbally signifying what to do and what to avoid

While verbal brackets do not contribute substantively to the content of an instruction, a verbal framing can also clarify whether the focus of an instruction is not primarily or exclusively on showing what actors should do, but what they should *not* do. In such cases, directors often use contrast pairs (Weeks, 1990; Keevallik, 2010; Messner, 2020; Wessel, 2020): demonstrations of what not to do (negative version) are contrasted with demonstration of what to do instead

(positive version). In contrast pairs, verbal means are crucial to distinguish between the positive and the negative status of a demonstration.

In extract 4 (Figure 8), a scene is rehearsed in which the actors perform with flashlights on a totally darkened stage. The director (D) instructs two actors (A1, A2) on how to use their flashlights:

Extract 4: *flashlights* (MV, 06.03.18, 8.1a, 31:29-31:39)

```
1    D      was_was STÖRT
             what what is disturbing
2           was nicht funktioniert is DES hier-
             what isn´t working is this
3           *(0.8)
d           *waves around with a turned on flashlight--->§
4    A2     mh-
             mh
             -->*
5    D      des is des was bei mir im PUBlikum ankommt-*
             this is what comes across to me in the audience
d           ----------------------------------------*
6           also eigentlich muss das ziel sein dass ihr nicht *SUCHT sondern
             dass ihr (.) findet.*
             actually it should be the goal that you don´t seek but that you
             (.) find
d                                                    *resting
             flashlight cone-----*
```

FIGURE 8
Extract 4: Flashlights.

D introduces his first demonstration of how to use the flashlights by a verbal introduction, which uses deictic reference as in extract 3 (line 2: "*what isn't working is this*"). By prefacing negative pseudo cleft clauses (line 1 "*what is disturbing,*" line 2 "*what isn't working,*" see, e.g., Hopper, 2004; Günthner and Hopper, 2010; De Stefani et al., 2022), the following indexed (line 2: "*this*") demonstration (line 2–5 *waving around with a flashlight*) is characterized as something that should be avoided. In his following second demonstration (line 6), he shows what the actors should do instead (producing a resting flashlight cone). It is accompanied by a contrastive formulation from which the positive version is inferable (line 6: "*actually it should be the goal that you don't seek but that you find*").

Without verbal means, it would not only be difficult to identify which of the flashlight movements are to be understood as demonstrations; it would be completely impossible to distinguish which movements are to be avoided (negative versions) and which ones should be produced (positive versions). While language has the capacity to express coherence relations, such as "either—or," "if—then," and abstract meanings, this is hardly possible by analogous means of communication, such as embodied demonstrations. In particular, they lack "a simple negation, i.e., an expression for 'not'" (Watzlawick et al., 1969, p. 66; English translation by authors).[14]

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14 One possible practice is to exaggerate or caricature negative versions (Keevallik, 2010), but compared with the binary logic of language, this remains rather ambiguous.

The verbal means on which we focused in the cases in 5.1–5.3 above do not provide an independent description of the instructed behavior, but serve as means to build (5.1), bracket and embed (5.2), or assign positive or negative value to a demonstration (5.3). We now turn to cases in which language contributes more substantially to co-construct the instructional content.

5.4. Relations between descriptions and demonstrations: Show and tell

In all our cases, directors use descriptive *and* depictive means to instruct how certain parts of a scene should be played. They show *and* tell. In the pursuit of accomplishing the instructional purpose, semiotically different means are systematically combined [for similar observations in music instructional settings see Weeks (1996) and Stevanovic and Frick (2014)].

In the rehearsals we have analyzed, the relationship between demonstrations and descriptions depends on the focus of the instruction. Sometimes, instructions focus on *content-related entities* of the fictional world created on stage (5.4.1), i.e., actions (e.g., "limping"), behaviors or states (e.g., "hyper-attentive"), or social categories (e.g., "school girl"). In other cases, instructions focus on *formal aspects* (5.4.2), e.g., temporal relations between turns, or between spoken text and embodied actions. Depending on the focus of the instruction, the relationship between demonstrations and descriptions is different.

