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Life in transition: nostalgia as change-related emotion

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Nostalgia is a complex emotion that connects the present with both the remembered past and the imagined future. While traditionally studied in its past-oriented form, future-oriented variants, such as *anticipatory* and *anticipated nostalgia*, remain underexplored, partly due to methodological challenges. Although these forms also engage prospective cognitive processes, like episodic future thinking and mental simulation, they have usually been addressed through conventional, memory-based paradigms. This perspective proposed novel methodological design guidelines for eliciting nostalgia across its full temporal spectrum (past and future oriented variants) by combining Virtual Reality (VR) with a specific class of content: *liminal spaces*, contexts marked by transition and ambiguity. VR offers immersive and controllable environments, while liminal settings symbolically reflect change, a core feature of nostalgic experience. Specifically, we offered design guidelines for constructing liminal spaces aimed at eliciting both past- and future-oriented nostalgia, through the manipulation of two key variables: familiarity and ambiguity. This approach seeks to enhance experimental control and ecological validity, addressing current limitations in nostalgia research. Finally, it offered potential clinical applications, especially in contexts where reconnecting with meaning and future self-continuity is essential, such as during life transitions or emotional distress.

KEYWORDS

nostalgia, complex emotion, liminal spaces, liminality, virtual reality, health, perspective

1 Introduction

Nostalgia is a complex and mixed emotion that connects the present to both the remembered past and the imagined future (Sedikides et al., 2008; Barrett et al., 2010; Yang et al., 2023; Cao, 2024). It can be elicited by a variety of stimuli (e.g., music, natural landscapes, images of the past; see (Sedikides et al., 2022; Wildschut et al., 2006; Michels-Ratliff and Ennis, 2016) and is characterized by a temporally fluid structure that facilitates meaning-making across life transitions (Routledge et al., 2011; Routledge et al., 2012). Although nostalgia has traditionally been examined in its past-oriented form, closely linked to autobiographical memory and emotion regulation, it also unfolds in future-oriented variants, such as *anticipatory* and *anticipated nostalgia* (Yang et al., 2023; Yang et al., 2022; Cheung et al., 2020; Cheung, 2023), which remain comparatively underexplored in empirical research.

These temporal forms of nostalgia differ not only in focus, but also in the cognitive mechanisms they engage (Batcho, 2020). While past-oriented nostalgia draws primarily on autobiographical recall, future-oriented nostalgia involves prospective processes such as mental time travel, imagination, and simulation (Cheung et al., 2020; Epstude and Peetz, 2012; Batcho and Shikh, 2016; Trigg, 2024). These forms are particularly salient during

transitional life phases (Cheung et al., 2020), moments when identity, social roles, and meaning are being redefined (Cheung, 2023; Denne and Thompson, 1991; Manzi et al., 2010; Cohen and Kassin, 2018). Despite growing theoretical interest, current empirical methods of induction mainly rely on traditional emotion-elicitation techniques, also for novel future-oriented forms of nostalgia. Most experimental paradigms have emerged from autobiographical memory research, relying on recall-based techniques such as the Event Reflection Task (ERT) or on sensory cues like song lyrics, smells or food (Routledge et al., 2011; Sedikides et al., 2015; Abeyta and Routledge, 2016; Cheung et al., 2013; Reid et al., 2023; Reid et al., 2015; Fetterman et al., 2025). These methods typically evoke warm, familiar, and emotionally positive associations with family, friends, or childhood (Wildschut et al., 2006; Hepper et al., 2012; Holak and Havlena, 1992). While they can offer high ecological validity, they entail low experimental control, and standardization (Wildschut and Sedikides, 2024; Clayton McClure et al., 2024). Furthermore, they depend heavily on participants' ability and willingness to access personal memories, introducing significant interindividual variability (Seehusen et al., 2013; Baldwin and Raney, 2021). This inherent subjectivity makes cross-study comparisons difficult (Batcho, 2013). Moreover, no existing induction method of nostalgia simultaneously meets the key methodological requirements of statistical power, internal validity, and ecological validity (Wildschut and Sedikides, 2024).

