

Virtual Mourning in the Metaverse: User Acceptance, Needs, and Limitations of AI-Based Memory Avatars

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ABSTRACT: Digital transformation is increasingly shaping the ways in which people remember and grieve. While existing platforms and social networks primarily preserve static content, immersive environments such as the metaverse and advances in generative artificial intelligence (AI) enable the creation of interactive, AI-based memory avatars, often also referred to as “griefbots” or “deadbots”. This study examines the perceptions, acceptance, opportunities, as well as psychosocial and ethical limitations of such avatars from the perspective of potential users. To provide an empirical foundation, an interactive prototype was developed and evaluated as part of a quantitative study (N = 33). These results were supplemented by qualitative guided interviews with experts in grief counseling, psychotherapy, and pastoral care. The findings paint a highly ambivalent picture: While respondents see potential in preserving life stories or in processing missed goodbyes, concerns regarding emotional dependence, difficulties in accepting loss, and ethical and data protection risks dominate. The Behavioral Intention to use the technology depends largely on Perceived Usefulness ($r = 0.74$) and Emotional Impact ($r = 0.82$), rather than purely on user interface elements. Experts emphasize that simulated interactions must not hinder the necessary process of letting go. The study concludes with recommendations for transparency requirements, time limits, and clear ethical safeguards for vulnerable groups.

Keywords: AI-based memory avatars, Metaverse, Digital grief culture, Deadbots, Deathbots, Griefbots, Technology acceptance, Posthumous Identity.

■ 1. INTRODUCTION

Grief and remembrance are among the fundamental experiences of human life. However, with digitalization, forms of remembrance have also changed: memories are no longer preserved solely in physical locations but increasingly in digital spaces. Research on digital grief culture shows that social networks, online memorial pages, and digital environments have created new opportunities to visibly commemorate the deceased and collectively express grief [1]. While existing offerings such as memorial portals (e.g., “ForeverMissed”¹) or memorial profiles on platforms like Facebook [2] are primarily static

and based on stored content such as images or text, virtual worlds and the metaverse are creating contexts in which digital presence and social interaction can be experienced even more intensely [3]. In the context of this article, the metaverse is understood as a persistent digital space in which people interact with one another via avatars [3].

At the same time, AI-based systems are being developed that create digital avatars from existing data (chat histories, voice recordings, images). Such applications,

¹ <https://www.forevermissed.com>

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which simulate communication with deceased individuals, are referred to as “griefbots,” “deadbots,” “postmortem avatars,” or “memorial avatars” [4-6]. This article uses the term memory avatar. To date, however, it remains largely unclear how potential users perceive AI-based memory avatars in the metaverse. In particular, it remains unclear whether such interactions are experienced as comforting and helpful or as burdensome, unsettling, or eerie. There is also a lack of knowledge regarding what characteristics (appearance, voice, form of interaction) an avatar should possess and where the ethical and emotional boundaries lie in the use of this technology in the sensitive realm of grief.

■ A. Study Aims and Research Questions

The primary aim of this study is to systematically examine the acceptance, psychosocial boundaries, and ethical implications of AI-based memory avatars within immersive metaverse environments from the perspective of potential users and professional counselors. To achieve this aim, the study fulfills the following specific objectives: (1) to evaluate user perceptions regarding the realism and emotional resonance of synthetic digital replicas, (2) to identify core factors associated with user adoption behavior, and (3) to delineate the ethical and psychological risks associated with commercial “griefbot” deployments.

To guide this investigation, we address five central research questions:

- RQ1: How are AI-based memory avatars in the metaverse perceived and evaluated by potential users?
- RQ2: What needs, expectations, and concerns exist regarding AI-based memory avatars?
- RQ3: How are the behavior, voice, and form of interaction of the AI-based memory avatar evaluated?
- RQ4: What factors correlate with acceptance of and behavioral intention to use AI-based memory avatars?
- RQ5: What are the ethical, emotional, and psychosocial boundaries regarding the use of AI-based memory avatar?

■ B. Paper Structure

The remainder of this paper is structured as follows. Section II (Related Work and Theoretical Framework) establishes the academic foundations of digital grief

culture and technology acceptance frameworks, introducing our revised research model and delineating the technical novelty of the study. Section III (Materials and Methods) details the multimodal development of the interactive HoloAvatar prototype alongside our mixed-methods empirical design. Section IV (Results) presents the quantitative scale reliabilities, descriptive findings, and the correlation matrix, complemented by the qualitative feedback from user responses and expert interviews. Section V (Discussion) systematically interprets these findings by directly addressing each research question and embedding the empirical data into our theoretical framework. Finally, Section VI (Conclusion) summarizes the core insights, addresses the methodological limitations, and outlines concrete pathways for future work.

■ 2. RELATED WORK AND THEORETICAL FRAMEWORK

To investigate the user evaluation of interactive AI-based technologies in the sensitive domain of digital mourning, this study builds upon a multidisciplinary foundation. This section contextualizes our work within the existing literature across three core areas. First, it reviews the digital transformation of mourning practices and the emergence of interactive memory avatars from a psychosocial perspective. Second, it evaluates traditional technology acceptance frameworks and details how they must be expanded to capture emotionally sensitive user experiences. Finally, it integrates these dimensions into our conceptual research model and establishes the specific technical novelty that differentiates this study from prior literature.

■ A. Digital Grief Culture and AI-Based Memory Avatars

This study builds upon several fields of research that address digital mourning culture, virtual environments, AI-based memory avatars, and psychological and ethical questions regarding the digital afterlife.

One research stream concerns the digital transformation of mourning and remembrance practices. Previous studies show that mourning processes are increasingly shifting to online and platform-based contexts. Walter *et al.* (2011) describe how the Internet is changing the conditions under which people mourn and remember [7]. Brubaker *et al.* (2013) [1], Marwick and Ellison (2012) [8], and Haverinen (2014) [9] also illustrate how social networks create new spaces for public and communal mourning. Fischer (2015) [2] and Offerhaus *et al.* (2013)

[10] point out that digital media are not merely repositories but give rise to new practices of visibility, communication, and coping with grief. More broadly, Arnold *et al.* (2017) [11] and Savin-Baden and Mason-Robbie (2020) [12] frame these developments as part of a comprehensive digital transformation of death, memory, and the afterlife.

A second area of research focuses on digital immortality, the digital afterlife industry, and AI-based avatars. Savin-Baden and Burden (2018) [13], Öhman and Floridi (2017) [14], Savin-Baden (2019) [15], and Hansen (2024) [16] address the political-economic and philosophical dimensions associated with the technological reconstruction of identity from personal data. Resendiz and Rodriguez (2024) [5] refer to this phenomenon as “digital resurrection.” Specifically in the context of generative AI, griefbots, deadbots, and voice cloning, Hollanek and Nowaczyk-Basińska (2024) [4], Lei *et al.* (2025) [17], and Campbell *et al.* (2025) [18], Morris and Brubaker (2024) [6], and Linden (2025) [19] emphasize the tension between emotional closeness, comfort, maintaining relationships, and significant ethical concerns.