5.4.1. Instructions focusing on content-related entities

One of the most important properties of language is its ability to categorize. In instructions, verbal descriptions are often used to *categorize* what the demonstration is to represent. Demonstrations, in turn, deliver a concrete and vivid sample of the category; they instruct by *exemplifying* what is described verbally.[15] In his classification system of quotative content, Terraschke (2013, p. 66) considers to "exemplify a concept or idea" to be a typical use of quotations. The use of both—a verbal categorization and a related embodied demonstration—leads to a disambiguation of meaning.

As with all depictive gestures, demonstrations enacting things known from the real world (e.g., "a school girl," "being hyper-attentive," or "limping") "are formed by incorporating bodily knowledge of the social world" (Hall et al., 2016, p. 83) in a selective way. This is most obvious when directors use *action verbs* to categorize demonstrations, as in Extract 5 (Figure 9)

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15   "Exemplifying" here means to deliver a typical example of a label possessing core features of it and referring to it (e.g., when a patch of green paint is used to exemplify and refer to the label "green")—which is roughly in line with Goodman's (1968) usage of the term.

when the director (D) instructs AS to exaggerate her limping (line 3):

FIGURE 9
Extract 5: Limping.

The aim of his instruction is first described (line 1: "*now you really have to limp*") and subsequently demonstrated (lines 5/6; Figure 10). D first provides a verbal category ("limping"), which then is exemplified by demonstration. Simultaneously with his demonstration, he delivers a description animated in character voice (lines 5/6: "*little sister with the very big disease...*").[16] Since this is not part of the script, it can be heard as a commentary describing the character's strategy in limping so exaggeratedly in order to arouse her sister's pity (indicated in line 3: "*in front of her,*" referring to the sister).

However, the verbal description does not only categorize what the demonstration is to represent ("*limping*"). At the same time, it introduces a gradation (line 1: "*now you really have to limp*") that makes the demonstration readable as an exaggerated display, which could hardly be expressed by the demonstration alone. Moreover, the accompanying subtext[17] (lines 5/6: "*little*

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16   Interestingly, his descriptions of the motive for exaggerating the limp with the character's voice make it readable as a tentative representation of the character's thoughts.

17   "Subtext" is a technical term in theater. It refers to the subliminal meanings of a text that are not part of the script. Explicating subtext in rehearsals—e.g., saying what characters think, might say, or what drives them—can serve to deepen the understanding of a character and thus its portrayal on stage (Stanislawski, 1986; Schorlemmer, 2009). In terms of the demonstrations, subtext functions as an annotative aspect that clarifies the meaning of the demonstrations, but is not meant to be imitated.

sister…") does not only explicate the figure's strategic aims, but also accounts for his suggestion—if she wants to arouse pity, she has to limp harder.

Demonstrations can also be categorized in terms of the *type of social behavior*. In Extract 6 (Figure 11), D instructs AS to be "*hyper attentive*" (line 1) and demonstrates possible behaviors for how to implement it:

FIGURE 11
Extract 6: Hyper attentive.

In the first part of his instruction (lines 1/2), the director provides a verbal category "*hyper attentive*" (line 1) and specifies the resources to be used (line 2: "*with your whole body*"), accompanied by an unspecific demonstration rapidly moving his body forth, while gesticulating with both arms (line 2). AS follows his instruction by an embodied "proposal" (Löfgren and Hofstetter, 2021, p. 1), leaning forward and lifting her body slightly from the chair (line 3). In the second part (lines 4–6), the director corrects AS's previous implementation with a more detailed description (line 4: "*stay seated but stick out your butt more*") and a more specific demonstration, which shows partly what he describes. He leans forward, stretches out his butt, puts his hand under his chin and produces a subtext in character voice readable as hyper-attentiveness (line 6: "*ah yes exactly yes exactly*"). AS implements D's instruction, while D is still demonstrating (line 5), adopting a posture very similar

to his (Figure 12). Finally, D re-categorizes the developed form ("*you are totally hyper-attentive,*" line 7), which at the same time confirms and reinforces AS's performance and his instruction.