Although it has been proposed that future-oriented nostalgia can share cognitive and neural substrates with autobiographical memory (Cheung, 2023), anticipating future experiences often involves more complex cognitive operations, such as simulation and imagination, and is thus more vulnerable to bias and variability (Epstude and Peetz, 2012; Clayton McClure et al., 2024). Recent research further emphasizes the need for paradigms capable of differentiating between *anticipated* and *anticipatory* emotions, underlining the lack of operational clarity in this area (Clayton McClure et al., 2024). Taken together, these limitations point to a critical need for novel methodological guidelines that can address the temporal fluidity and generative complexity of nostalgia, especially in its future-oriented forms.

Virtual Reality (VR) as an advanced emotion-elicitation method, also emerged as a suitable technique to work on cognitive processes related to anticipated or anticipatory emotions (e.g., (Bø et al., 2022), such as episodic-future-thinking (Habak et al., 2021) or imagination (Chirico and Gaggioli, 2023), as well as on peculiar complex emotional states with a mixed nature (e.g., awe, see (Chirico et al., 2016; Pizzolante et al., 2023), also due to the sense of presence - as the illusion of "being there" (Chirico and Gaggioli, 2021; Waterworth et al., 2015) in that simulation. Thus, here, we proposed to use VR to enhance the elicitation of nostalgia, especially in its future-oriented forms. Moreover, since emotion-induction in VR depends not only on medium but also on the content (e.g., (Somarathna et al., 2022), especially for complex emotions (e.g., awe in Triberti et al. (2017), here, we also outlined the key role played by a peculiar content on the induction of VR-based nostalgia, that is *liminal spaces*. These situations, conceivable as psychological or environmental contexts marked by transition and ambiguity and characterized by symbolic openness and narrative fluidity, reify the concept of change itself (Meethan, 2012). Indeed, the core feature of "change" (Sedikides

et al., 2008; Cheung et al., 2020; Sweeney, 2020; Iyer and Jetten, 2011; Brown and Humphreys, 2002; van Dijke and Leunissen, 2023; Turner and Stanley, 2021), which has always been conceptually embedded into all forms of nostalgia, has rarely been considered in the experimental elicitation of this emotion. In this regard, we suggested that liminal spaces would turn into suitable nostalgia-inducing content, especially when embedded within virtual reality scenarios.

To summarize, this perspective introduces novel evidence-based design guidelines for eliciting nostalgia across its full temporal spectrum. These guidelines develop along two complementary dimensions: medium and content. First, regarding the medium, we highlight the potential of immersive technologies, particularly Virtual Reality (VR), as innovative tools for nostalgia induction, capable of engaging cognitive processes associated with both past- and future-oriented forms of nostalgia. Second, in terms of content, *liminal spaces* have already emerged as settings capable of evoking transitional experiences. These spaces can be purposefully designed within virtual environments (Liedgren et al., 2023). More specifically, this perspective emphasizes that a particular type of emotional transition should be targeted within liminal spaces, namely, the one associated with nostalgia. To this end, we identify and detail key variables, or design dimensions, that should be manipulated to create simulated liminal environments capable of eliciting nostalgia, even within controlled laboratory settings.

2 The temporal and cognitive fluidity of nostalgia: change-related features of nostalgia

Nostalgia is a complex and mixed emotion, characterized by a distinctive blend of positive and negative affect, typically involving warmth, longing, and a sense of loss (Sedikides et al., 2008; Barrett et al., 2010). This emotional ambivalence makes nostalgia especially salient in situations of transition, ambiguity, or psychological threat, where it can function as a self-regulatory resource (Cheung et al., 2020; Karagöz and Loneliness, 2024). One of its most defining features is temporal fluidity: while it has traditionally been studied as a past-oriented emotion rooted in autobiographical memory, nostalgia also unfolds in future-oriented forms, namely, *anticipated nostalgia* (expecting to miss something in the future) and *anticipatory nostalgia* (pre-emptively missing something before it is lost) (Yang et al., 2023; Yang et al., 2022; Cheung et al., 2020; Batcho and Shikh, 2016). These two future-oriented forms differ not only in temporal direction but also in cognitive structure: whereas anticipated nostalgia involves the cognitive forecasting of nostalgia, anticipatory nostalgia involves an emotionally laden simulation of future loss in the present moment (Cheung, 2023; Batcho, 2020). Future-oriented nostalgia engages higher-order cognitive processes such as episodic future thinking, mental simulation, and prospective memory (Cheung, 2023; Epstude and Peetz, 2012; Batcho and Shikh, 2016), and therefore requires greater imaginative flexibility than recalling a past experience. Unlike conventional autobiographical recall tasks used in laboratory settings, often based on personal memories, familiar music, or sensory cues (Routledge et al., 2011; Abeyta and Routledge, 2016;

Reid et al., 2023), future-oriented forms are more generative and cognitively demanding. This makes them less compatible with standardized induction paradigms, which tend to lack the contextual richness and narrative ambiguity that characterize real-life transitions (Cheung, 2023; Clayton McClure et al., 2024).