This topic is further expanded by immersive virtual environments and the metaverse. Research on interaction with avatars in virtual worlds shows that factors such as social presence, embodiment, and interaction quality are crucial to how intensely and credibly digital counterparts are perceived (Kyrlitsias and Michael-Grigoriou, 2022 [20], Geissler, 2023 [21], Frey, 2025 [22]). The metaverse thus transforms static mementos into socially experiential, spatially staged representations.

From a psychological perspective, the concept of “continuing bonds” is particularly central; it posits that the relationship with the deceased does not end but can continue in an altered, symbolic form (Krueger & Osler, 2022 [23], Rovetta & Valentini, 2025 [24]). Furthermore, the dual-process model of grief and current grief models illustrate that the grieving process is a dynamic and individualized process of adaptation (Schröter-Rupieper, 2021[25], 2024 [26], Paul, 2021[27], 2026 [28]). AI-based memory avatars build upon existing internal dialogues but transform them into a technologically mediated, external interaction. On the one hand, this can be experienced as comforting; on the other hand, it also carries the risk of blurring the line between symbolic memory and apparent presence in an emotionally distressing way (Rovetta & Valentini, 2025 [24], Vahid-Moghtada, 2025 [29]).

Recent literature highlights the rapid evolution and growing societal discussion around generative AI applications for grief support and digital legacy maintenance. For instance, recent studies emphasize how public acceptance of interactive ‘deadbots’ or AI-driven avatars is negotiated through perceived emotional comfort, continuing bonds, and psychological readiness [30]. Complementing this, Lei *et al.*, 2025 [17] empirically investigate user perceptions, expectations, and safety concerns regarding ‘AI afterlives’ as an evolving form of digital legacy. Furthermore, ongoing research demonstrates that users actively construct and reconstruct memories of loved ones through sustained interaction with conversational AI agents, blurring the boundaries between historical reflection and digital presence [31].

■ B. Technology Acceptance Frameworks in Emotionally Sensitive Contexts

To investigate the acceptance of AI-based memory avatars, it is necessary to clarify under what conditions people are generally willing to use a new technology. The central question here is how a system is evaluated by potential users and which factors influence their willingness to use it. Especially when it comes to technologies in the emotionally sensitive context of grief, a purely technical perspective is insufficient. The theoretical framework is based on the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh *et al.* (2003) [32]. The TAM assumes that Perceived Usefulness and Perceived Ease of Use, in particular, shape the willingness to use a system [32]. Perceived Usefulness describes the extent to which a system offers relevant added value, which, in the case of memory avatars, can relate to comfort, emotional support, or a sense of closeness. Perceived Ease of Use describes how simple the system is perceived to be to use, whereby complicated operation can reduce willingness to use it at an early stage.

■ C. Conceptual Research Model, Ethical Dimensions, and Technical Novelty

Since traditional models are often insufficient on their own for this specific usage context [33], Extended-TAM approaches are employed and expanded to include context-specific variables such as Perceived Risk & Limits, and Future Perspectives. Additionally, the UTAUT model is taken into account [32].

Key factors in the UTAUT model include performance expectancy, effort expectancy, social influence, and

facilitating conditions [32]. For this study, Perceived Behavior parallels the concept of Performance Expectancy by measuring how effectively the avatar fulfills interaction expectations, while Emotional Impact links to affective components and social influence. It reflects both how strongly individuals are influenced by the opinions of their social environment and the emotional weight of the use of the technology itself [14]. Since the use of digitally reconstructed representations of the deceased is viewed differently from a social and moral perspective, its adoption depends largely on whether the social environment considers this form of remembrance to be acceptable or problematic. The combination of selected constructs from TAM and UTAUT, supplemented by context-specific factors, forms the theoretical research model of this thesis, as illustrated in Figure 1.

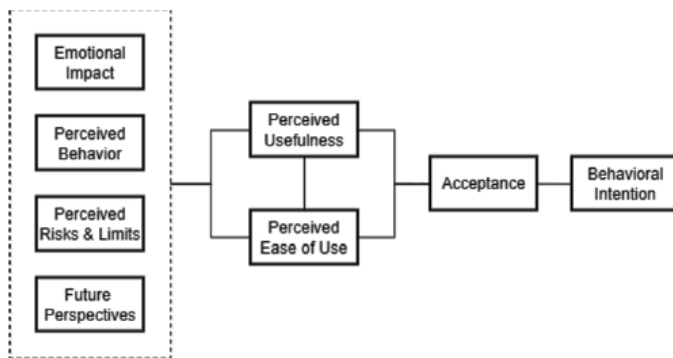


Figure 1: Research model for evaluating the acceptance of AI-based memory avatars, adapted from TAM and UTAUT (Source: own presentation).

Furthermore, the development of AI-based memory avatars raises fundamental ethical, legal, and psychosocial questions. Since memory avatars generate new content and statements compared to static media, a gray area emerges between memory, reconstruction, and construction [34]. From an ethical and legal perspective, questions arise regarding the protection of posthumous personality rights [35], the presumed will of the deceased, and the legitimacy of relatives or platform operators (Funk, 2017). Developments such as the Meta patent for simulating user behavior (Bosworth, 2025 [37]) also underscore the practical relevance of these issues. Finally, highly realistic systems can blur the line between symbolic memory and apparent presence, which is why transparent safeguards and sensitive design are necessary [24, 34].

In summary, this work is situated at the intersection of digital mourning culture, immersive interaction, grief

psychology, acceptance research, and ethics, with the aim of systematically bringing together the opportunities, risks, and design requirements of AI-based memory avatars in the metaverse.

While prior research on digital afterlife technologies has predominantly focused on static online memorials, [3] or textual chat-based griefbots, [24], the technical novelty of this study lies in the implementation and empirical evaluation of a fully interactive, voice-cloned, multimodal HoloAvatar simulation. By combining generative AI voice-cloning (Speechify), dynamic single-image facial animation (DeeVid AI), and real-time knowledge-base synchronization (2wai platform), this prototype shifts the technological paradigm from passive remembrance to active, real-time social presence in a persistent digital space, providing a unique baseline for empirical technology acceptance modeling in the sensitive context of grief.

■ 3. MATERIALS AND METHODS

This Section explains the methods applied to answering the research questions, which have been explained in Section I.

