New Understandings of Loss: Examining the Role of Reflective Technology Within Bereavement and Meaning-Making

Colin LeFevre
clefevr@iu.edu
Indiana University
Bloomington, IN, USA

Chia-Fang Chung
cfchung@ucsc.edu
University of California, Santa Cruz
Santa Cruz, CA, USA

ABSTRACT

Bereavement causes unique challenges, and bereaved individuals can benefit from support during their grieving process. Grief theory emphasizes the importance of reflection during bereavement, and HCI has established that reflective technology can support well-being. However, it remains unclear how to provide bereavement support with reflective technology. We build on constructivist grief psychotherapies to investigate bereavement meaning-making as a focus for reflective technology. We study meaning-making in the context of the digital game *GRIS*, due to digital games' alignment with meaning-making. To understand the progression of meaning-making experiences, we conducted a qualitative diary and interview study: 11 bereaved individuals were interviewed on their bereavement experiences, played and completed diaries on *GRIS*, and were interviewed on their experiences engaging in meaning-making while playing. From these findings, we propose design recommendations for reflective technology to engage with individualized bereavement experiences, embed user agency within reflections, and focus on novel and anti-nihilistic reflections.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Health, Design, Bereavement, Grief, Reflection, Meaning-Making, Constructivism

1 INTRODUCTION

Bereavement is a universal yet individual experience. All individuals have experienced or will experience bereavement, but each loss is highly unique and individualized [72]. These losses can have a significant, harmful impact on individual health, transitioning to

long-term psychiatric distress [13], such as Prolonged Grief Disorder [76] or Complicated Grief [82]. In both the short- and long-term, bereaved individuals can benefit from support during their grieving process [83], all the more so in the wake of the global COVID-19 pandemic [21, 22, 32, 35, 90]. Past work in Human-Computer Interaction (HCI) suggests that a varied array of technologies can provide bereavement support (e.g., [14, 52, 86, 88]). As every instance of grief is unique, there is a persistent need to expand HCI's approaches to and methods of providing bereavement support.

Within HCI, the concept of reflection has promising applications for supporting bereaved individuals. HCI literature has established that reflection can support individuals' health in diverse contexts and through diverse means (e.g., [54, 56, 57, 81]). Furthermore, reflection is prevalent in many prevailing theories of grief [50]. However, despite these parallels, the role of reflective technology in bereavement has been empirically under-explored. The importance of reflection for bereaved individuals' grieving process is well-established, but it remains unclear how reflective technology can provide meaningful support to bereaved individuals.

Meaning-making is a grief therapy outcome that could be a relevant focus for reflective technology. Specifically, constructivist grief psychotherapies are an empirically supported approach to bereavement support which centers on finding meaning within the loss of a loved one [62, 65, 67]. Within these therapies, the therapist and client collaboratively reflect on the bereavement, arrive at new interpretations and conceptualizations, and ultimately challenge the client's nihilistic bereavement perspectives (e.g., believing that grievers are powerless). This reflective process is referred to as meaning-making and is linked to improved bereavement outcomes [74, 75]. Meaning-making's emphasis on reflection and positive impacts suggests that it could be a beneficial focus for bereavement-focused reflective technology. Such technology could potentially provide bereavement support by facilitating reflection, culminating in meaning-making and the associated benefits described in constructivist grief literature. To date, however, this design opportunity has been empirically underexplored.

As constructivist grief therapeutic practices are flexible and tailored to the individual client [62, 67, 69], there is no particular type of interactive technology that is uniquely suited to exploring this design opportunity. Game Studies literature suggests that digital games are a type of interactive technology that would be appropriate. Digital games can engage with reflection [39, 54], bereavement [27, 53], and emotionally challenging subjects [10, 11], which constitute the key aspects of constructivist meaning-making. In this research, we explore this HCI design opportunity with *GRIS*, a digital action-adventure game that focuses on bereavement meaning-making. Using the game as a study instrument, we answer the

following research question: *How can reflective technology build on constructivist grief theory and practice to support bereavement meaning-making?*

To answer this question, we conducted a qualitative interview and diary study with 11 bereaved individuals. Participants completed a semi-structured interview on their bereavement experiences, played and completed diaries on *GRIS*, and completed a follow-up semi-structured interview on their experiences playing the game. Participation spanned one to four weeks to accommodate different levels of experience with digital games. We present our empirical findings from this study: the levels and associations of participants' reflections, those reflections' alignment with constructivist meaning-making, and the tensions between the game's narrative and participants' bereavement experiences. From these findings, we contribute three design recommendations for reflective technology aiming to support bereavement meaning-making: representing individualized bereavement experiences; supporting user agency; and focusing on novel, anti-nihilistic reflections.

2 BACKGROUND

2.1 HCI, Reflection, and Bereavement

Grieving the death of a loved one is a complex and challenging process with no set solution. Though earlier conceptions of grief emphasized the linearity and universality of people's grief journeys, prevailing theories have rejected these claims and instead emphasized the non-linear, individualistic, and multi-faceted ways in which grievers process bereavement [72]. As processing a loss requires thinking back to and pondering a loss, an implicit, highly relevant aspect of these grieving experiences [12, 84, 87] is reflection [50]. Past HCI research has studied both how technology supports grievers' processing of bereavement [1] and how technology can facilitate reflection [5]. But, despite the theoretical link between grief processing and reflection, reflection's specific role within technological support for bereaved individuals has been underexplored.

Reflection, as defined by Dewey [26], is the *"active, persistent, and careful consideration of any belief or supposed form of knowledge."* Substantial past work within HCI has investigated reflective technology, i.e., interactive technology facilitating reflection, examining the mechanisms and outcomes of technologically-facilitated reflection in a variety of contexts [5]. An important component of this past work is Fleck and Fitzpatrick's reflection framework [29], which categorizes the types of reflection facilitated by reflective technology into five levels: description (R0), reflective description (R1), dialogic reflection (R2), transformative reflection (R3), and critical reflection (R4). This framework allows HCI practitioners to categorize and evaluate the reflections experienced by users of a system. In our work, we use Fleck and Fitzpatrick's framework to understand what levels of reflection bereaved individuals engaged in, and associate those levels with potential design elements.

Reflective technology in HCI has been applied to a diverse array of health support areas, such as physical health (e.g., [4, 81]), chronic conditions (e.g., [7, 16]), and mental health (e.g., [47, 78]). By facilitating reflection and increasing self-awareness, these reflective technologies aim to help users reach health goals and manage health conditions. As bereavement can impact physical and psychological well-being [83], this corpus suggests that bereavement

support could be an appropriate domain for reflective technology to explore.

However, prior HCI research on supporting bereaved individuals has not had reflection as a primary focus. Instead, this research mostly focuses on three broad categories: digital remains, remembrance, and coping [1]. Research in digital remains has examined preserving digital remains [71], interacting with embodied representations [18], and evoking feelings of closeness [89]. Research in remembrance has studied integrating the deceased into everyday life [33], routine gestures of remembrance [85], online memorials [30], and telling the story of the loss [52]. Research in coping has investigated online social support for grievers [51], informational and educational resources [80], and digital disposal practices [45]. These studies present a multiplicity of unique HCI approaches to providing bereavement support. However, reflection itself has not received extensive attention in this line of work and has not been explored as an individual approach to bereavement support.