In ambiguous and transitional life phases, nostalgia supports meaning-making and continuity by linking past values with imagined futures (Cheung et al., 2020; Reich et al., 2008). The COVID-19 pandemic, for example, has been described as a paradigmatic ambiguous event (Simonovic and Taber, 2022; Gunessee and Subramanian, 2020), during which nostalgia functioned as a coping mechanism in response to social disconnection and disrupted routines (Batcho, 2020; Juhl et al., 2020). In such contexts, individuals engaged with nostalgic media not only to recover a sense of stability, but also to envision alternative post-crisis futures (Wulf et al., 2022). This dual orientation, anchored in memory but oriented toward future adaptation, makes nostalgia a uniquely flexible resource during change. Its emotional ambivalence, combining comfort with loss, enables individuals to tolerate uncertainty while maintaining continuity of identity (Routledge et al., 2012; Sedikides et al., 2015). Furthermore, nostalgia has been shown to support adaptive behaviors, including prosociality and environmental engagement, by reactivating core values and reinforcing meaning in life (Cheung et al., 2013; Baldwin and Landau, 2014; Abeyta et al., 2015). In this way, nostalgia functions not only as a regulatory mechanism in the face of change, but also as a motivational resource that links emotional insight with future-oriented action. Yet it is precisely within such transitional contexts, identity shifts, turning points, uncertain futures, that nostalgia most powerfully emerges and performs its psychological functions (Denne and Thompson, 1991; Manzi et al., 2010; Cohen and Kassan, 2018). In other words, nostalgia can be deemed as a “change-directed” emotion (Sweeney, 2020) and even change-making (Bonnett, 2015), in that it motivates individuals to engage with transitions by drawing from emotionally salient memories. A person is not as likely to miss something they don’t expect to be different or lost someday (Zhou et al., 2020). However, in this perspective, we adopt the broader term “change-related” to emphasize the contextual and experiential embedding of nostalgia within liminal and transitional phases, foregrounding not only its motivational potential, but also its regulatory, reflective, and meaning-making functions during times of uncertainty.

3 Towards novel evidence-based design guidelines for eliciting nostalgia in the lab: VR and liminal spaces as allies

Existing methods for eliciting nostalgia can be improved, particularly with regard to anticipatory and anticipated nostalgia, which depend on complex cognitive processes such as episodic future thinking, simulation, and self-projection (Batcho, 2020; Cheung et al., 2013). These future-oriented forms are difficult to evoke through conventional memory- or stimulus-based paradigms, originally designed for past-oriented nostalgia. To address this, we propose novel evidence-based design guidelines for eliciting nostalgia across its full temporal spectrum by combining immersive Virtual Reality (VR) as the medium with *liminal*

spaces as the content. We conceptualized future-oriented nostalgia as a change-related emotion that is especially likely to emerge in psychologically liminal contexts, situations marked by ambiguity, transition, and symbolic openness (Blackburn et al., 2024). VR, with its capacity to simulate spatial and temporal dislocation with ecological realism and heightened presence (the subjective sense of “being there”), offers the ideal infrastructure for constructing such experiential spaces (Riva et al., 2007). However, the effectiveness of VR relies not only on immersion but on the integration of psychologically resonant content. Liminal spaces, such as airports (Huang et al., 2018), festivals (Kim and Jamal, 2007), restaurants (Liedgren et al., 2023), beaches (Preston-Whyte, 2004), symbolize suspended states where boundaries blur, and temporal coordinates dissolve (Turner, 1983). These spaces prompt narrative reconfiguration and emotional openness, conditions conducive to nostalgia’s integrative processes.