Across the two parts, the verbal descriptions become more concrete (from the mood adjective "*hyper-attentive*" to the behavioral description "*stick out your butt more*"), as do the accompanying demonstrations (from a very unspecific gesticulation in line 2 to a specific pose in line 5). This is obviously due to AS's implementation in line 3, which offers a specific sitting posture ("leaning forward"). Her posture is picked up by the director, who verbally corrects a detail (line 4: "*stay seated, stick out your butt more*") and at the same time demonstrates a concrete posture that she immediately adopts (Figure 12).

Extract 6 nicely shows how verbal descriptions and embodied demonstrations elaborate each other. The instructional sequence begins with a verbal category (line 1: "*hyper-attentive*"), which is elaborated in its behavioral details in two consecutive sequences of instructions and implementations (lines 1–3 and 4–6). Finally, it is (re-)confirmed by D applying the same category he used initially (line 7: "*hyper-attentive*").

In other cases, *social categories* are used as descriptions for demonstrations. In extract 7 (Figure 13), D instructs A to act as a "*school girl*" (line 1). He demonstrates her behavior:

FIGURE 13
Extract 7: School girl.

D's instruction starts with a description in which he implicitly relates two social categories (line 1: "*he enlightens*" vs. "*you are/imitate the little school girl*") by an "if-then" construction ("if he does this, you do that"), which embodies a relationship of epistemic asymmetry ["knowing husband, (apparently) ignorant wife"]. In the following demonstration, he embodies the category "*school girl*" he expects her to play. His demonstration is a full-fledged enactment (s. Keevallik, 2010, p. 421 et. seqq.; see also Löfgren and Hofstetter, 2021), similar to staging scenes in make-believe plays (Clark, 2016, p. 329–330), combining movements with (sub-)text animated with the voice

of the enacted character (lines 2–4: "*ah okay aha, oh, you know, now I am feeling so bad already, I have, I couldn't remember*"). D's demonstration is understandable as a category-bound activity of the membership category (Sacks, 1972) "*school girl*." His demonstration is not meant to be taken over as such. It portrays a stereotype which he expects AS to adopt by creating own ways to enact it. In her subsequent performance, she implements D's instruction by producing excessive backchannel behavior (starting in line 6: "*hm hm*") and talking in a sweet high voice. Both are variations of the behavior D had demonstrated.

In extract 7, D does not depict a concrete action, but a broader *type* (Clark and Gerrig, 1990, p. 767), which tends toward a cliché, in part because AS is instructed to pretend (line 1: "*you imitate the little school girl*"). Using enactments for crafting caricatures is common (Günthner, 1999; Streeck, 2009; Goodwin and Alim, 2010; Hall et al., 2016).

5.4.2. Instructions focusing on formal aspects

In the cases discussed in Section 5.4.1, verbal means are used to describe the core of the instructed behavior. Yet, the focus of instruction can be *more aspectualized and formalized*. Descriptions can be used to explain how demonstrations are to be interpreted, and demonstrations can be more stylized to deal with formal aspects of the performance. Extract 8 (Figure 14) is a case in point.

FIGURE 14
Extract 8: Gedenke mein.

D explains A how the text should be spoken. The script prescribes a "*loud scream*" followed by the text line "*flown away is gedenke mein*." D first explains that there is no separate scream, but the text line is to be animated screamingly (lines 1–3). To support his reading of this passage of the script, D demonstrates it (lines 5–6).

First, he quotes the part of the script that he thinks should *not* be realized (spoken in a soft voice in line 5: "*a loud scream*"), followed by a full-fledged demonstration of the part that he thinks should be spoken screamingly (line 6: "*flown away is gedenke mein*"). He shouts to represent the scream and raises

both arms, a gesture that is also used when this line of text is performed on stage. A treats D's reading of the script as new information by producing a "change-of-state token" (Heritage, 1984) ("*aha*" in line 8). After a short negotiation, A accepts D's interpretation (not part of the transcript) and reproduces D's demonstration in his later re-performance of this part of the scene.