■ A. Development of the Prototype

To investigate user perception, a functional, exploratory research prototype of an AI-based memory avatar was developed. The goal was not to create a technically perfect digital twin, but rather an audiovisual simulation credible enough to systematically examine reactions to appearance, voice, form of interaction, and Emotional Impact. After evaluating various technical options (including D-ID and Aidentical), the 2wai platform proved to be suitable, as it enables the creation of interactive HoloAvatars that can communicate with users in real time [38]. An initial test attempt to create an avatar of a well-known public figure was rejected by the platform, highlighting the legal implications of personality rights and image rights in digital human reconstruction. To avoid conflicts regarding copyright and data protection laws while simultaneously adhering to a realistic application scenario, image material of a recently deceased person from one author's private life was selected – see Figure 2. To ensure strict compliance with ethical and privacy standards, explicit informed consent for the use of the photographic and biographical material was obtained from the deceased person's next of kin prior to the study.



Figure 2: Image selected for avatar creation (author's own photo).

Since the platform requires a video as source material, the still image was animated using the AI tool DeeVid AI, looped in Adobe Premiere Pro (v26.0, January 2026 release), and provided with prompts to simulate natural basic movements (breathing, shoulder movement, blinking) as well as synchronized mouth movements. The generated video was played in full-screen mode and re-recorded with the smartphone camera in accordance with the technical specifications of the 2wai app. The recording included a ten-second neutral posture (idle sequence) as well as a ten-second sequence with mouth movements. Figure 3 shows the app's instruction screens for both recordings.

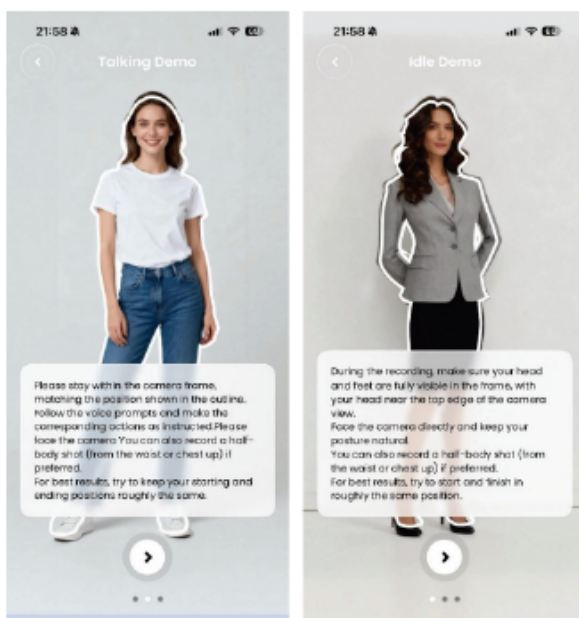


Figure 3: Notes and Tips Before Recording Video (Own Recordings).

For voice generation, a five-second historical audio signal was processed in Adobe Premiere Pro. Using the text-to-

speech and voice-cloning software Speechify, a synthetic voice was generated that closely matched the original person's pitch and vocal character, although regional dialect features could only be approximated. Content control was managed via the system prompts and the 2wai platform's knowledge base ("virtual brain"). Technical limitations in processing German umlauts (*i.e.*, ä, ö, ü) in the system prompt were resolved by substituting them with "ae," "oe," and "ue." The prompt was used to define the character's personality, biography (DIY activities, connection to nature), and tone. By uploading supplementary texts, the knowledge base was expanded to enable context-sensitive responses. The finished prototype enabled interactive, dialogic communication via text and voice input and output. It is depicted in Figure 4.

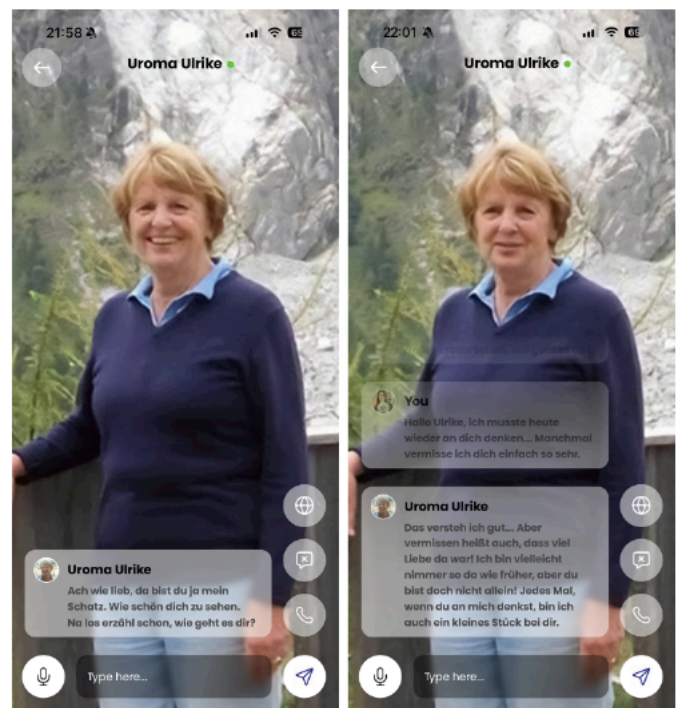


Figure 4: Final prototype of the memory avatar with chat example in German (own recordings).

■ B. Quantitative Study Design and Process

A quantitative user study was conducted to assess the Acceptance, Emotional Impact, and perceived opportunities and limitations. Recruitment took place through active outreach in Austria and Germany by actively approaching strangers in public as well as through personal networks. The sample included 33 individuals ranging in age from 17 to 85 years. With the exception of one person, none of the participants knew the person depicted by the avatar. To establish a comparable basis for evaluation, participants were

provided in advance with standardized background information on the avatar's biography. Experiences of loss of closely related persons varied within the sample; while younger participants were less likely to have experienced deaths among close relatives or friends, nearly all participants had already experienced a loss within their wider social circle.

A dedicated iPhone 16 Pro (Apple Inc., running iOS 26.2) was provided, to ensure a consistent environment across all participants during the prototype evaluation. The device's built-in microphone and display were utilized for real-time speech or text input and audiovisual feedback with the *prototype*.

The procedure was structured as follows:

- 1) Introduction and Consent: Before the study began, participants were fully informed about the purpose and scope of the research. They received a consent form and privacy policy that clearly explained that the data would be analyzed anonymously as part of a scientific project, that participation was entirely voluntary, and that they could withdraw from the experiment at any time without providing a reason. All participants consented to these conditions.
- 2) Interaction with the Prototype: This was followed by interaction with the AI-based memory avatar. Participants were given a brief introduction to the system beforehand. The interaction was deliberately placed at the beginning of the study to create a concrete, immediate experience with the system, which served as the basis for the subsequent evaluation. The duration of the conversation was not strictly limited, but was moderated to ensure a comparable interaction time of generally about five minutes. This ensured that participants gained a sufficient personal impression without being exposed to the situation for an unnecessarily long time or being emotionally overwhelmed.
- 3) Questionnaire Completion: Immediately following the interaction, the participants completed the standardized questionnaire. The total duration per person was 15 to 20 minutes.