Our design guidelines entail two interdependent variables critical to simulating nostalgia-inducing liminal spaces: familiarity and ambiguity. *Familiarity*, via personally or culturally meaningful cues, supports temporal continuity and self-coherence (Sedikides et al., 2008; Sedikides et al., 2015; Iyer and Jetten, 2011; Sedikides et al., 2004; Sedikides and Wildschut, 2016; Sedikides et al., 2023) while *ambiguity*, through open-ended, transitional elements, invites imaginative projection and reflective processing of nostalgia (Cheung, 2023; Clayton McClure et al., 2024). Their calibrated interplay allows VR environments to model the psychological conditions in which nostalgia, particularly future-oriented forms, naturally emerges. Moreover, liminality functions not just as a contextual backdrop but as a *design principle* for emotional transition. Anticipatory and anticipated nostalgia require individuals to imagine a future in which the present is already lost, an operation that blends presence, detachment, and narrative reorientation (Zhou et al., 2020). By affording a suspended experiential frame where “what is” and “what might be” can coexist (Stenner and Jackson, 2017; Land et al., 2014; O’Callaghan et al., 2020), liminal VR spaces become symbolic containers for emotional ambivalence, temporal fluidity, and self-reconstruction. Already applied in clinical fields to support mood regulation and emotional processing (e.g., in depression, anxiety, addiction, see (Chirico and Gaggioli, 2021; Triberti et al., 2017; Riva et al., 2016; Boltri et al., 2025)), VR now offers a structured, immersive platform for eliciting complex, generative emotions such as nostalgia. This integrated approach was detailed in the following.

4 Designing nostalgia-inducing liminal spaces in virtual reality: not all “liminal spaces” are equal

VR offers a powerful medium for exploring the full temporal spectrum of nostalgia, including its future-oriented forms (Bergs et al., 2020). Due to its immersive qualities and heightened sense of presence, VR enables individuals to inhabit liminal spaces, environments marked by symbolic openness, narrative fluidity and transitional ambiguity (Meethan, 2012). These characteristics make VR particularly suited to simulate moments of change and reflection, which are psychologically fertile conditions for nostalgia

TABLE 1 Examples and related references of how Familiarity design principle, drawn from liminality, can be embedded into experimental settings as nostalgia-inducing content.

Category	Example	Supporting evidence
Autobiographical spaces	A childhood bedroom with decade-specific toys; posters; furniture; and ambient sounds	Huang et al. (2024)
Childhood-related stimuli	Familiar objects from one’s formative years (e.g., toys, books, school-related items); evoking developmental anchors	Wildschut et al. (2006)
Music-based stimuli	Background music featuring popular songs from adolescence or formative years	Barrett et al. (2010)
Collective rituals	Holiday, birthday parties, graduation ceremonies, marriages	Yin et al. (2024)
Festival environments	Symbolically rich and affect-laden spaces that foster communal memory through music, ritual, and shared narratives	Holyfield et al. (2013), Dresler and Jackson (2024)

to emerge (Triberti et al., 2017; Chirico et al., 2017). In this perspective, we propose novel evidence-based design guidelines for creating nostalgia-inducing virtual environments starting from a liminal content. Indeed, not all liminal spaces are equal and can potentially elicit a wide array of emotions or experiences. Here, our goal was to specifically target liminal scenarios able to induce nostalgia (past and future oriented) in an ecologically valid but controlled way. To this end, drawing from scientific literature on nostalgia (e.g., (Barrett et al., 2010; Reid et al., 2015; Janata et al., 2007; Kim et al., 2019), we outlined key variables that can be manipulated in order to facilitate the emergence of nostalgia in VR drawing from liminal spaces as content.

Specifically, central to our guidelines was the intentional manipulation of two variables: familiarity and ambiguity. *Familiarity* refers to the degree to which an environment or its elements are perceived as personally meaningful, culturally shared, or recognizably patterned (Felder, 2021). It supports emotional safety, self-continuity, and reflective depth. In fact, familiarity is not limited to past-oriented content, nor is it constrained to autobiographical memory. Due to the shared neural architecture between episodic memory and episodic future thinking, familiar elements can serve as scaffolds for constructing plausible future scenarios (Addis et al., 2007; Schacter et al., 2012; Schacter et al., 2017). In fact, several studies have shown that patients with impaired memory of the past are similarly deficient when asked to imagine future experiences (Addis et al., 2009; Andelman et al., 2010; d’Argembeau et al., 2008; Gamboz et al., 2010; Klein et al., 2002; Rasmussen and Berntsen, 2014; Tulving, 1985).