The main purpose of D's demonstration is not to show A how he should play the passage, but to explain (and convince him) how the script is to be understood—which is a precondition to play it properly. The demonstration in this case is primarily used to make his interpretation intelligible. Correspondingly, the actor's first response is not an implementation, but an expression displaying his altered knowledge (line 8: "*aha*"). Nevertheless, D's instruction includes a depiction that does not only illustrate an idea, but also demonstrates the way in which A should adopt it (speaking the text with a screaming voice), what A does in his next implementation.

Demonstrations can be highly stylized to clarify the underlying idea, as in extract 9 (Figure 15). The director (D) focuses on the speed of the actors' (A1 and A2) turn-taking:

FIGURE 15
Extract 9: Increase speed.

D instructs the actors to accelerate their turn-taking. To make this possible, the actors have to begin in a slow pace. First, D verbally describes his idea, supported by gestures illustrating accelerating (lines 1–5, Figure 16), followed by a demonstration (lines 7–12, Figures 17, 18).

His demonstration is highly stylized, focusing on the aspect of starting in a slow pace in order to be able to accelerate the turn-taking. He uses non-lexical vocalizations (Tolins, 2013; Keevallik and Ogden, 2020) (lines 9 and 11: "*de de de de*") to symbolize spoken lines, abstracting from concrete wording and its possible pronunciation (see Clark and Gerrig, 1990, p. 780 on "quotations without propositional content"). He also alternately turns his body to gaze at each actor as he demonstrates the accelerated turn taking and points at the actor in turn who is to speak the respective dummy lines (Figures 17, 18). He terminates his demonstration by repeating his claim (lines 13–15: "*you can only make an increase if you have the possibility to get even faster*"), what is confirmed by A2 (line 16: "*yes*").

The embodied temporality of turn-taking together with gaze and pointing shifts serve to underscore the instructional focus of the demonstration—starting at a slow pace to be able to accelerate turn-taking. The demonstration is highly stylized, it is not meant to be implemented as such: The actors are not expected to turn their bodies, point and gaze at each other, and, of course, should not produce dummy syllables. The proportion of "depictive elements," i.e., elements that D expects the actors to reproduce the way they were shown, is low. One reason is that the demonstration does not refer to the behavior of one person, but to a relationship between two people. Evans and Lindwall (2020) show concerning teaching basketball, in "multiparty demonstrations" (p. 1), which "involve the contributions of multiple interacting parties" (p. 2), "the coach must (…) recruit codemonstrators and direct their actions" (p. 5) to achieve a realistic demonstration. This is exactly what the director in extract 9 does not do. The main purpose of his demonstration is not to show behaviors that the actors should imitate, but to highlight properties that should inform the actors' performance. Nevertheless, parts of his demonstration, especially the accelerated tempo of turn-taking, should be adopted in the actors' play.

Extract 10 (Figure 19) is an example of the instructional focus being on something that is difficult to demonstrate, in this case a pause:

FIGURE 19
Extract 10: Pause.

D instructs the actors to play the scene again (line 1: "*once again*") with a modification, which he first describes ("*with more pause there at the beginning*" in line 1). In his ensuing demonstration, he quotes a line from the script (line 2: "*the black man*") followed by a pause (line 3). The demonstrated pausing is only recognizable as such by producing surrounding auditory phenomena. Both his verbal description and the accompanying beat gestures (line 1) direct the focus to temporal-rhythmic properties. Reciting a line from the script ("*the black man,*" line 2) marks his behavior as a demonstration and provides the left bracket of the pause. D emphasizes the duration of the following pause by adding annotative aspects—slow rhythmic nodding of the head (reminiscent of a clock or a metronome counting time units) and a posture symbolizing "waiting" by looking down with folded hands (lines 2/3; Figure 20). The behavior shown in the demonstration should not be taken over identically. The demonstration embodies the duration of the pause, which would remain unclear by verbal description alone (how long is "*more pause*"? see Stevanovic and Frick (2014), p. 8) for a similar argument in the case of singing). Still, the depiction again is not limited to illustrating an idea. Parts of his demonstration, namely the spoken text and the length of the pause in-between, should be and are reproduced when both actors restart the performance (after the extract).

6. Conclusion

This paper has analyzed how directors use demonstrations to instruct actors in theater rehearsals. We have shown

1. What embodied demonstrations achieve compared to verbal descriptions, and how they are embedded in surrounding activities,

2. How language features in embodied demonstrations, and
3. How verbal descriptions and embodied demonstrations are combined in instructions.