■ C. Design and Structure of the Questionnaire

To begin with, basic sociodemographic information was collected to describe the sample structure and contextualize the results. In addition, participants were asked about their prior experience with virtual reality (VR), the metaverse, and text-based AI chatbots, quantified

using a 5-point Likert scale ranging from 1 ("no prior experience") to 5 ("extensive experience"). These data served as contextual information, as it can be assumed that prior experience with virtual or AI-supported systems may influence evaluation behavior.

The main section covered the key dimensions of perception and acceptance of the avatar. Theoretically, the instrument is based on established constructs from the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). In particular, it measured Perceived Usefulness, Perceived Ease of Use, Acceptance, and Behavioral Intention.

In addition, further dimensions were included—such as Emotional Impact, Perceived Behavior, Perceived Risks & Limits, and Future Perspectives—which arise from the sensitive application context of AI-based memory avatars. The survey concluded with open-ended questions in which participants could freely describe their positive impressions, moments of frustration, perceived opportunities, or requirements for such an avatar. The closed-ended questions were measured on a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Supplementary open-ended questions were used to gather qualitative feedback.

■ D. Qualitative Expert Interviews

To broaden the interpretive framework, semi-structured guided interviews were also conducted with experts from relevant fields (psychological counseling, grief counseling, therapeutic practice, and pastoral care). The interviewees were informed in advance about the research objectives and provided their written consent for the recording and anonymized analysis of the interviews. Half of the interviews were conducted online via an online meeting, while the other half took place in person. The interviews lasted an average of 30 to 45 minutes. Approximately 10 minutes were dedicated to onboarding, introducing the project background and securing informed consent. The remaining 20 to 35 minutes were allocated to the semi-structured interview itself. Variations in duration depended on individual expert insights and whether specific topics required deeper discussion or follow-up questions.

The interview guide was divided into three thematic sections:

- 1) Professional background and practice: experiences with bereaved individuals and the role of digital media in the grieving process.

- 2) Evaluation of the memory avatar: Assessments of the basic concept, potential use cases, risks (e.g., emotional dependence), suitability for target groups, realism, and requirements for protective measures, based on a short demonstration of the prototype system.
- 3) Social and ethical perspectives: Questions regarding the acceptance, normalization, changes in the culture of saying goodbye, commercialization, and the distribution of responsibility.

The interviews were analyzed using qualitative content analysis to systematically identify key patterns of argumentation, stress factors, and design requirements, and to compare these findings with the quantitative study results.

■ 4. RESULTS

This Section presents the results from the experiment as well as insights gained from the expert interviews.

■ A. Quantitative Study Design and Sample

The quantitative user survey included $N = 33$ participants. The age range of the participants was very broad, spanning from 17 to 85 years. As visualized in Figure 5, the age distribution shows a distinct clustering within the younger demographic cohorts, particularly between the ages of 19 and 25. While middle-aged and older participants up to 85 years are continuously represented to ensure a broad exploratory spectrum, this younger emphasis reflects a digital-native baseline within the sample.

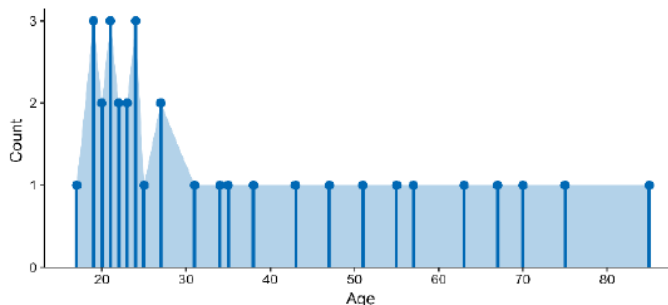


Figure 5: Age distribution (Source: own presentation).

The sample size is consistent with recent empirical field experiments evaluating immersive metaverse applications and avatar interaction dynamics under real-world conditions. For instance, similar pilot evaluations of emerging user experiences in virtual environments have relied on comparable cohort sizes, ranging from $N = 33$

completed responses for local virtual political discourse [39] to $N = 54$ participants for laboratory-controlled mixed reality avatar assessments [40]. Given the emotionally sensitive context of postmortem interaction and the exploratory focus on qualitative-quantitative baseline patterns, this sample size provides a sufficient empirical foundation for our initial technology acceptance insights.

Demographically, there was a slight majority of male participants, and the geographic distribution was concentrated in Germany and Austria, as can be seen from Figure 6.

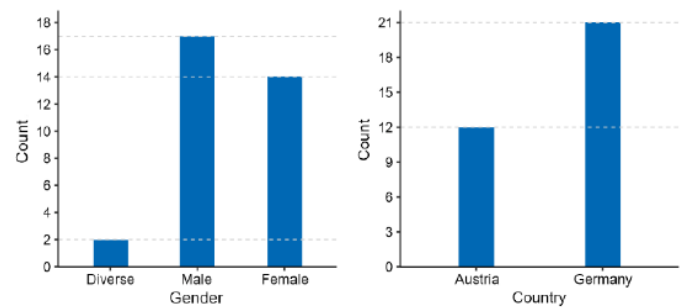


Figure 6: Gender distribution and country distribution (Source: own presentation).

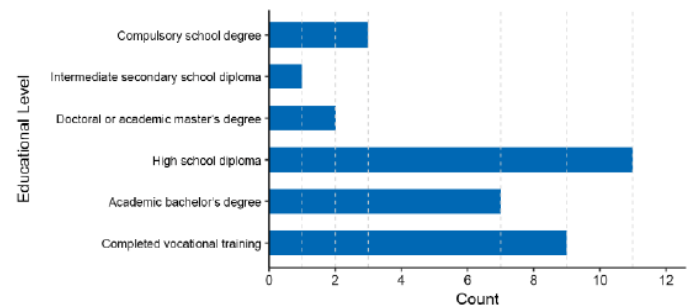


Figure 7: Highest level of education exported from JASP (Source: own presentation).

As illustrated in Figure 7, the sample exhibits a comparatively high level of formal education, with the vast majority of participants holding either a high school diploma, a completed vocational training, or an academic degree. This skewed distribution represents a specific demographic characteristic of our exploratory cohort and should be considered when evaluating the technological open-mindedness of the sample. Participants were provided with background information about the person depicted by the avatar in advance so that they could better put themselves in the interaction situation. There was a mixed distribution regarding personal experiences with death in their social circles: Some of the younger respondents had not yet experienced a loss in their family, but nearly all respondents had already

experienced a death in their social circle. Technological experience is shown in Table 1. The participants showed greater familiarity with text-based AI chatbots (e.g., ChatGPT) than with VR and metaverse technologies.