Several studies have examined how the familiarity of the context of an imagined event affects the phenomenology of the event itself, such as more detailed and more vivid imagined events (Szpunar and McDermott, 2008). Moreover, when asked to imagine events in familiar, common locations (e.g., library or dorm) versus unfamiliar locations (never-visited famous locations) the events set in familiar locations were imagined more clearly and easily (Arnold et al., 2011). So, by reducing cognitive load and enhancing affective grounding, familiar stimuli or contexts facilitate the projection of the self into potential futures with greater vividness and coherence (Robin et al., 2018). In immersive settings, familiarity can arise from a variety of environmental features, ranging from personally significant cues to culturally shared symbols, which can be intentionally embedded to scaffold nostalgic engagement. In Table 1., we reported several key examples of studies that have intentionally relied on the dimension of familiarity for the elicitation

of nostalgia, which show how familiarity can be operationalized in VR environments. Specifically, we identified key categories of familiarity that have been already implemented within experimental settings but only for past-oriented forms of nostalgia.

Therefore, based on prior empirical evidence and theoretical models, we propose a set of preliminary design guidelines for embedding and modulating familiarity within immersive liminal scenarios, also applicable to future-oriented forms of nostalgia. Familiarity should be conceived as a multidimensional construct that, when carefully assessed by the individual’s experiential history, can be strategically manipulated to produce environments perceived as highly or minimally familiar. Sub-constructs of familiarity can serve as operational criteria for evaluating and embedding familiar stimuli within immersive environments (Zhang et al., 2019).

1. Prior experience: person’s previous experiences related to the target stimulus;
2. Positive emotional valence: whether the stimulus has historically elicited or been associated with positive affect;
3. Occurrence frequency: how often the stimulus has been encountered and encoded, increasing its cognitive accessibility;
4. Depth of processing: degree of elaboration during previous exposures, which enhances memorability;
5. Retention rate: the strength and persistence of the memory trace over time, inversely related to temporal decay.

Higher levels across these five sub-constructs are expected to predict stronger perceived familiarity. Accordingly, and in line with the theoretical and empirical evidence discussed above, high familiarity environments are more likely to induce past-oriented nostalgia, whereas low familiarity, especially when embedded within liminal, ambiguous contexts, can more readily elicit future-oriented nostalgia. Moreover, if the evoked emotional tone is predominantly positive, as frequently reported (Clayton McClure et al., 2024), such experiences can be more likely to trigger anticipated nostalgia rather than anticipatory nostalgia.

In contrast, *ambiguity* refers to the degree to which an environment resists fixed interpretation, temporal anchoring, or semantic closure. Ambiguous situations are open to multiple perspectives and interpretations, often lacking a singular, stable meaning (Weick, 2015). In design research, ambiguity is recognized not as a deficit but as a generative feature: it is considered an essential component of the design process (Bucciarelli, 2002) and is understood as emergent from the

TABLE 2 Examples of how Ambiguity design principle, drawn from liminality, can be embedded into experimental settings as nostalgia-inducing content.

Category	Example	Supporting evidence
Visual ambiguity	Graphics, illustrations, or images that are unclear or abstract and let the individual understand them for himself	Abdo (2024), Eppler et al. (2008)
Semantic or Information Ambiguity	- Use imprecise representations to emphasize uncertainty: information that is physically or conceptually blurred (e.g., kind of digital sfumato for images or virtual world; decontextualized phrases to create a similar air of enigma); - Inconsistent information to create a space of interpretation (e.g. a quiet family scene next to a protest march) or arising from the multiple meanings of words or symbols.	Gaver and Martin (2000), Long and Vines (2013), Weiser and Brown (1996), Dahley et al. (1998), Gaver and Dunne (1999), Cleland et al. (2006)
Context Ambiguity	- Implicate incompatible contexts to disrupt preconceptions (e.g., bringing together disparate contexts); - Add incongruous functions to breach existing genres; - Block expected functionality to comment on familiar products (e.g., simultaneously phone and not-phone that cannot call).	Gaver and Dunne (1999)
Cultural Ambiguity	Design elements that are open to interpretation based on diverse cultural backgrounds (e.g., symbols that can hold diverse cultural significance)	Abdo (2024), Blanchard and Allard (2010)
Ambiguity of relationship	- Offer unaccustomed roles to encourage imagination (e.g., allowing people to engage in a radical first-person narrative as a kind of experiment in living); - Point out things without explaining why; - Introduce disturbing side effects to question responsibility (e.g., balance of desire and ethics can be provoked by designs that seem immediately appealing but which have disquieting implications such as artificially intelligent feeder that uses operant conditioning principles to teach local birds new songs).	Gaver and Martin (2000), Gaver et al. (2006), Bentvelzen et al. (2022), Trujillo-Pisa et al. (2014), Núñez-Pacheco and Loke (2014)
Narrative Ambiguity	Openness or uncertainty in the narrative or storytelling elements of design	Dunne (2008), Shipe (2017), Lyons (2001)
Aesthetic Ambiguity	Aesthetic features that are interpretable (e.g., artistic arrangements that purposefully obfuscate the distinctions between various visual components to enable personal interpretation)	Gaver et al. (2006), Marchesini and Özcan (2016), Rohlf's (2023)