6.1. Demonstrations

When studying demonstrations, two seemingly contradictory properties strike us: They use *depictive means* to communicate; at the same time, they use *rhetorical means*, which are not meant to be depictive. In Clark's (2016) staging theory, depictions are seen as physical analogs of the referents they depict, adapted to the actual situation by merging selected depictive aspects and added non-depictive aspects into a gestalt intended to convey a proximal scene for a current interactional purpose. Depictions are therefore never exact copies of the "distal scenes" in a "there-and-then." Rather, they are selective and come with annotative aspects that, taken together, provide an interpretive framework rhetorically shaping the to-be-inferred "demonstration proper."

Demonstrations are only intelligible in their sequential context. In our cases, they are embedded in instructions of directors aimed at developing a performance together. Instructions of directors usually seek to improve actors' previous performances by instructing future actions. Therefore, demonstrations are not sufficiently characterized by classifying them as using a depictive semiotic mode.[18] By virtue of being embedded in instruction sequences, they obtain representational qualities that distinguish them from depictions in general. These qualities arise from their action-related function concerning contextually grounded expectations about what is to be imitated in the actual practical context and what is not (Szczepek Reed, 2021).

Demonstrations are similar to reenactments, quotations and direct reported speech in being realized as separate components of a larger instructional action, marked and framed by vocal or embodied resources or combinations thereof (s. Cantarutti, 2020, p. 134–167) as representations of a displaced action. When language is used concurrently with the demonstration, it is treated as a part of the demonstration (as quoting a script) or as an annotative aspect commenting on it, but not, as is usual for depictions and illustrative gestures, for contextualizing talk.

In contrast to quotes and reenactments used in stories, demonstrations model future events. They are produced as instructions to implement parts of the shown behavior. This is due not only to the ways in which demonstrations are constructed (Sections 4.2 and 4.4) and their sequential placement (4.1), but also because they are embedded in directive framings.

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18 Since actual behavior in most cases is based on a mixture of meaning-making methods, "a prototypical depiction is really a communicative signal whose depictive property is more salient than its indicative and descriptive properties" (Hsu et al., 2021a, p. 3).

6.2. How language features in embodied demonstrations

All of the demonstrations we investigated come with verbal utterances. Language fulfills a variety of functions to make demonstrations intelligible. Since demonstrations are realized as component (not concurrent) parts of instructions, they are typically bracketed by introductory verbal framings of their beginning (as in ex. 4/line 2: "*what isn't working is this*") and often followed by descriptions or accounts marking their endings. The demonstration itself can be additionally made salient by practices of emphasizing, e.g., using a theatrical voice or making the body noticeable by adopting a visible position and/or exaggeration (see also Ivaldi et al., 2021, p. 8 et. seq.; Keevallik, 2010). In these respects, demonstrations are again similar to quotes and reenactments.

However, verbal material can also be used concurrently to build the demonstration. Language can either be part of the "demonstration proper" (as with script texts) or comment on the demonstration in parallel. In separating depictive from non-depictive parts that are to be imitated, actors rely on different sources. In addition to instructional framings provided locally, common ground (concerning occupational practices, the script text, etc.) and the interactional history concerning previous agreements about the performance play a crucial role (on iterativity in rehearsals see Hazel, 2018; Hsu et al., 2021b; Löfgren and Hofstetter, 2021; on the emergence of common ground over interactional histories in rehearsals see Deppermann and Schmidt, 2021; Schmidt and Deppermann, in press).

All instructions we analyzed contain verbal materials that indicate how a demonstration is to be interpreted. Directors treat demonstrations as being in need of additional descriptions that clarify what they are supposed to represent in order to be comprehensible for the actors, thus providing clues as to what should and should not be adopted by the actors and in which way. Verbal description clarifies the status of demonstrations (e.g., by gradation, negation, contrast formats, or by establishing an "if-then"-relationship). Such clarifications cannot be accomplished by demonstrations alone. More elaborate descriptions accompanying the demonstrations provide an instructional focus making demonstrations intelligible.