Reflection has, however, been studied as a secondary element of technology-facilitated bereavement support. Kerkhoff et al. [45] conceptualize digitally-mediated disposal practices that facilitate user reflection on the relationship with the deceased. Wallace et al. [86] show how reflection on shared life experiences can support individual re-exploration of their relationship with the deceased. Uriu et al. [85] discuss how technology-facilitated reflection can be an important part of the user's remembrance of the deceased and memorialization practices. These papers establish reflection's significance and appropriateness within their respective approaches to bereavement support. However, like the broader corpus, they do not offer design recommendations for how reflection specifically can provide bereavement support.

This corpus offers two key takeaways for this current research. Firstly, HCI has produced many diverse approaches to support the grieving process of bereaved individuals. This parallels grief theory's emphasis on the highly individualized nature of grief and the lack of a set solution. It also suggests that HCI communities are appropriately engaging with and responding to the disparate needs of different grievers. As grieving and its associated support needs will continue to vary widely, HCI communities should continue to investigate diverse approaches to bereavement support.

Secondly, reflection could be a fruitful primary focus for HCI research on bereavement support, but has been underexplored in that specific context. Grief theory emphasizes the importance of reflection for processing the loss of a loved one, and the HCI and reflection corpus suggests that reflection can provide meaningful support for physical and mental well-being. The HCI and bereavement support corpus indicates that reflection is an important element of various approaches to bereavement support [45, 85, 86], but has not explored specific design directions for reflection. At present, HCI communities could benefit from a better understanding of how reflective technology can uniquely support bereaved individuals.

In this research, we aim to contribute to this research gap by investigating the design opportunity of meaning-making. Building on the grief theory, HCI and reflection, and HCI and bereavement support corpora, we explore how the meaning-making within constructivist grief psychotherapies can serve as a foundation for reflective technology that supports bereaved individuals.

2.2 Meaning-Making & the Constructivist Orientation to Bereavement

Constructivism[1] is an orientation to psychology that asserts that individuals, on a fundamental level, are driven to "impose meaning on their life experiences" [62, 67]. From the micro-narratives of everyday life, individuals create a macro "self-narrative", condensing personal experiences into a set of beliefs, expectations, and goals which guide interactions with the world [44, 60, 61]. Bereavement, from a constructivist perspective, often challenges the self-narrative. The death of a loved one can upend fundamental beliefs and experiences [41] and create a problematic self-narrative that prevents the griever from making sense of the loss; these narratives are broadly nihilistic, including beliefs in the meaningless of life and powerless of the self [25]. Grieving, therefore, is a process of meaning reconstruction [65]; grievers search for greater meaning within a personal loss to repair their self-narrative and make sense of the world post-loss [9, 59, 61, 63].

There is notable empirical data supporting this meaning-centric orientation to bereavement and grief work. A search for meaning following a loss is relatively common [67]; though violent death does exacerbate this search [24, 79], it can occur during normative losses, e.g., the death of a spouse late in life [67]. Prior work shows that an inability to find meaning within a personal loss is associated with intense grief symptoms–specifically, in the contexts of young adults [36], late-life widows and widowers [20], parents [43, 49], and the families of terminally ill veterans [15]. In contrast, the ability to find meaning within loss has been shown to moderate the impact of significant personal losses [6] and predict positive emotional well-being [20].

Constructivist-oriented grief therapies focus on supporting bereavement meaning-making [52, 64]. Both therapist and client collaboratively reflect on the loss, focusing on two narrative activities: processing the "event story" of the death and its implications and accessing the "back story" of the relationship and any unfinished business with the deceased [68, 70]. These narrative activities allow the client to repair their problematic, fractured self-narrative by finding greater, coherent meaning in a loss. The specific methods for these activities are quite flexible. Though they can be structured with specific modules and techniques [3, 66], the presentation and form of the activities adapt to suit the client, therapist, and context [62, 67, 69].

Within these broad narrative activities, meaning-making often takes the form of specific "innovative moments". In these moments, both the client and therapist *"discover fresh meaning in the form of novel reflections, actions, and emerging reconceptualization"* of the client's problematic self-narrative [2, 68]. In so doing, the client moves towards a more congruent self-narrative. Within constructivist therapies, past work has linked the sustained development of these innovative moments with improved treatment outcomes [74, 75]. The five specific innovative moments (IMs) are as follows [2, 31]:

(1) **Action IMs:** Clients enact novel, specific behavior(s) that differ from the expected behavior based on the problematic self-narrative.
(2) **Reflection[2] IMs:** Clients reach a new understanding that challenges the problematic self-narrative.
(3) **Protest IMs:** Clients directly refuse the problematic self-narrative and its assumptions.
(4) **Re-conceptualization IMs:** Clients can describe what is different about them, articulating the past (problematic self-narrative), present (alternative self-narrative), and how they can move from past to present.
(5) **Performing change IMs:** Clients engage in new activities that were not possible before under the restrictions of the problematic self-narrative.

Within constructivist therapies, reflection is an integral aspect of the meaning-making process. This process begins by reflecting on constructivist narrative activities, transitions to reconstructing one's understanding of the world, and ends with rebutting nihilistic, problematic self-narratives. Innovative moments articulate specific conclusions of meaning-making, and by extension, reflection. Through constructivist meaning-making, reflection becomes a catalyst for impactful bereavement support.

This meaning-making process has promising implications for the design of reflective technology. Reflective technology could orient towards meaning-making specifically, aiming to facilitate reflection on constructivist narrative activities and produce reflection outcomes that parallel innovative moments. In so doing, reflective technology could potentially provide bereavement support through healthier, repaired self-narratives. The flexible activities and implementations of constructivist grief therapies suggest that many types of interactive technology could accomplish this, as the only explicit requirement for meaning-making is emotionally intensive reflection on prior bereavement experiences.

Overall, we see meaning-making as a noteworthy, potential approach to designing reflective technology for bereavement support. To that end, we explore how the design of reflective technology can be informed by constructivist grief theory and practice, and provide bereavement support via meaning-making.

2.3 Connecting Digital Games to Bereavement and Meaning-Making

Digital games are a type of interactive technology with promising applications to constructivist meaning-making. As we discuss in Section 2.2, interactive technology exploring this design space should be able to facilitate emotionally-challenging reflection on bereavement experiences. Past research suggests that digital games could have these abilities, showing that digital games can engage with bereavement, player reflection, and emotional challenges.

In regards to meaningfully engaging with bereavement, research suggests that digital games can provide meaningful mental health support, including in the context of bereavement. On a broad level, Iacovides et al. [40] found that games could provide temporary

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[1]Readers may recognize constructivism as a learning theory that the HCI and education corpus has previously explored. The constructivist orientation to grief is based on this underlying theory. Our research is not related to HCI research on constructivist education practices, but instead focuses on constructivist grief theory and practice.

[2]Note the difference between reflection generally and the Reflection IM specifically. Reflection broadly, which we define according to Dewey [26], is present in all innovative moments. The innovative moments represent specific outcomes of broad reflection and subsequent meaning-making, one of which is a Reflection IM. Reflection broadly is not under the exclusive purview of the Reflection IM.

respite from difficult life experiences, and Pallavicini et al. [73] found that games could mitigate mental health challenges during COVID-19 lockdown restrictions for some individuals. Specific to bereavement, both Eum et al. [27] and McGuire [53] suggest that games can help individuals cope with bereavement. Both Harrer and Schoenau-Fog [34] and Chittaro and Sioni [19] identify games as catalysts for personal reflection and dialogue on bereavement experiences. These works suggest that digital games, whether intended for serious or entertainment purposes, could potentially support the emotional well-being of bereaved individuals.