dynamic interplay between individuals and artefacts within a context (Gaver and Martin, 2000). Accordingly, ambiguity is frequently explored in stimuli and environments that demand a careful balance between expressive openness and communicative clarity (Lawson and Loke, 1997; Wiegers et al., 2011; Abdo, 2024). It has been extensively used as a resource to foster reflection, emotional resonance, and deeper individual engagement (Gaver et al., 2006; Long and Vines, 2013; Bentvelzen et al., 2022). Psychological literature further conceptualizes ambiguity as a feature of stimuli that are unexpected, novel, or interpretable in more than one way within their spatial or temporal context (Rapoport and Kantor, 1967; Schoth and Liossi, 2017). This quality mirrors one of the defining traits of liminality itself: the blurring and suspension of established spatial, temporal, and identity boundaries (Chirico et al., 2017; Hepper et al., 2021). In this sense, ambiguity plays a critical role in enabling the transitional openness of liminal spaces, facilitating personal meaning-making processes that unfold beyond linear or categorical interpretation. Ambiguity can manifest in different modalities, as outlined in Table 2, and is often expressed in virtual environments through minimal, symbolic, or atmospherically open spaces that foster interpretive flexibility, imaginative immersion, and prospective self-projection (Triliva et al., 2022). These features are particularly salient within VR-based liminal settings, where ambiguity not only sustains interpretative openness but also enables disengagement from

rigid autobiographical constraints, allowing for the exploration of alternative identities, meanings, and futures. The examples provided in Table 2 illustrate how ambiguity has been operationalized across distinct experimental categories to elicit nostalgia, though primarily in relation to past-oriented forms.

Based on previous evidence, including insights relevant to future-oriented nostalgia, we developed the following design guidelines for embedding and manipulating ambiguity within virtual environments. While familiarity is primarily evaluated in relation to the individual's past experiences with specific objects or contexts, ambiguity is assessed based on the degree of interpretative openness or uncertainty elicited by the environment. In design research, various levels of ambiguity have been operationalized, for instance, through graded measurement tools such as a nine-point ambiguity scale (Tseng, 2018), which captures the extent to which a space resists fixed categorization or invites multiple meanings. For example, a low level of visual ambiguity is characterized by clearly legible and unambiguous elements (e.g., a written sign on a wall or a well-defined, photorealistic liminal scene) providing immediate cues for recognition and interpretation. Conversely, a high level of visual ambiguity involves more abstract, indeterminate, or symbolically open-ended visual stimuli, thereby requiring the individual to actively interpret the environment and infer its meaning (e.g., using unclear signage, fog, or blurred spatial contours). This interpretative effort increases the