Table 1: Statistics on participants' prior technical experience (Source: Author's own presentation)

Variable	Descriptive Statistics & Reliability			
	Mean (M)	Standard deviation (SD)	Min	Max
Experience with AI-based applications	3.48	1.20	1.00	5.00
Experience VR/Metaverse	2.82	1.24	1.00	5.00

■ B. Scale Reliabilities and Descriptive Findings

Reliability analyses of the scales show good to very good internal consistency for the constructs of Behavioral Intention ($\alpha = 0.92$), Future Perspectives ($\alpha = 0.78$), Perceived Usefulness ($\alpha = 0.75$), and Emotional Impact ($\alpha = 0.74$). The Perceived Risks & Limits ($\alpha = 0.65$) and Perceived Behavior ($\alpha = 0.58$) range from moderate to borderline. The constructs Perceived Ease of Use ($\alpha = 0.53$) and Acceptance ($\alpha = 0.44$) exhibit low reliability. These critically low coefficients fall below the conventional psychometric threshold of 0.60, indicating a lack of internal consistency among the items. Statistically, this instability is likely amplified by the brief nature of the scales (3 items each) combined with the small

Table 2: Overview of Scale Reliabilities (Source: Author's own presentation)

Variable	Descriptive Statistics & Reliability		
	Cronbach's Alpha (α)	Standard deviation (SD)	Number of items
Perceived Usefulness (PU)	0.75	0.08	3
Perceived Ease of Use (PEoU)	0.53	0.18	3
Emotional Impact (EI)	0.74	0.06	4
Acceptance (ACC)	0.44	0.18	3
Perceived Behavior (PB)	0.58	0.11	3
Behavioral Intention (BI)	0.92	0.02	4
Perceived Risks & Limits (PRL)	0.65	0.14	3
Future Perspectives (FP)	0.78	0.05	3

exploratory sample size ($N = 33$). Consequently, any statistical paths or correlations involving Acceptance or Perceived Ease of Use cannot be interpreted as definitive psychometric evidence, but must be treated strictly as preliminary, exploratory trends.

In the descriptive analysis, the Perceived Risks & Limitations category received the highest level of agreement, with $M = 4.04$ ($SD = 0.75$). In particular, respondents called for clear criteria and guidelines regarding the suitability of such avatars for different target groups. The Future Perspectives regarding precautionary arrangements during one's lifetime are also rated predominantly positively ($M = 3.63$, $SD = 1.03$). Perceived Usefulness falls within the moderate to indifferent range ($M = 2.87$, $SD = 0.98$), as do the Behavioral Intention ($M = 2.70$, $SD = 1.26$), the Perceived Behavior of the avatar ($M = 2.74$, $SD = 0.85$), and the Acceptance ($M = 2.58$, $SD = 0.71$). The Emotional Impact falls within the neutral range ($M = 2.99$, $SD = 0.79$), with individual ratings varying widely between personal engagement and detachment. Perceived Ease of Use was rated as moderately positive ($M = 3.49$, $SD = 0.73$).

Table 3: Descriptive Statistics of the Main Constructs (Source: Author's own presentation)

Variable (total value)	Descriptive Statistics of Constructs			
	Total mean (M)	Standard deviation (SD)	Min.	Max.
PU	2.87	0.98	1.00	5.00
PEOU	3.49	0.73	1.67	4.67
EI	2.99	0.79	1.50	4.25
ACC	2.58	0.71	1.33	4.67
PB	2.74	0.85	1.00	4.33
BI	2.70	1.26	1.00	5.00
PRL	4.04	0.75	2.67	5.00
FP	3.63	1.03	1.67	5.00

■ C. Correlation Analysis

Pearson correlation coefficients were calculated to examine the relationships between the measured constructs. An overview of the calculated coefficients is depicted in Figure 8.

The relationship between Emotional Impact and Behavioral Intention is particularly strong. With $r = 0.82$ ($p < 0.01$), a very high positive correlation is evident here. Participants who attributed stronger or more meaningful emotional effects to the interaction were more likely to consider using it in the future. The relationship between Perceived Usefulness and Behavioral Intention is also

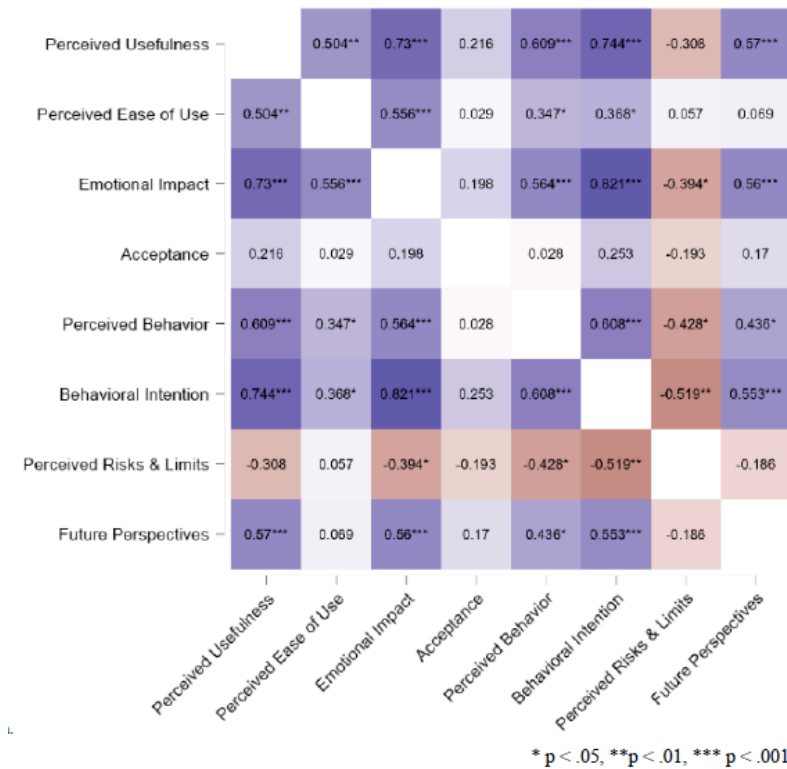


Figure 8: Pearson correlation matrix of the main construct's total values (Source: Author's own depiction).

very clear ($r = 0.74$, $p < 0.01$). The more the avatar was perceived as helpful or meaningful, the greater the willingness to use it oneself or to view its further development positively.

The Perceived Behavior of the avatar—that is, how appropriate, realistic, or coherent the reactions were perceived to be—also correlates significantly and positively with the Behavioral Intention ($r = 0.61$, $p < 0.01$). This suggests that the specific impact of the interaction is closely linked to openness toward future use. Another clear positive correlation is evident between Perceived Usefulness and Emotional Impact ($r = 0.73$, $p < 0.01$) as well as between Perceived Usefulness and Perceived Behavior ($r = 0.61$, $p < 0.01$). This suggests that the perceived meaningfulness of the avatar is strongly related to the emotional experience and the perceived quality of the interaction.