6.3. How more elaborate verbal descriptions and embodied demonstrations of the same instructional focus are combined

There is a division of labor between telling and showing: Directors' descriptions provide an interpretative framework

for how to interpret demonstrations, whereas demonstrations make parts of to-be-imitated physical movements tangible. In particular, demonstrations make behavior that is difficult to describe or partly ineffable more accessible for recipients. "Ineffability is a strong reason for quoting instead of describing" (Ryle, 1949; Clark and Gerrig, 1990, p. 793; Hsu et al., 2021a,b).[19] Both verbal descriptions and embodied demonstrations are indispensable parts of directors' instructions and mutually elaborate each other (Goodwin, 2018, ch. 8).

Verbal descriptions and embodied demonstrations stand in a reflexive relationship to each other: verbal means categorize what a demonstration is to represent; demonstrations show how what is specified by verbal means is to be realized. This reflects the two aspects that instructions in theater always orient to, namely a concept (or idea), which has to be bodily implemented. Szczepek Reed (2021) argues that conceptual meaning and their embodiment are two sides of a coin in instructions—sometimes being more "body-focused," sometimes being rather "concept-focused." Directors not only introduce a concept, but they often also show—at least in part—how this concept could be played.

It has to be noted that verbal descriptions can be more or less detailed, ranging from just providing a category to elaborate descriptions and accounts, and embodied demonstrations can be more or less accurate and holistic vs. highly stylized (Section 5). Less detailed descriptions are often accompanied by more elaborated demonstrations, whereas elaborate descriptions accompany rather stylized demonstrations. These variations depend on whether instructions focus more on content-related entities such as actions, ways of behaving or social categories (Section 5.4.1) or on more formal aspects, as, e.g., the coordination of temporal relationships (Section 5.4.2).[20] Demonstrations focused on *formal aspects* tend to be stylized and in need of more elaborate descriptions and occasionally accounts to make clear what the demonstration aims for. If demonstrations focus on *content-related entities*, in contrast, it is often sufficient to provide verbal categories (as "*limping*," "*hyper attentive*," "*school girl*") to make the idea that informs the instruction clear. These categories are accompanied by

full-fledged demonstrations of the director. In our data, demonstrations tied to enacting categories of behavior or persons do not show concrete behaviors that are meant to be imitated exactly, but they perform types metonymically that provide a basis for the actors to develop their own ways of suitable realization.[21] This is supported by the director enacting a social category but using subtext which in some cases is not even animated in a character voice. Nevertheless, the demonstration contains aspects which are to be taken over. Demonstrating types comes close to illustration, yet without being only an illustration. Further research is needed on the relation of illustrations and demonstrations and how it relates to whether depictions or demonstrations represent concrete behaviors as opposed to types. This is particularly relevant for theater, as instructing types seems to be a creative practice by directors to elicit actors' own ideas for performing a scene, on which directors can subsequently build.

Data availability statement

The datasets presented in this study are from a private corpus, further inquiries can be directed to the corresponding author.

Ethics statement

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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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19 "…'embodied knowledge' (…) needs to be enacted by the lived body in order to be accessible in the interaction (be it in dance, instrument playing, singing, sports, or any other type) and in this sense defies its separation from that same body as its original habitat. In other words, it is a form of knowledge that is non-representational in the sense that it can only be partly 'represented' at the conceptual level" (Ehmer and Brône, 2021, p. 3).

20 As Norrthon (2019) has shown, often a script provides a rough framework for *what* to play (e.g., a quarrel), whereas the "howness" (p. 183) has to be developed in the rehearsals. In developing how to play a scene, however, both the "what" (e.g., playing a "school girl") and the "how" (e.g., talking in a very high voice) can be aspects of *how* to play a scene, with the former being delivered as a verbal category and the latter as a behavioral description, often accompanied by a demonstration.

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21 "(…) [T]he events, states, processes, and objects we can demonstrate can be either generic or specific—either types or tokens" (Clark and Gerrig, 1990, p. 767). The director's demonstration of "a school girl" is a generic one—he refers to a type rather than a token.

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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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