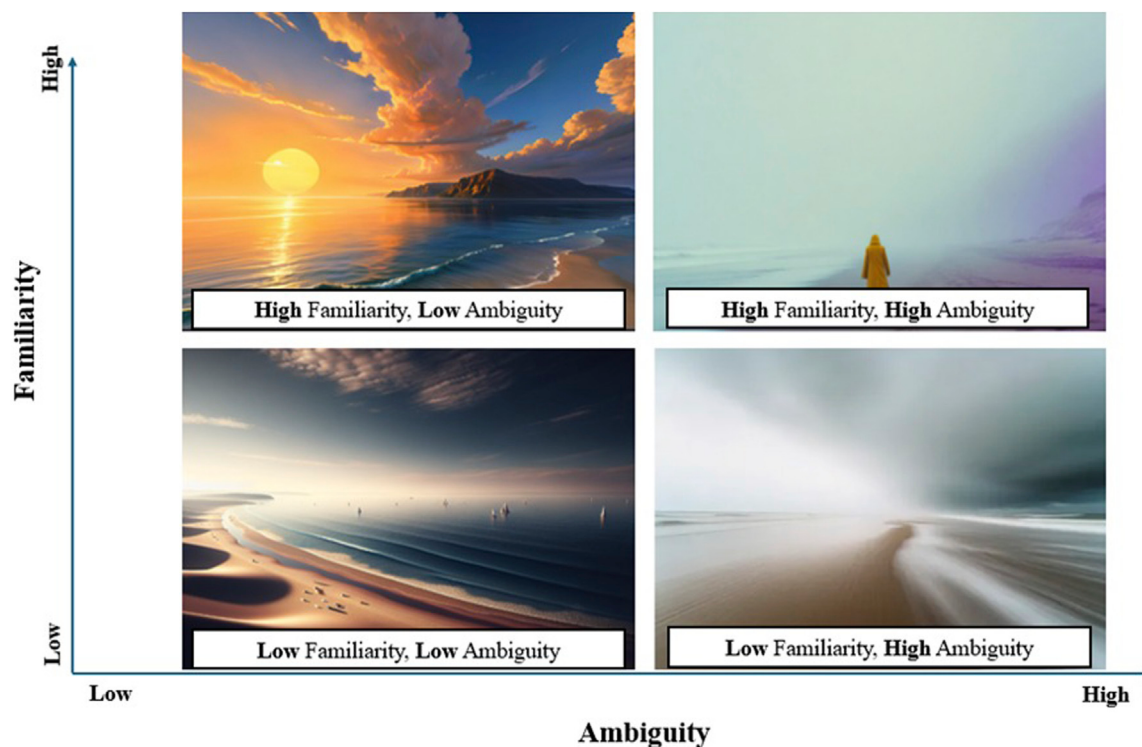


FIGURE 1

Conceptual example to orient the design of nostalgia-inducing virtual liminal spaces. This illustrative diagram, created by the authors as proprietary content using the Envato Labs platform¹, visually represents the intersection of familiarity (horizontal axis: personal or cultural relevance) and ambiguity (vertical axis: symbolic openness or indeterminacy). The four resulting quadrants illustrate possible combinations of these dimensions that can be associated with distinct temporal orientations of nostalgia and selected depending on the type of nostalgia one aims to elicit.

cognitive and affective uncertainty of the setting, amplifying the sense of disorientation that is characteristic of liminal spaces. In line with the theoretical and empirical considerations discussed above, we hypothesize that high levels of ambiguity within virtual liminal environments are more likely to induce future-oriented nostalgia, as they stimulate imaginative projection, anticipation, and narrative openness. In contrast, low levels of ambiguity are more likely to evoke past-oriented nostalgia, by reinforcing recognition, memory retrieval, and a sense of temporal anchoring.

We now propose a synthesis of how familiarity and ambiguity can be strategically combined in virtual environments to elicit distinct forms of nostalgia. When manipulated together, these two dimensions shape the user's experience along a temporal and affective axis, influencing whether nostalgia is more past- or future-oriented. Ambiguity promotes interpretative openness and imaginative engagement, while familiarity modulates affective grounding and autobiographical resonance. Their interaction defines the quality and directionality of the nostalgic experience. To support these guidelines visually, we introduce a conceptual example (Figure 1) that maps the intersection between familiarity (low–high) and ambiguity (low–high). This example illustrates four distinct design quadrants, each associated with specific temporal

orientations of nostalgia, and corresponding to a possible choice depending on the type of nostalgia one aims to elicit. Specifically,

- Quadrant I–High Familiarity/Low Ambiguity, Past-Oriented Nostalgia: Virtual spaces in this quadrant feature recognizable, personally or culturally meaningful cues presented with clear, structured semantics. These environments foster straightforward autobiographical recall and emotional grounding by evoking comforting memories of the past. The nostalgic response is primarily *evocative* and affectively warm, centered on temporal anchoring and the recovery of self-continuity.
- Quadrant II–High Familiarity/High Ambiguity, Past-Oriented Nostalgia (*anticipated*): These scenarios embed familiar stimuli within atmospheres marked by symbolic openness or ambiguity. The combination of recognizably positive cues and interpretative openness fosters anticipated nostalgia, positively valenced longing for the present as it unfolds. By blending emotional familiarity with perceptual uncertainty, these environments support reflective savoring and facilitate the projection of the self into future recollections. While not nostalgic in the moment, the individual develops a reflective awareness that the current experience will later acquire emotional significance.
- Quadrant III–Low Familiarity/High Ambiguity, Future-oriented (*anticipatory*) nostalgia: These highly imaginative