In comparison, Perceived Ease of Use, *i.e.*, usability, shows only moderate correlations. It does, however, correlate positively with Perceived Usefulness ($r = 0.50$, $p < 0.01$), Emotional Impact ($r = 0.56$, $p < 0.01$), and, to a lesser extent, with the avatar's Perceived Behavior ($r = 0.35$, $p = 0.05$) and Behavioral Intention ($r = 0.37$, $p = 0.04$). While these correlations do exist, they are significantly weaker than those for Perceived Usefulness

or Emotional Impact. In terms of content, this suggests that usability does play a role but is apparently not the decisive factor in the overall evaluation of such a memory avatar.

The Perceived Risks & Limits scale, *i.e.*, ethical concerns, fear of negative impact on mourning processes, and the need for clear usage recommendations, on the other hand, correlates negatively with several constructs. Particularly relevant is the negative correlation with Behavioral Intention ($r = -0.52$, $p < 0.01$). The more strongly ethical concerns, potentially negative influences on the grieving process, or the need for clear recommendations were perceived, the lower the willingness to use such an avatar oneself. There are also significant negative correlations with the avatar's Perceived Behavior ($r = -0.43$, $p = 0.01$) and Emotional Impact ($r = -0.39$, $p = 0.02$). This suggests that concerns and reservations are not merely abstract but are in fact associated with a more reserved overall evaluation.

By contrast, the correlations involving the Acceptance construct remain weak and statistically insignificant. Given the critically low internal consistency of this scale ($\alpha = 0.44$), these coefficients must be interpreted with extreme caution, as statistical noise likely suppresses any meaningful structural relationships.

Future Perspectives, on the other hand, correlate positively with several areas, particularly with Behavioral Intention ($r = 0.55$, $p < 0.01$), Perceived Usefulness ($r = 0.57$, $p < 0.01$), and Emotional Impact ($r = 0.56$, $p < 0.01$). Thus, those who are generally more open to regulatory options and self-determined arrangements during their lifetime also tend to evaluate the current application more positively.

Overall, the correlation analyses make it clear that the Behavioral Intention to use the avatar is closely linked to three pillars in particular:

- Perceived Usefulness,
- the Emotional Impact of the interaction, and
- the consistency of the avatar's Perceived Behavior.

At the same time, Perceived Risks & Limits significantly reduce openness to using the technology. This is a key finding for answering the research questions, as it shows that the evaluation of AI-based memory avatars is linked more to emotional and normative classifications than to purely operational aspects.

■ D. Qualitative Results of the Open-Ended user Responses

The qualitative feedback very clearly complements the quantitative results in terms of content. The participants expressed a broad spectrum of feelings during the interaction: Reactions ranged from “exciting,” “entertaining,” and “quite okay” to “uncomfortable,” “disturbed,” “alienating,” or “concerned.” Several statements illustrate that the interaction was experienced as both surprisingly realistic and clearly artificial. It is precisely this simultaneity of closeness and distance that reflects the indecision already evident in the scales.

Aspects that tied in with real memories were cited above all as positive or comforting: hearing the voice again, seeing the face once more, revisiting shared memories, or being able to ask unanswered questions. Some participants also highlighted the reassuring nature of the responses or the possibility of a belated farewell as potentially helpful. At the same time, several people explicitly stated that they found nothing comforting or that they preferred to rely on traditional forms of remembrance, such as photos. While the positive potential is thus recognized, it is by no means uncontroversial.

Among the unsettling and distressing aspects, three themes in particular stand out: first, the uncanniness or strangeness of the interaction; second, concern about the

high degree of realism; and third, the fear of being unable to let go. In addition, participants pointed out concerns about data privacy, inappropriate movements, unnatural pauses, and what was perceived as an inadequate replication of the real person's speech and manner of expression. Several participants explicitly emphasized the conflict of experiencing the interaction as technically impressive on the one hand and as problematic or “creepy” on the other.

Regarding target groups and situations where this could be helpful, respondents primarily mentioned people who were unable to say goodbye, are suffering from a sudden loss, have unanswered questions, or feel lonely. A potential benefit was also occasionally cited for older adults or for people who wish to actively preserve memories. In contrast, other responses explicitly pointed out that such an avatar is not particularly helpful for the natural grieving process, underscoring the clear differentiation based on the individual and the situation.

The feedback regarding potentially vulnerable groups is particularly clear. Children, adolescents, mentally or emotionally unstable individuals, as well as people who have not yet come to terms with the loss or who have difficulty distinguishing between reality and simulation, are mentioned very frequently. Several responses explicitly address the risk of dependency, confusion, or an unhealthy attachment to the digital avatar, which closely corresponds to the high mean scores on the scale regarding Perceived Risk & Limits.

Finally, the requirements for an acceptable memory avatar make it clear that realism and responsibility are equally important. Respondents cited a harmonious interplay of voice, appearance, and behavior; high data protection standards; local or secure data processing; clear control over permission to create the avatar; and unambiguous communication that the deceased person is not being replaced. This combination of the demand for realism and the need for protection makes it clear that while an avatar should appear as authentic as possible, it must not—precisely because of this—lead to a problematic confusion between memory and a substitute relationship.

■ E. Results of the Expert Interviews

To gain a deeper understanding of AI-based memory avatars, guided expert interviews were conducted with four specialists in grief counseling, psychotherapy, and pastoral care. The goal was to gather professional perspectives on opportunities, risks, ethical boundaries, and requirements for responsible design in the context of

grief processes. The semi-structured interviews were conducted using a flexible guide that expanded upon the dimensions of technology acceptance theory from the quantitative questionnaire to include aspects of grief psychology and ethics. The qualitative analysis was based on transcripts and involved thematic consolidation into overarching categories.

The professional assessment of memory avatars depends largely on the underlying understanding of grief. The experts do not view grief as a linear sequence of phases, but rather as a multifaceted, active process of coping and adaptation (referencing, among other things, Chris Paul's "Kaleidoscope of Grief"), in which the finality of death must be acknowledged and integrated into one's own life. While an enduring inner relationship (e.g., through places of remembrance or symbolic dialogue) is understood as a healthy part of the grieving process, avatars create a problematic, technologically mediated illusion of presence. If AI gives the impression that the deceased is actually still responding, the necessary confrontation with the reality of the loss is undermined, and the healing process is hindered. Consequently, the criticism is not directed at remembrance itself, but rather at the reenactment of social interaction in the here and now.