In regards to reflection, research suggests that games can support player reflection to a degree. Mekler et al. [54] found that digital games can support reflection, which can be an important aspect of the player experience; specifically, they applied Fleck and Fitzpatrick's levels of reflection framework [29] to games with notable success, recording the R1 (reflective description) and R2 (dialogical reflection) levels of reflection primarily. Iacovides et al. [39] expand on this work by examining the role of distance and relevance in reflection games. These concepts build on past work which conflicted on how relevant to the player's experiences a game ought to be and how similar to the player a character ought to be [42, 46]. They suggest that reflective games should incorporate narratives and context clearly related to the theme being reflected upon, e.g., using the environment of a university in a game about managing work-life balance as a student; they also argue for a third-person player character which the player is clearly separate from but can relate to and potentially customize, e.g., Commander Shepard from the *Mass Effect* series.

In regards to engaging players in emotionally challenging moments, research suggests that games can provide emotional challenges that players appreciate. Bopp et al. [10] found that negative emotions in games, such as particularly sad moments, led to emotionally intense and moving movements that players perceived positively. Building on these findings, Bopp et al. [11] further found that emotional challenges more broadly did evoke a wider range of negative emotions in players than functional challenges, but were also well-received.

Together, these three areas of prior research suggest that digital games are a relevant and appropriate type of interactive technology to explore the HCI design opportunity of constructivist meaning-making. Whether for entertainment or serious purposes, games can meaningfully engage with health contexts; games can engage with player reflection, particularly when relevance and distance are taken into account; and games can touch on emotionally intense subjects without alienating players. These capabilities strongly align with the criteria we draw from constructivist literature (refer to Section 2.2). We therefore used digital games to explore the design opportunity of constructivist meaning-making.

2.4 Study Context: *GRIS*

Specifically, we explore the design opportunity of constructivist meaning-making with the digital game *GRIS*, a 2019 2D platform-adventure game by Nomada Studio.[3] *GRIS* is a commercially available entertainment game–we, the authors, were not involved in its development. Our selection of an entertainment game aligns with

past work studying entertainment games in the context of bereavement [19, 34]. Players of the game play as Gris, a young woman who has lost a loved one. Gris goes through a multi-stage grief journey (refer to Table 1), which is loosely modeled after Kübler-Ross' Five Stages of Grief model [48].[4] This narrative experience is heavily symbolic and abstract, and centers on the event story of Gris' bereavement, one of the constructivist narrative activities. The design goal of *GRIS* is empowering the player to project their own grief experiences onto the abstract, symbolic story of Gris, and create their own meanings from Gris' grief journey [23].

We use the MDA framework (Mechanics, Dynamics, Aesthetics) [38] to separate the different design aspects of *GRIS*. The mechanics of *GRIS*, i.e., the rules that define how the player can and cannot interact with the game, are platforming, powers, and puzzles. The dynamics of *GRIS*, i.e., the emerging behaviors and patterns as the player engages with the mechanics, can be modeled with a lock and key. As in many 2D platformer games, the player in *GRIS* experiments with various environmental elements and earned powers to progress through platforming and puzzles. And the aesthetics of *GRIS*, i.e., the emotional responses evoked in the player, are intended to fall under three of Hunicke et al's [38] aesthetic heuristics: narrative (game as drama), challenge (game as obstacle), and expression (game as self-discovery).

We specifically chose *GRIS* as a study instrument because of its emphasis on meaning-making. *GRIS* is explicitly designed to prompt reflection and meaning-making on a linear grief journey and happens to include the narrative activities of constructivist grief therapies. Furthermore, the game's design aligns to varying degrees with Game Studies literature on games that engage with health contexts, reflection, and emotionally challenging moments. In regards to health contexts, this study frames it as an entertainment game in a "serious scenario," as in many other studies on games and bereavement. In regards to reflection, *GRIS* incorporates a third-person player character separate from the player and attempts a relatable and relevant bereavement narrative via symbolism, which somewhat parallels the recommendations of Iacovides et al. [39]. In regards to emotional challenge, *GRIS* employs a combination of functional challenge in its mechanics and dynamics as well as emotional challenge in interpreting and processing the aesthetics and narrative. With these design alignments in mind, we consider the digital game *GRIS* an appropriate example of interactive technology to support meaning-making in bereavement and grief.

Importantly, *GRIS* employs an outdated and criticized model of bereavement: Kübler-Ross' five stages model [48]. As we discussed above in Section 2.1, bereavement is individualized, multi-faceted, and non-linear. Through its symbolic narrative, *GRIS* presents bereavement as individualized, but nonetheless linear. Players can find their own unique meanings with the narrative's events, but must follow a set path paralleling the five stages model. This is an important limitation of *GRIS* which we actively engage with in our study findings and discussion.

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[3]https://store.steampowered.com/app/683320/GRIS/

[4]For a visual overview of *GRIS* and its elements, we recommend viewing video reviews of the game, such as SkillUp's YouTube review: https://youtu.be/PehrCkdrfd8?si=6m0wlT5eBSKQzrPm

Table 1: The Six Chapters of *GRIS*

Chapter	Grief Stage	New Power	New Color	Location
1	Denial	Jump	White / Black	Monochromatic wasteland
2	Anger	Block	Red	Windy desert
3	Bargaining	Double jump	Green	Lush forest and ruins
4	Depression	Swim	Blue	Deep ocean
5	Acceptance	Sing	Yellow	Airy sky city
6	N/A	None	None	Wasteland and starry sky

3 METHODS

To answer our research question and observe the progression of meaning-making experiences, we conducted a qualitative diary and interview study with 11 participants (refer to Table 2). None of the research team members identified as grievers, and we approached the study design and analysis as a way to examine potential supports for grievers. While we did not consider interactive technology as an all-encompassing solution for bereavement support and strove to critically engage with the limitations of technology in this work, an underlying expectation was that interactive technology would have some beneficial capabilities in this context. To that end, we used the digital game *GRIS* as an example design probe [8] that aims to support meaning-making in the grieving process. Our study design focused on understanding participants' experiences playing the game, with a particular emphasis on their ability to reflect on their bereavement experiences and engage in meaning-making.

3.1 Study Activities

Our study had three sequential activities. Participants engaged in each activity in numeric order and completed the study after finishing all three activities.

3.1.1 Activity 1: Orientation & Background Interview. In Activity 1, we conducted a 30-45 minute introductory, semi-structured interview over Zoom. Participants were compensated with a $10 USD digital Amazon gift card upon completion. In this activity, we explained the study format, answered any questions participants had, and discussed participants' previous bereavement experiences. We used these personal experiences to contextualize their gameplay and meaning-making process.

3.1.2 Activity 2: Play-through Diary Study. In Activity 2, participants engaged in an independently paced, one- to four-week play-through of the digital game *GRIS*. This play-through occurred in the format of a diary study, an established method to examine both gaming experiences [55] and the role of technology in sensitive health conditions [77]. Participants were temporarily provided with the game, free of charge, by the research team; they were also compensated with a $15 USD digital Amazon gift card upon completion of the activity. They engaged in a singular, sequential play-through of *GRIS*, playing the six chapters once sequentially. Immediately after completing each chapter, participants completed a 10-15 minute diary on their experiences in that specific chapter. Diary entries included short answer reflections on the chapter's difficulty, story, colors, powers, and location. Additionally, to support memory recollection [17], participants we asked to submit one to five in-game screenshots they found particularly interesting.