¹ <https://labs.envato.com/>

environments are perceptually and semantically open, lacking direct autobiographical anchoring but fostering projection into plausible futures. This configuration is more likely to elicit anticipatory nostalgia, a form of nostalgia more strongly associated with negative feeling yet carrying adaptive cognitive value in uncertain situations.

- Quadrant IV—Low Familiarity/Low Ambiguity, Past-Oriented Nostalgia: Virtual spaces in this quadrant are unfamiliar yet semantically clear and perceptually coherent. In the absence of familiar cues, individuals can engage in past-oriented nostalgia as a regulatory mechanism, retrieving personal memories to restore emotional grounding. This compensatory process is particularly likely to occur in contexts of uncertainty or psychological threat, where nostalgia serves as an adaptive resource to maintain self-continuity and affective stability.

5 Conclusions

This perspective proposes novel guidelines for the systematic elicitation of nostalgia, particularly its future-oriented forms, by combining two complementary dimensions: the medium of Virtual Reality (VR) and the content of liminal spaces. While nostalgia has traditionally been studied through memory-based induction methods targeting past-oriented form, we argue that future-oriented nostalgia, especially in its *anticipated* and *anticipatory* variants, requires dedicated design strategies capable of engaging cognitive processes such as imagination, simulation, and projection. To address this gap, we introduced a novel design matrix based on the interaction between familiarity and ambiguity, two core variables that shape the phenomenology of nostalgia. We demonstrated theoretically how their intentional manipulation within immersive liminal environments can elicit different nostalgic experiences. Liminal spaces, conceptually aligned with transition, symbolic openness, and psychological thresholds, emerge as particularly suitable content for nostalgia induction when embedded in VR scenarios. VR, in turn, offers an immersive medium capable of enhancing the sense of presence and supporting temporally extended forms of emotional experience (Riva et al., 2007; Chirico et al., 2017). Together, this medium-content alignment enables the creation of controlled, ecologically valid settings that overcome the limitations of traditional, recall-based paradigms.

Despite its theoretical and design contribution, these guidelines present several limitations. First, it remains theoretical and design-driven and requires empirical validation across diverse populations and contexts. Second, nostalgia is highly subjective and culturally shaped, which raises the challenge of balancing personalization with experimental control. Third, the distinction between *anticipated* and *anticipatory* nostalgia, while theoretically grounded, still lacks validated measurement tools in immersive settings. Additionally, the role of multisensory components, such as sound, scent, and tactile feedback, in manipulating nostalgia within VR environments could be further explored.

Future research should aim to operationalize these guidelines experimentally, investigating how different configurations of familiarity and ambiguity influence the elicitation of nostalgia and its downstream effects on affect regulation, temporal coherence, and self-continuity. Additionally, the applicability of nostalgia-inducing

VR scenarios should be explored across applied domains such as mental health, life transitions, career reflection, and cultural displacement. Future-oriented nostalgia, when elicited through immersive and presence-rich environments, may offer novel tools to support individuals facing reduced meaning, emotional disengagement, or identity discontinuity (122, 123). This approach also holds promise for clinical contexts, where future-oriented nostalgia, especially when elicited through immersive, presence-rich experiences, may help re-engage individuals with muted positive affect or diminished sense of meaning in life, as observed in depression and major life transitions (Clayton McClure et al., 2024; Reich et al., 2008). By identifying familiarity and ambiguity as key variables, and by embedding them within immersive liminal environments, we offer guidelines that can facilitate the experimental elicitation of both past- and future-oriented forms of nostalgia in controlled laboratory settings. This enables new opportunities to investigate how nostalgia can be reliably induced, measured, and differentiated, thus advancing research on temporal self-continuity, emotion regulation, and meaning-making within immersive contexts.

Data availability statement

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

Author contributions

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Conflict of interest

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