The experts expressed potential benefits only very cautiously and explicitly distinguished them from actual grief therapy. A conceivable benefit would be primarily as a medium for the culture of remembrance, serving to preserve family histories, characteristics, or voice recordings for future generations. In specific cases, the avatar could serve as a low-threshold transitional medium to channel symbolic dialogues, unspoken thoughts, or a delayed farewell within a protected setting. However, this benefit is strictly tied to a conscious limitation: The opportunity lies not in maximum immersion and realism, but in a transparently simplified design as a digital memory archive.

From a professional perspective, the risks clearly outweigh the opportunities. The main risk lies in a structural shift in the grieving process: Instead of processing the loss, simulated availability tempts people to avoid grief or artificially prolong it. Repeated interactive validation and simulated closeness also carry the risk of psychological and emotional dependence, especially for vulnerable mourners. A high degree of realism also blurs the boundaries between genuine relationships, memories, and computer-generated simulations, raising moral concerns that this could "disturb the peace of the dead." In addition to individual risks, respondents point to

structural risks such as data misuse, access to intimate relationship data, and the economic exploitation of grief and vulnerability by commercial providers.

The identified ethical boundaries span several main areas. While the deceased person's consent, documented during their lifetime, is considered a formal requirement, it does not resolve the ethical dilemma that AI creates an autonomous system that encroaches on the deceased's identity. The data-driven recreation of an identity is sometimes viewed as an impermissible appropriation and an infringement on personal dignity. Furthermore, the use of intimate speech patterns and personal texts poses a significant burden in terms of both data protection law and moral considerations. Interviewees are particularly concerned about the transformation of loss and longing into a profit-driven business model with a motivation to foster customer retention. Transparency regarding the artificial nature of the experience is therefore considered a minimum ethical requirement.

From the experts' perspective, socially and ethically sustainable use does not require optimization of immersion, but rather conscious regulation and limitation. This includes continuous, unambiguous labeling (e.g., disclaimers) indicating that the system is artificial and lacks a human counterpart, as well as refraining from fully replicating triggering characteristics such as voice or facial expressions. Systems should be designed—both in terms of duration and functionality—to aim for weaning and separation rather than permanent attachment. Additionally, they must be integrated into real-world, analog support services (grief counseling, psychotherapy), include referrals to crisis hotlines, ensure a high level of data protection, and exclude or provide special protection for vulnerable groups such as children, adolescents, or mentally unstable individuals.

In summary, the expert interviews paint an overall skeptical picture. AI-based memory avatars are by no means viewed as neutral tools or substitutes for the grieving process. Their positive contribution is limited to clearly defined, carefully considered niches within the preservation of memory. However, as soon as the systems simulate an ongoing relational reality, the psychological, ethical, and societal risks clearly outweigh the benefits.

■ 5. DISCUSSION

This study examined AI-based memory avatars in the metaverse as a new form of digital mourning and remembrance culture. The goal was to identify how

potential users perceive such technology, what needs, opportunities, concerns, and limitations are associated with it, and under what conditions a memory avatar is considered supportive, appropriate, or problematic. The results of the quantitative user survey and the qualitative expert interviews paint a distinctly ambivalent picture overall. AI-based memory avatars are neither unequivocally rejected nor unreservedly endorsed. Rather, their evaluation depends heavily on how useful, emotionally meaningful, credible, controllable, and ethically justifiable such an interaction is perceived to be. This confirms that memory avatars must be understood not only as technical applications but, above all, as systems that are highly sensitive from a psychosocial and normative perspective.

■ **A. RQ1: How are AI-based memory avatars in the metaverse perceived and evaluated by potential users?**

With regard to RQ1, neither the user survey nor the expert interviews reveal a clearly positive or negative overall picture. Instead, there is a tension between interest, technical fascination, and recognizable potential on the one hand, and unease, irritation, and clear reservations on the other. This ambivalence is quantitatively reflected in our descriptive data. While participants recognized the baseline usability of the system (Perceived Ease of Use: $M = 3.49$, $SD = 0.73$), their actual willingness to adopt it remained highly conservative, as shown by the lower scores for Acceptance ($M = 2.58$, $SD = 0.71$) and Behavioral Intention ($M = 2.70$, $SD = 1.26$). Furthermore, the Emotional Impact score sits almost exactly in the neutral center ($M = 2.99$, $SD = 0.79$). While some respondents describe the interaction as exciting, moving, or interesting, others find it alienating, eerie, or emotionally problematic. It is particularly striking that many respondents cannot personally imagine using the technology, yet at the same time assume that an avatar could be helpful for others. The assessment is thus viewed as highly personal. The expert interviews confirm this nuanced perception, placing greater emphasis on potential problems and highlighting the need to strictly distinguish between mere remembrance and actual grief processing.

■ **B. RQ2: What needs, expectations, and concerns exist regarding AI-based memory avatars?**

With regard to RQ2, desires for comfort, closeness, remembrance, symbolic communication, and the preservation of one's life story are counterbalanced by significant fears. This imbalance is explicitly captured by the fact that Perceived Risks & Limitations received the highest agreement across the entire study, with a

dominant mean score of $M = 4.04$ ($SD = 0.75$). This statistical peak proves that user expectations are primarily shaped by caution and protective anxieties rather than the anticipated utility of the system, which is also reflected in the moderate to indifferent score for Perceived Usefulness ($M = 2.87$, $SD = 0.98$). In addition to the desire to revisit shared memories or the hope of being able to say something in the absence of a proper farewell, concerns about emotional overwhelm, the inability to let go, as well as privacy and misuse concerns come to the fore. Experts emphasize that memory avatars are better situated within the realm of remembrance and preservation. There is a risk that the technology may satisfy needs for closeness in the short term but, in the long term, function as a false solution and hinder the necessary process of coming to terms with loss and finality.

■ **C. RQ3: How are the behavior, voice, and form of interaction of the AI-based memory avatar evaluated?**

With regard to the avatar system itself (RQ3), behavior, voice, choice of words, and form of interaction prove to be key evaluation criteria. As presented in the correlation matrix depicted in Figure 8, we found a strong, statistically significant positive correlation between Perceived Behavior and Perceived Usefulness ($r = 0.61$, $p < 0.01$), as well as between Perceived Behavior and Emotional Impact ($r = 0.56$, $p < 0.01$). This indicates that when the avatar's reactions and phrasing are perceived as appropriate and reassuring, users also associate the system with higher meaningfulness and a stronger emotional resonance. On the contrary, unnatural movements, artificial speech, or inconsistent overall impressions were identified as problematic. Realism is evaluated inconsistently, as some participants desire a voice or facial expressions that are as realistic as possible, while others find them particularly unsettling. The expert interviews also emphasize that voice and interaction logic are highly sensitive from a psychological perspective. The AI's rapid, uncontradictory, and consistently attentive response style can simulate a sense of closeness that differs from genuine human communication and makes the system appear overly available.