We allowed participants to play at their own pace (i.e., one to four weeks) to accommodate their individual schedules and varying levels of experience with digital games. Furthermore, if participants partially but not fully finished the activity, i.e., completed one or more but less than six diaries, they could still progress to Activity 3. We allowed this to include the perspectives of participants who experienced significant technical and gameplay challenges (e.g., P01 and P08). We used the diary entries to develop individual follow-up interview questions and support participants' recollection of their gameplay and meaning-making experiences.

3.1.3 Activity 3: Follow-up Interview. In Activity 3, we conducted a 30-45 minute follow-up, semi-structured interview. This activity took place in Zoom sessions, and participants were compensated with a $10 USD digital Amazon gift card upon completion. In this activity, we discussed participants' experiences playing the digital game *GRIS*. All interviews shared a set of general questions focused on Gris' journey as a griever; additionally, we developed a personalized set of questions based on individual responses in Activities 1 and 2 to further probe the relationship between Gris' grief journey and the participant's grief journey.

3.2 Eligibility & Recruitment

Individuals were eligible to participate in the study if they experienced nonviolent bereavement 2-8 years prior. Within the context of the study, we defined bereavement as a "significant loss of a loved one." We purposefully allowed participants to self-define a "significant" loss to encompass a diverse set of grief experiences. Individuals experience loss differently, and our conception of "significant" losses is by no means definitive. Additionally, we established our two primary eligibility criteria–nonviolent losses and a loss gap of 2 to 8 years–to support an ethical study design. We describe more detailed ethical study design considerations in Section 3.3.

We recruited participants through All IN for Health,[5] a volunteer registry for health-related research studies conducted by academic institutions in the US state of Indiana. All of our participants, therefore, were current residents of the US state of Indiana. The registry disseminated the study recruitment information through regular newsletters. Interested individuals were directed to a screening survey and were contacted via email if eligible. In total, we recruited 19 participants; 11 completed the study, three formally withdrew, and five informally withdrew, i.e., stopped completing study activities and did not respond to attempts to confirm they had withdrawn.

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[5]https://allinforhealth.info/

Table 2: Study participants' (n=11) self-reported demographic and personal loss information

ID	Age	Gender	Ethnicity	Diaries	Loss Gap (yrs)	Loss Relationship	Loss Cause
01	34	Female	White	1/6	3	Grandparent	Heart attack
02	29	Female	White	6/6	2	Parent-in-law	Stroke
03	26	Male	Latino	6/6	5	Cousin	Cardiovascular disease
04	34	Female	Latina	6/6	3	Friend	Diabetes
05	27	Male	White	6/6	2	Parent	Stroke
06	31	Female	White	6/6	4	Parent	Cancer
07	30	Female	White	6/6	3	Grandparent	COVID-19
08	28	Female	White	5/6	5	Aunt/Uncle	Alcohol abuse disorder
09	40	Non-binary	White	6/6	2	Sibling-in-law	Cancer
10	34	Female	Latina	6/6	2.5	Child	Stroke
11	31	Male	Asian	6/6	7	Grandparent	Old age

3.3 Ethical Considerations

Given the specific context of grief and past HCI work documenting the double-edged outcomes of reflective technology in mental health contexts [28, 37, 58], a core focus of our study design was ensuring our participants' mental health was not adversely affected by study participation. To that end, we consulted with an expert Death Studies researcher while designing our study. This consultation resulted in the following study features:

- As noted above in Section 3.2, we limited eligibility to bereaved individuals with nonviolent losses at least two years prior to study participation.
- We emphasize to prospective participants that we, as researchers, are not licensed counselors or therapists, and participating in our study is not a suitable replacement for enrollment in grief counseling, therapy, support groups, etc.
- When participants enrolled in the study, they received a list of bereavement support resources via email; during their participation, they additionally received weekly check-ins via email.
- Study activities allowed for but did not require extensive discussion of personal grief experiences; participants could skip any interview questions they wanted, without providing a particular reason.
- If weekly check-ins suggested that activities were negatively impacting a participant's mental health, we reserved the right to pause and/or end their participation (with no loss in compensation) based on the severity of the adverse effects.

No participants, either formally withdrawn or completed, reported adverse effects on their mental health during their playthrough. Since the five participants who informally withdrew did not explain their reasons for withdrawal, we cannot speak to any adverse effects they may have experienced. Based on interviews, weekly check-ins, and diary entries, we did not at any point in the study pause or end any participant's involvement in the study. We were prepared to do so, but no need arose. To the best of our knowledge, therefore, no study participants experienced adverse effects on their mental health during study activities.

3.4 Data Analysis

Our analysis focused on data collected in Activity 3. As we discuss in Section 3.1, we used Activity 1 and 2 to support the development of interview questions and execution of Activity 3 as well as contextualize the responses to those questions. Therefore, our analysis centered on the Activity 3 interview transcripts, with occasional reference to the Activity 1 interview transcripts and Activity 2 diaries and screenshots for context. Our analysis had three phases:

(1) We began our analysis with affinity mapping. We read through the interview transcripts from Activity 3 and created memos including game chapter-specific elements: colors, powers, emotionality, and corresponding stages of grief. We then iteratively sorted these insights from each interview into high-level themes. We used these high-level themes to create the initial codebook for the second round of analysis.

(2) Based on the initial codebook, we iteratively coded all the interview transcripts from Activity 3. We also developed new codes to expand our themes from chapter-specific to more general applications, such as how participants relate to the game narrative, how they experienced moments of reflection, and how they personally connect and contrast their personal journey.

(3) We iteratively mapped our codes onto the MDA framework [38], Fleck and Fitzpatrick's levels of reflection framework [29], and constructivist grief theory's innovative moments [2, 31], identifying relationships between game elements, levels of reflection, and meaning-making outcomes.

4 FINDINGS

4.1 Reflection on Bereavement Experiences

We analyzed participants' reflections using Fleck and Fitzpatrick's levels of reflection framework [29] to understand how participants reflect on and make sense of their individual bereavement experience with the game narrative and design. Out of 11 total participants, eight (P2-P7, P10, P11) reported reflecting on their bereavement experiences as they played *GRIS*, and three (P1, P8, P9) reported no reflection. For those who did reflect, their reflections spanned levels *R0 - Description* (one out of eight), *R1 - Reflective Description* (three out of eight), and *R2 - Dialogic Reflection* (four out of eight) [29]. We did not observe any participants adopting transformative

practices (R3) or considering social and ethical issues (R4) in their reflection activities.

From a constructivist perspective, all eight participants' reflections exclusively focused on their bereavement event story: the loved one's death and its implications [68, 70]. Participants generated these reflections by connecting the parallels between in-game experiences and bereavement event story experiences. Each participant's individual reflection clustered around a shared theme, game element, and event story. These reflections were primarily associated with the game's dynamics (five out of eight) and secondarily with the game's aesthetics (three of out eight) [38].

4.1.1 Grappling with Abstract Game Narratives (No Reflection). Three participants (P01, P08, 09) did not report any level of reflection on bereavement experiences while they played *GRIS*. For these participants, the narrative of *GRIS* was too abstract and symbolic to support connections to the game narrative and reflection on personal grief experiences, lacking specific details which would connect it to death, bereavement, and a grief journey. For instance, P01 specifically reported the lack of words as a barrier to engaging with the game's narrative:

> *"I think I guess it felt really abstract, maybe. Like maybe I'm more of a person who appreciates words as part of it."* (P01)

4.1.2 Revisiting Bereavement Experiences (R0). One participant (P10) reported reflection at level R0, defined as *"description or statement about events without further elaboration or explanation"* [29]. P10 compared her bereavement event story to the game's aesthetics, connecting Gris losing her voice in the game's narrative to her previously losing her ability to speak due to grief. She did not, however, report reasons for losing her voice or consider explanations of that event; for that reason, we categorize her reflection as R0.

> *"[She lost] her voice and she was holding your throat and stuff. And it resonated with me... [during my grief] I was crying so bad. Like, I was dry heaving and I lost my voice."* (P10)

4.1.3 Rediscovering Prior Insights on Bereavement Event Stories (R1). Three participants (P05, P06, P11) reported reflection at level R1, defined as "*description including justification or reasons for action or interpretation, but in a reportive or descriptive way*" [29]. In their reflections, participants described their bereavement event stories and included explanations for and implications of their past actions. These reflections re-emphasized participants' prior insights on their event stories but did not change participants' overall perspectives on bereavement.

Specifically, P05 compared his bereavement event story to the game's aesthetics, connecting the feelings of aimlessness he experienced navigating a game level to his personal experiences with post-loss depression. Within this reflection, he considered how his inability to engage with the loss of his parent was one of the explanations for both his prior struggle with depression and the resonance he currently felt with the game's dynamics. He had already been aware of this inability, but his reflection re-emphasized its significance.

> *"There was a lot of depression realizing now he's gone, and there wouldn't be a chance to, you know, mend those bridges anymore... I started losing touch with a lot of people... And it was very isolating and lonely and sad. And I really felt that kind of being lost [in the blue water level]."* (P05)

P06 compared her bereavement event story to the game's dynamics, comparing her challenging grief journey to Gris using the block power to navigate a storm. Within this reflection, she contemplated how and why she had difficulty moving forward in her grief journey. She had previously arrived at these insights through professional counseling and therapy; playing the game brought them to the forefront of her mind.

> *"I feel I [have] been [in] a lot of situations where I just don't have enough strength to continue... [so] where you have to go through the storm was powerful... [I was] experienc[ing] [my grief journey] a little bit and kind of reflect[ing] on like how and why [things happened] throughout it."* (P06)

P11 compared his bereavement event story to the game's dynamics, describing the back-and-forth gameplay of the final level as paralleling his own back-and-forth struggle with post-loss alcoholism. Within this reflection, he considered how that cycle of progress and regression made it difficult to engage in self-care during bereavement. He was already aware of this specific challenge, but playing the fifth level re-emphasized its importance.

> *"You have to switch from the one gravity to another gravity, kind of like back and forth... I felt like, I did that same kind of mistakes, when it comes to my [grieving] process where I drink, I try to stop it, I could not be able to stop it, then I could not be able to concentrate on... the things that I should do."* (P11)

Overall, these reflections at R1 were associated with moments of connection between the game's dynamics and aesthetics and the participants' individual bereavement event stories. From these reflections, participants derived re-emphasized, prior insights on their inabilities and abilities as grievers. These reflections did not achieve a higher level than R1 because they emphasized renewed rather than new insights, reinforcing rather than notably changing participants' perspectives.

4.1.4 Discovering New Insights on Bereavement Event Stories (R2). Four participants (P02, P03, P04, P07) reported reflection at level R2, defined as *"looking for relationships between pieces of experience or knowledge, evidence of cycles of interpreting and questioning, consideration of different explanations, hypothesis and other points of view"* [29]. In their reflections, participants not only described their bereavement event stories and included explanations and implications, but also discovered novel insights on their event stories which informed but did not transform their perspectives on bereavement.

Specifically, P02 compared her bereavement event story to the game's dynamics, building on her frustration navigating the fourth level to explore her difficulties navigating bereavement. Within this reflection, she arrived at an enhanced understanding of those difficulties, realizing the lack of a singular, "right" approach in the grieving process and engaging with her frustration at this aspect of bereavement.

"I found that level really frustrating is because I was able to relate to that a lot... where it's like, everywhere you turn, there's no right path... there were other things that were underneath that that I was then able to kind of think about later... that kind of level really touched me in a way I wasn't expecting." (P02)

P03 compared her bereavement event story to the game's aesthetics, reflecting on how the narrative conclusion of the game applied to his own grief journey. In so doing, he realized that just as the ultimate barrier to Gris' grief journey is herself, he too is the foremost barrier to or facilitator of his grief journey.

"She's the bird, like [it] transforms into her and start to [chase] her... my conclusion is like the same... my worst enemy is myself, like I am the only one who can destroy myself or can heal myself." (P03)

P04 compared her bereavement event story to the game's dynamics, considering how the strengths and weaknesses of the block power contextualized her own defensive tendencies as a griever. Within this reflection, she realized that just as the protective block power slows the in-game character, her defensive tendencies while grieving cut her off from external support.

" I see like, yeah, she's protecting herself but at the same time when she's like that she cannot walk properly... So I had very huge philosophical thoughts... because I associate completely with the emotions, what it is like, when... you protect yourself but at the same time you will have problems, like she couldn't run." (P04)

P07 compared her bereavement event story to the game's dynamics in a similar fashion to P06, connecting her experiences navigating adversity to Gris navigating a storm. Through this reflection, she achieved a more nuanced perspective on bereavement, feeling that Gris' perseverance through adversity validated and normalized her own, similar reactions to adversity while grieving.

"When she turns into a block to go through the really rough storm that she couldn't go through with regular walking, it made me think of the times where I've either, you know, forced myself out of bed and pushed myself forward... Like, I did that too, right?" (P07)

Similar to the R1 reflections, these reflections at R2 were associated with moments of connection between the game's dynamics and aesthetics and the participants' individual bereavement event stories. They also produced insights on participants' inabilities and abilities as grievers. Unlike the R1 reflections, however, the R2 reflections centered on new rather than renewed insights and were able to inform participants' perspectives on grieving. These reflections did not achieve a higher level than R2 because they did not fully transform participants' perspectives.

4.2 Constructivist Outcomes of Reflection

To understand how the outcomes of participants' reflections align with constructivist meaning-making, we mapped these outcomes onto innovative moments (IMs), which are specific types of meaning-making worked towards in constructivist grief therapies. Each IM represents a different way in which a bereaved individual can rebut a problematic self-narrative, i.e., an often nihilistic perspective that

prevents them from making sense of the world post-loss [2, 24, 41]. We classify reflections' alignments with IMs as partial or full in response to the nuance of assessing IMs, which are typically assessed in situ by expert psychotherapists.

Within the outcomes of participants' reflections, we found that R1 reflections partially aligned with and R2 reflections fully aligned with the Reflection IM. The Reflection IM is defined as *"reach[ing] a new understanding which challenges the problematic self-narrative"* [2, 31]. To align with this IM, reflection outcomes require a new understanding contributing to a less nihilistic perspective.