■ **D. RQ4: What factors correlate with acceptance of and behavioral intention to use AI-based memory avatars?**

The analysis regarding RQ4 shows that Behavioral Intention and Acceptance covary primarily with emotional and normative factors rather than purely functional

elements. As illustrated in Figure 8, the strongest correlations with Behavioral Intention are found in Emotional Impact ($r = 0.82$, $p < 0.01$), Perceived Usefulness ($r = 0.74$, $p < 0.01$), and the avatar's Perceived Behavior ($r = 0.61$, $p < 0.01$). In contrast, the correlation with Perceived Ease of Use is substantially weaker ($r = 0.37$, $p = 0.04$). However, it must be noted that this weaker relationship may also be an artifact of the scale's limited internal consistency ($\alpha = 0.53$), which inherently restricts its statistical power and increases measurement error. Consequently, while emotional quality appears to dominate the willingness to adopt the technology in this exploratory setting, the exact relative weight of usability metrics cannot be conclusively determined and requires validation through highly optimized psychometric scales in future studies. Theoretically, this can be framed within technology acceptance models such as the TAM, in which Perceived Usefulness and emotional quality show the strongest correlations with the willingness to use the technology. In this context, the experts emphasize that professional acceptance depends heavily on guidance and the ability to consistently distinguish between digital simulation and real relationships.

■ E. RQ5: What are the ethical, emotional, and psychosocial boundaries regarding the use of AI-based reminder avatars?

The ethical, emotional, and psychosocial boundaries (RQ5) become apparent where memory transitions into a simulated present. The high agreement on the Perceived Risks & Limits scale ($M = 4.04$, $SD = 0.75$) underscores that both potential users and experts view the simulation of an ongoing relational reality as highly critical. In addition to concerns about endangering vulnerable groups (such as children, adolescents, or people in acute stages of grief), the risks of repression and becoming trapped in an illusion are at the forefront. Ethical concerns also relate to protecting the dignity and identity of the deceased, the risk of disturbing the peace of the dead, and the risks of commercial exploitation of grief and vulnerability. As protective measures, the study therefore calls for transparency requirements (e.g., recurring references to the synthetic nature of the content), temporal and functional restrictions on use, strong data protection, prior consent from the individual during their lifetime, and integration into real-world support services.

■ F. Limitations

While the study provided the answers to its research questions, which have been explained above, the

following methodological limitations of the study have to be considered:

- 1) Sample size and field access: The quantitative survey is based on an exploratory sample of $N = 33$ respondents and is not representative of the general population.
- 2) Scale reliability: Individual scales developed on an exploratory basis, such as Perceived Ease of Use ($\alpha = 0.53$) and the Acceptance of the avatar ($\alpha = 0.44$), exhibited limited internal consistency, which is why their results must be interpreted with caution.
- 3) Study Setting: The evaluation was conducted following a single interaction of a few minutes' duration with a prototype under specified conditions. The majority of participants did not know the person depicted by the avatar; thus, none of the participants was in actual grief related to this person. Long-term effects on grief processes, the potential development of dependencies, or habituation effects could not be examined within the scope of this study.

■ 6. CONCLUSION

This study examined AI-based memory avatars in the metaverse as a new form of digital mourning and remembrance culture. The focus was on how such systems are perceived by potential users, what opportunities and risks are associated with them, and what requirements arise for their responsible use. The results of the quantitative user survey and the qualitative expert interviews reveal an ambivalent overall picture. AI-based memory avatars are neither unreservedly endorsed nor categorically rejected, but are perceived as a sensitive offering that is highly dependent on the individual and the context. Their psychosocial impact depends largely on the specific systemic design, the respective context of use, and the individual needs and levels of distress among those who are grieving.

The study makes it clear that memory avatars address real human needs. These include the desire for enduring connection, the preservation of memories, the hope for symbolic closeness, and the need for a belated farewell or to express remaining thoughts. At the same time, it is precisely at these points of intersection that the most serious risks arise. While some respondents described the interaction as familiar, comforting, or moving, it triggered feelings of alienation, distress, or discomfort in others. The fact that many respondents reject personal use of the technology but consider it helpful for third parties in exceptional situations underscores the need for

a nuanced assessment tailored to individual psychological dispositions.

A key finding of this study is that evaluation does not depend solely on the abstract idea but is largely determined by the concrete manifestation of behavior, voice, manner of response, and form of interaction. These factors can foster credibility and comfort, but they can also intensify irritation, emotional overwhelm, and the impression of a problematic, artificial presence. The professionals surveyed—from the fields of grief counseling, therapy, and pastoral care—are predominantly critical of the technology. They emphasize that while healthy grief may involve an inner, enduring relationship with the deceased, this should not be equated with a technologically simulated interaction. They identify the main risks as the development of emotional dependencies, the hindrance of the necessary process of letting go and accepting finality, and particular risks for vulnerable groups.

In summary, while AI-based memory avatars offer valuable potential for preserving life stories and biographies, they require clear ethical boundaries and consistent, transparent labeling as synthetic simulations due to the high risks of emotional dependence and a potential hindrance to the grieving process. Since digital legacies and simulated social presences are already a technological reality, the relevance of this topic will continue to grow in the future. In light of these findings, this study establishes a foundational framework that can be directly utilized in future work in three distinct ways. First, for technology acceptance research in highly sensitive domains, our conceptual model – demonstrating that Emotional Impact heavily outweighs ease of use – can be deployed by future researchers to test and evaluate other digital afterlife technologies or therapeutic AI tools. Second, the concrete design requirements derived from our mixed-methods approach (e.g., explicit synthetic content disclosures, integrated crisis hotline routing, and built-in weaning mechanisms) offer an empirical checklist for computer scientists to develop and experimentally test safer, risk-reduced user interfaces in comparative A/B studies. Finally, the exceptionally high concern regarding ethical boundaries provides a justified empirical baseline for legal and psychological scholars to draft standardized ethical guidelines and regulatory policies for commercial deadbot developers. Ultimately, by shifting the focus from purely technical optimization to emotional safety boundaries, this work serves as a stepping stone for empirical long-term studies to systematically investigate the psychological impact of repeated avatar interactions over extended periods.

■ AUTHOR CONTRIBUTIONS

Conceptualization, M.W. and S.S.; methodology, S.S.; validation, M.W. and S.S.; formal analysis, S.S.; investigation, S.S.; prototype development, S.S.; data curation, S.S.; writing—original draft preparation, S.S.; writing—review and editing, M.W.; visualization, S.S.; supervision, M.W. All authors have read and agreed to the published version of the manuscript.

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■ CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

■ ETHICS STATEMENT

According to the Aalen University Ethics Committee, a self-assessment with a standardized checklist has been conducted. As this did not reveal any critical issues, formal approval was not required.

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