Reflections at level R2 fully aligned with the Reflection IM. Their reflections produced novel insights that elucidated their inabilities and abilities as grievers and notably informed their perspectives on bereavement. The novelty and impact of these R2 insights, as described in Fleck and Fitzpatrick's definition of dialogic reflection [29], satisfied the *new understanding* criterion. The insights' focus on explicit inabilities and abilities also rebutted the nihilistic conception of grievers as powerless, satisfying the *less nihilistic* criterion. For example, P04's reported reflection outcome was a novel insight into her ability to recognize and describe herself as a bereaved individual:

"I started to think about my grandfather, and I didn't think that could be possible to think because I'm avoiding a lot of stuff... I was trying to interpret things and I said yeah, this is this stage of grief. And I was like, but how do I know? Yeah, because I'm grieving too." (P04)

Reflections at level R1 partially aligned with the Reflection IM. Like the reflections at level R2, they focused on grievers' abilities and inabilities and therefore satisfied the *less nihilistic* criterion. But, these reflections produced renewed rather than new insights into bereavement, hence their classification as descriptive reflection (R1). This lack of novelty did not meet the *new understanding* criterion. However, because assessing IMs requires nuance and renewal is thematically related to novelty, we categorize R1 reflections as partially aligning with the Reflection IM. For example, P11 described a reflection outcome which, while generally positive and anti-nihilistic, was a prior insight he had been reminded of:

"Like, the thing that I got like that, that means, yes, you need to have the closures, you have to have the memories. But you can't [remain] really sad [forever]." (P11)

Beyond the Reflection IM, we also found that two reflections (P05 at R1, P11 at R2) partially aligned with the Re-conceptualization IM. The Re-conceptualization IM is defined as *"describ[ing] what is different about [oneself], articulating the past (problematic self-narrative), present (alternative self-narrative), and how [one] can move from past to present".* To align with this IM, reflection outcomes need to describe a more nihilistic past perspective and a less nihilistic present perspective. They also need to articulate how the individual reflecting can move from the past perspective to the present perspective.

No participants reported reflection outcomes that fully satisfied these criteria; however, two participants (P05, P11) reported reflection outcomes that partially fulfilled these criteria, describing the past and/or present perspectives but not clearly articulating

how to move between these perspectives. Because these reflections fulfill some of the criteria and are generally oriented towards temporality, we categorize them as partially aligning with the Reconceptualization IM. As an example, P05 described a reflection outcome that emphasized his flawed past perspective on grieving, but did not articulate how he could achieve a less nihilistic perspective in the present:

> "It's not necessarily the events that caused her to experience grief that's sad. It's sad that at times, when experiencing grief, it's like, it was ourselves or herself that are really holding her back. And that I really felt." (P05)

From participants' reflection outcomes, we did not find any alignments with other IMs. Participants did not focus on new, unexpected behaviors (Action IM), refusal of a problematic self-narrative (Protest IM), or new, previously impossible behaviors (Performing change IM).

4.3 *GRIS*' Linear Conceptualization of Bereavement

A key limitation of *GRIS* is its linear conceptualization of bereavement. As we discuss in Section 2.4, the game presents bereavement as a linear process in contravention of the modern understanding of bereavement as individualistic. As part of our engagement with this limitation, we investigated the potential tension between the linearity of Gris' journey and the uniqueness of participants' grief experiences. We found that the impact of this linear conceptualization varied widely on an individual basis, with participants reporting that the linearity either felt logical and appropriate (P02, P05-P8), contradicted their individual grief experiences (P09, P10), or aligned with their individual grief experiences (P04). Additionally, three participants (P01, P03, P11) did not notice the presence of the conceptualization and therefore did not report any impacts.

4.3.1 Linearity as a Logical Design Choice. Five participants (P02, P05-P08) felt the game's linear conceptualization of grief was a logical design choice. They discussed either the broad appropriateness of the linearity (P06, P07), or specific, particularly interesting implementations of linearity (P02, P05, P08). However, they did not report any impact of the linearity on their ability to connect the in-game narrative to their personal grief experiences. For instance, P06 broadly felt that the inclusion of the model made sense, and P02 specifically felt that the game's representation of the bargaining stage was well done:

> "I don't know if there is a direct correlation with like, the five stages of grief... but it makes sense." (P06)

> "So she was working [with] the [animals], and there were some, like, kind of give and take... And I was like, oh my gosh, this reminds me of like bargaining, you know, like, she's bargaining for their help. And they're like, they're helping her out in a way. And so I thought that that was really cool." (P02)

4.3.2 Linearity as a Disconnection from Individual Grieving Experiences. Two participants (P09, P10) felt the game's linear conceptualization of grief disconnected the narrative from their individual grieving experiences and made it more difficult to connect with the story being told. Specifically, P09 felt the grief stages conflicted with the design of the game's levels, drawing attention to the cheery, colorful fauna of the depression-themed level. This tonal disconnect between underlying conceptualization and in-game implementation led to a "weird", disconnected experience.

> "It might be the stages of grief. But again, the sadness part made you feel more free, which is kind of weird. [The level] was visually trying to be more gloomy yet it was the most open, bright, and interesting part of the game." (P09)

Somewhat differently, P10 felt the linear progression of the game did not align with her current orientation to bereavement. She resonated with the anger-associated power because she wanted to remember her loved one through that emotion, both within and outside of the digital game. The inclusion of other themed powers, and by extension the other stages of grief, conflicted with this desire and contributed to her disconnected experience.

> "It felt a lot... more freeing to smash through things than to like glide or sing... I don't think I want to move on, I think I just want to stay in like, anger. Because I feel like, once I get to the end, [my child is] gone." (P10)

4.3.3 Linearity as a Connection to Individual Grieving Experiences. One participant (P04) felt the game's linear conceptualization of grief connected the narrative to their individual grieving experiences and enhanced their ability to connect with the story being told. Specifically, P04 felt the game's implementation of the linear Kübler-Ross model helped her connect her own grief experiences to the game's narrative.

> "The different stages of grief, somehow you can see it through her journey. And I could connect with myself, with my experience." (P04)

4.3.4 Overall Impact of Linearity. *GRIS*' linear conceptualization of bereavement, as per the Kübler-Ross model, had nuanced impacts on participants' game experiences. We anticipated tensions between this oversimplified linearity and participants' dynamic and individualized bereavement experiences. However, only two participants reported such tensions, describing being disconnected from the game's narratives. The other six participants did not report any tensions, instead feeling the conceptualization was logical (n=5) or beneficial (n=1). The underlying cause, as reported by participants, was the prevalence of the Kübler-Ross model in common conceptions of grief. Participants implicitly regarded the inaccurate conceptualization as accurate, because it was the foremost model of grief they were aware of. This familiarity appeared to moderate the impact of the conceptualization's linearity.

5 DISCUSSION

Our findings indicate that reflective technology has the potential to support bereaved individuals via constructivist meaning-making. Out of the 11 participants who played *GRIS*, eight connected the in-game narrative to their bereavement event stories and reflected on those event stories. Furthermore, four participants' reflections (P02-P04, P7) fully aligned with constructivist grief therapy's definition of beneficial meaning-making via the Reflection IM, and,

three participants' reflections (P05, P06, P11) partially aligned with definitions of beneficial meaning-making via the Reflection and Re-conceptualization IMs. Overall, constructivist meaning-making appeared to be facilitated by reflective technology, primarily at the level of dialogic reflection.

Understanding that meaning-making (including but not limited to specific innovative moments) is beneficial for bereaved individuals [6, 20, 74, 75], our study provides bounded but important evidence that reflective technology can meaningfully support bereaved individuals through an emphasis on meaning-making. The critical question to answer, therefore, is how we can apply *GRIS*' success supporting constructivist meaning-making to the design of reflective, interactive technology more broadly. Operationalizing constructivist grief theory and our study findings, we propose three design recommendations for reflective technology which aims to provide bereavement support via meaning-making, referred to herein as constructivist reflective technology.

5.1 Engaging with Individualized Bereavement Experiences

The first design recommendation focuses on how reflective technology can support and engage with highly individualized bereavement experiences. Our findings show that a key part of participants' meaning-making was connecting to the interactive technology's representation of bereavement. As bereavement is highly individualized and defies singular solutions and representations, a key design challenge is creating a representation of bereavement that can speak to grievers' unique and disparate experiences. Based on our findings, we put forward two important elements of creating such representations: balancing abstractness and specificity as well as selecting a model of bereavement.

GRIS engages with both of these elements with mixed results. In regards to balancing abstractness and specificity, the game leans heavily on abstract narrative elements and avoids specificity. In so doing, it provides few details which could contradict a player's bereavement experiences but also puts forward equally few details which could explicitly parallel a player's bereavement experiences. It places the burden of interpretation on the player to speak to many disparate bereavement experiences. This approach both succeeds and fails. On the one hand, eight participants were able to connect with disparate dynamics and aesthetics, and arrive at unique insights on their bereavement experiences. On the other hand, three participants did not connect at any level and specifically cited the abstraction as a barrier.

These findings emphasize the nuanced balance between abstractness and specificity in constructivist reflective technology. Compared to specificity, abstractness is a safer but less rewarding option, containing fewer details that contradict or connect with a user's bereavement experiences and requiring more interpretation. It risks alienating users through the intellectual labor of interpretation it requires. Specificity is a more challenging but also more rewarding design choice, containing more details that can contradict or connect with a user's bereavement experiences and requiring less user interpretation. It risks alienating users by inaccurately representing the details of their bereavement experiences. When designing constructivist reflective technology, HCI practitioners should carefully

consider what type of reflection experience, user burden, and potential alienation are appropriate for specific design contexts. For example, individuals in different stages of their grieving process may require different levels of support. Similarly, individuals with or without expert support may have different abilities in interpreting or connecting their individual bereavement experiences.

In regards to selecting a model of bereavement, the game conceptualizes bereavement as linear via the Kübler-Ross model. This conceptualization is embedded throughout all of the game's elements: mechanics, dynamics, and aesthetics. And yet, despite the model's oversimplification of the bereavement process, only two participants felt it was a barrier to connection. Five participants felt it was a logical inclusion, one felt it enhanced her ability to connect with the narrative. That is to say, the common knowledge misconception of bereavement as exhibiting five linear, discrete stages impacted participants' assessments of the conceptualization's impact. For one participant (P04), this misconception was even the catalyst for reflection and meaning-making.

These findings emphasize the complexity of modeling bereavement via theory. Grief theory has clearly established that bereavement is not linear and suggests that tensions would arise between reflective technology's linear conceptualization of bereavement and users' non-linear bereavement experiences. And yet, as our findings show, the familiarity of linear bereavement processes can appeal to users, even though it may misrepresent their experiences. Ultimately, selecting a model of bereavement has trade-offs. A linear conceptualization will be more familiar to a lay audience, but may misrepresent experiences; a non-linear conceptualization will be less familiar to a lay audience but more familiar to a scholarly audience, and may more authentically represent experiences. When designing constructivist reflective technology, HCI practitioners should carefully consider both their users' knowledge of bereavement conceptualization and whether to prioritize familiar linearity or accurate non-linearity. For example, when working with a population very familiar with linear models, designers could frame bereavement as a linear process with discrete stages. Within that frame, designers could allow individuals to stay, revisit, or skip particular stages, allowing users to personalize their experience within a familiar linear model.

These design elements–balancing abstractness and specificity, and selecting a model of bereavement–are two ways reflective technology can represent and engage with individualized bereavement experiences, and by extension support bereavement meaning-making. In this endeavor, there are no easy decisions; both of these elements require nuance and entail trade-offs. Involving intended audiences and engaging in design methods that incorporate their needs is a crucial element of implementing and assessing these design elements.

5.2 Embedding User Agency within Reflection

The second design recommendation centers on the importance of user agency. In constructivist theory and practice, the client collaboratively leads the meaning-making process with the therapist; the client is not, under any circumstances, unilaterally guided. This theoretical stance suggests that reflection should not be imposed

or forced upon the user. Rather, it should exist in a context of user agency, where users direct their own reflection.

The design of *GRIS* parallels this theoretical stance. *GRIS* gives the player a high degree of control over their reflections. The game does not have rigid prompts for reflection. Instead, it embeds flexible parallels to bereavement experiences throughout all of the game elements and allows the player to draw their own conclusions. For instance, in the second level on anger, the mechanics of the block power smashing objects corresponds to the destructive aspect of anger; the dynamics of using the block to push through the storm correspond to using internal anger to navigate adversity; and the deep red desert aesthetics set a context of harshness and anger. In this level, all three components of the game experience provide a potential, unique starting point for reflection on anger. But, the player is not required to reflect to progress through the level; and, if they do reflect, there is no "correct" outcome put forward by the level. The player is ultimately allowed to direct their reflection, choosing where it will begin and end.

Our findings show that this flexible, agency-centric approach to reflection can successfully lead to meaning-making. Participants in our study engaged in meaning-making in disparate ways, even when reflecting on the same theme. For example, both P04 and P07 connected navigating the storm with the block power to their own bereavement experiences; however, they derived notably different meanings from that shared dynamic, with P04 exploring the negative impacts of her defensive behavior and P07 realizing the validity of her actions as a griever. These participants' disparate but equally valid meaning-making was possible because they were allowed to direct their own reflections. P04 and P07 self-selected the dynamics of the game's second level to reflect upon and took that reflection to a personally meaningful conclusion.

When considering how to operationalize constructivist grief theory and practice in the design of reflective technology, these findings and the constructivist theoretical stance call for a similar level of user agency. Constructivist reflective technology should position reflection as an option, not an imposition, which users can exercise a high degree of control over. For example, designers could create a lack of "correct" interpretations and reflections, the ability to choose and/or modify reflection prompts, or the ability to change reflection frequency and intensity. Circumstances might arise which call for limitations to be placed upon the user. In these instances, designers should carefully consider to what degree these limitations are necessary, and what benefit and harm they will have. For example, if a designer feels that reflecting on constructivist narrative activities specifically is necessary, they should interrogate that belief and consider how these narratives might misrepresent the user's bereavement experiences.

This approach to designing reflective technology may seem counter-intuitive. After all, users may not be aware of constructivist best practices. But, similar to a constructivist grief therapist, the role of constructivist reflective technology is to collaborate with the griever within meaning-making, not guide or control them through meaning-making. It is ultimately the user, not the technology, that engages in meaning-making and re-conceptualizes their bereavement experiences.

5.3 Focusing on Novel & Anti-Nihilistic Reflections

The third recommendation focuses on the importance of novel and anti-nihilistic reflections. Using constructivist grief therapy's innovative moments as an analytical lens, our findings show that reflection outcomes strongly align with constructivist meaning-making when the underlying reflection produces a novel insight and rebuts nihilistic worldviews on bereavement experiences. We propose that reflective technology aiming to support bereavement meaning-making should focus on these two aspects of reflection.

In regards to producing novel insights, our findings show an association between reflections that satisfy innovative moments' novelty criterion and reflections that achieve dialogic reflection (R2). This association suggests that reflective technology can support novel reflections on bereavement experiences by focusing on dialogic reflection. Transformative reflection (R3) theoretically could also support this novelty; but, as participants did not achieve this level, we can only speculate about its potential appropriateness.

Within dialogic reflection, Fleck and Fitzpatrick emphasize the importance of considering alternative perspectives when attempting to shift one's own perspective, i.e., achieve a novel insight [29]. Our findings mirror this understanding–participants achieved new insights on their bereavement experiences when they reached dialogic reflection (R2), using alternative perspectives to arrive at new understandings of their bereavement experiences. For instance, P04 achieves dialogic reflection by interpreting the game's block power as hindering the character, applying that alternate perspective to her own behavior and arriving at a new understanding of her defensive tendencies.

Reflective technology can build on these findings and underlying theories by specifically presenting varied perspectives on bereavement. These perspectives can form the basis of dialogic reflection, and support users' ability to arrive at novel insights into their bereavement experiences. Designers should also consider the impact of alternative perspectives on a system's representation of bereavement. As we discuss in Section 5.1, representing individualized bereavement experiences is a careful and balanced endeavor. Our findings do not provide clear answers on how alternative perspectives interface with a system's representation of bereavement. But, given that alternative perspectives inherently challenge a dominant representation, we speculate that some relationship between the two exists. Future research could further examine how various representations of bereavement and alternative perspectives shape individual reflection process and how design can better support these mechanisms.

In regards to rebutting nihilistic worldviews, our findings suggest that reflections can be influenced by positive, hopeful elements throughout an interactive experience. The narrative of *GRIS* is broadly anti-nihilistic, showing the positive development of a fictional young character which culminates in her confronting and defeating her grief journey's antagonist. Its implicit message of personal capability shines through in participants' reflections at R1 and R2, all of which engage with their inabilities and abilities as grievers. This suggests that these reflections were impacted to some degree by the positive, hopeful narrative of the game.

Reflective technology can incorporate these findings by representing bereavement in positive and hopeful terms. The case of *GRIS* suggests that reflections within this technological context would generally be anti-nihilistic and would rebut problematic self-narratives to varying degrees. The overall takeaway, as constructivist theory suggests, should be that bereavement is an experience that can be processed and understood–how precisely that processing and knowledge occur is left to the user. For example, designers could incorporate reflective questions that discuss broad positive outcomes from bereavement experiences; the user could then interpret those broad outcomes to specifically fit their own understanding of bereavement.

Overall, our findings suggest that novelty and anti-nihilism are two aspects of participants' reflections relevant to the broader design of constructivist reflective technology. We propose that presenting alternative perspectives on bereavement and embedding positive representations of bereavement journeys are two ways in which designers can support these respective elements. In so doing, reflective technology can more effectively support beneficial meaning-making in bereavement experiences.

5.4 Speculative Examples of Constructivist Reflective Technology

In addition to the three design directions we propose, we also provide two speculative examples of constructivist reflective technology. These examples illustrate how the considerations we put forward could be applied to the design of a particular system. Importantly, these examples should not be viewed as rigid blueprints for applying the recommendation we propose. Rather, they represent two of potentially many approaches to designing constructivist reflective technology.

5.4.1 Example 1: Interactive Bereavement Storybooks. Our first speculative example is interactive bereavement storybooks. These storybooks could create interactive narratives that combine a themed grief story with on-theme interactive elements to facilitate reflection on bereavement experiences. These narratives would be relatively specific, containing specific, positive endings as well as challenges to the protagonist's perspective. Additionally, these narratives would differ from each other in their conceptualizations of bereavement and specific details. Users would select a narrative to explore from the collection of narratives, aka "storybook"; within these stories, they would not be explicitly tasked with reflecting on their own experiences, and would instead be allowed to explore as they saw fit.

This speculative concept emphasizes specificity over abstractness while still prioritizing alternative perspectives, a hopeful framing, and a high degree of user agency. The stories within the storybook are specific enough to potentially alienate users; for that reason, many disparate stories are presented as options. This allows individuals to self-select narratives that they connect with, an interesting combination of agency and specificity that could, we speculate, support meaning-making.

5.4.2 Example 2: Open-Ended Reflective Questions. Our second speculative example is open-ended reflective questions. These questions would focus on broad elements of bereavement and would

exist in a sequence, with each follow-up question building on the previous. These questions would not communicate a highly specific stance on bereavement; rather, they would be designed to prompt the user's interpretation and self-interrogation. At each point in a sequence, users could select from a range of follow-up questions to tailor their experience. Framing all of these questions would be a focus on better understanding oneself as a griever.

In contrast to the first example, this speculative concept emphasizes abstractness while placing light limits on user agency. The more abstract questions represent a different style of meaning-making support; additionally, the imposition of questions gives the user less control over their experience. Users are not provided with "correct" solutions nor are forced to reflect on particular elements. However, some degree of their agency has been sacrificed to more directly prompt their reflection.

6 LIMITATIONS

Our findings are limited by the scope of our recruitment. We recruited from a particular research registry in a particular region; our study's participants were relatively homogeneous in age, gender identity, and ethnicity. Like many qualitative works, our goal is to document and synthesize the experiences of individuals, not provide a generalizable sample of a population. Our participants do not necessarily represent bereaved individuals with other backgrounds and experiences.

Our findings are also limited by a lack of comparison to other mediums and non-players. We solely study the experiences of participants playing a digital game and do not investigate how other mediums or a lack of technology might impact participants' meaning-making. Therefore, our study does not provide insights into how specific mediums of reflective technology impact bereavement meaning-making.

Finally, similar to the majority of qualitative work, our study does not include a control group and is not setup as experimental research to evaluate the effect of digital games on the meaning-making process. Our findings powerfully speak to individual experiences, but do not provide definitive evidence that GRIS was a successful intervention that benefited player well-being. Rather, these findings suggest that meaning-making could potentially be a beneficial focus for reflective technology and provide recommendations for pursuing this design opportunity

7 CONCLUSION & FUTURE WORK

In this paper, we explored how reflective technology can support bereaved individuals by orienting toward constructivist meaning-making. Conducting a qualitative diary and interview study with 11 bereaved individuals, we documented participants' reflections and meaning-making within a bereavement-focused digital game. We found that reflective technology can, to a degree, orient toward bereavement meaning-making and produce outcomes that align with constructivist theory and practice. Meaning-making was most associated with dialogic reflection and clustered around the Reflection innovative moment. We also found that common misconceptions about bereavement moderated the impact of the game's inaccurate, linear conceptualization of bereavement. From these findings, we proposed three design recommendations for reflective technology

to provide bereavement support via constructivist meaning-making: engaging with individualized bereavement experiences, embedding user agency in reflection, and focusing on novel and anti-nihilistic reflections. We also provided two speculative examples of these recommendations' implementations.

There are many potential directions to build on our investigation into applying constructivist meaning-making to bereavement-focused reflective technology. Broadly, the homogeneity of our participants calls for future work which explicitly engages with more heterogeneous, underrepresented populations of grievers. More specifically, we propose three themes for future exploration: levels of reflection, anti-nihilism, and mediums. Our findings associate meaning-making with dialogic reflection. However, as we note, transformative reflection could potentially also result in innovative moments. A clearer understanding of how each level of reflection impacts meaning-making would benefit designers of future constructivist reflective technology. Future research could also further investigate how reflective technology can create positive, hopeful takeaways that rebut nihilistic perspectives on bereavement. From our findings, *GRIS*' positive narrative seems to impact participant reflections; however, the exact relationship between these elements is unclear. There is an opportunity to more deeply investigate how technology can support anti-nihilistic reflections that rebut problematic self-narratives. Finally, as we discussed in Section 6, we extrapolate from a digital game to interactive technology more broadly and are unable to provide insight on how specific mediums of technology might affect meaning-making. Investigating the impact of mediums would improve designers' ability to design constructivist reflective technology.

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