The Last Door You Open: A Mixed-Methods Study on Design Strategies for Positive Disengagement in Virtual Reality Games

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Abstract

Disengagement plays an important role in the overall game experience. However, extensive game research has focused on creating engaging experiences, whereas how players disengage remains insufficiently understood. Emerging studies have outlined characteristics of disengagement in screen-based video games. Little is known about how virtual reality (VR) shapes players' disengagement process and what strategies might support positive disengagement experiences in VR games. Therefore, we conducted a co-design workshop (n = 18) and an online survey (n = 115) with VR game players. Our findings show that disengagement in VR games is often driven by factors such as physical discomfort and emotional overload. Participants adopt different disengagement strategies depending on the situation, such as restoring physical-world awareness to assist disengagement decisions. Then, we summarize three strategies for fostering positive disengagement experiences. Finally, we discuss these strategies, such as MR-based narrative space, extending the understanding of virtual-to-real transitions from a game experience perspective.

CCS Concepts

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

Keywords

Game, Virtual Reality, Disengagement, Player Experience

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1 Introduction

Research on games has long focused on how to attract players, sustain their interest, and encourage prolonged engagement [9, 16, 48, 52]. In contrast, the process of how players "disengage" from games has received little systematic attention. Disengagement, generally defined as the temporary or permanent cessation of interaction with a system [34], is often viewed as a poorly designed result [7, 34]. However, more and more studies have demonstrated that "disengagement" is not necessarily tied to negative emotion like boredom and frustration [3, 34]. When thoughtfully designed, disengagement mechanisms can foster positive experiences, offering players moments of closure, reflection, or recovery [20, 26, 34]. These perspectives reposition the role of "disengagement" within the player experience, shifting it from "being avoided" to "worth designing."

Building on this shift, recent studies have begun examining the dynamics of disengagement across various game contexts. At first, Obrain et al. proposed a user experience model that redefined the role of disengagement within the overall experience cycle [34]. In the context of games, Alexandrovsky et al. were among the first to characterize the process of exiting a play session, identifying constructive strategies that both facilitate and hinder positive disengagement [3]. Building on this work, Doan et al. examined engagement–disengagement dynamics in multiplayer contexts using Minecraft [17], while Seim et al. analyzed League of Legends to investigate how disengagement unfolds in competitive play [44]. Other scholars have focused on disengagement in children's games and developed tools to study it [4, 5, 36, 50]. In sum, these efforts

provide a rich foundation for understanding disengagement in games. Nevertheless, most of these studies have centered on screen-based games. Although Alexandrovsky et al.'s study incorporated some insights from VR players [3], it did not sufficiently explore how head-mounted device (HMD)-based VR, as a unique medium, shapes players' disengagement experience.

Based on HMDs, VR provides players with a unique and relatively enclosed gameplay environment. Rather than being constrained by a 2D screen and a limited set of input devices (e.g., keyboard and mouse), players engage through embodied interaction within a surrounding virtual space [6]. A growing body of research has examined VR exit processes and cross-reality transitions. Some studies explore frictions in transitioning from VR to realities [43, 47]. Others analyze transition mechanisms between virtual, physical, and mixed reality (MR) contexts[23, 31, 39, 40, 40]. For example, Pointecker et al. show that portal metaphors better support hedonic applications such as games [40]. Additional work investigates the experiential moment of leaving VR, including spatial disorientation [25], cybersickness [42], and memory distortions that persist beyond the session [12]. These studies reveal the physiological, emotional, and operational complexities involved in exiting VR. Although they do not deeply consider the role of games in VR exiting, they implicitly suggest that VR introduces additional layers of complexity to game disengagement. Exiting a VR game is not only a matter of ending a play session, but also a matter of how players decide on, carry out, and manage the transition from the virtual world back to reality. From this perspective, we argue that it is necessary to investigate the relationship between game disengagement and VR exits. As a first step, we should understand how players disengage in VR.

To more precisely conceptualize the scope of this work, we draw on Alexandrovsky et al.'s definition [3] and, within the context of VR, define disengagement as ending a VR play session with the intention of returning later. We formulate our first research question:

- RQ1: What motivates players to disengage, and how do they end a play session in VR games?

Furthermore, Alexandrovsky et al. define positive disengagement as an exit experience that provides closure and satisfaction while preserving player agency [3]. Yet it remains unclear how VR game design can effectively support such positive exits, especially given the unique challenges and costs associated with VR transitions. This motivates our second research question:

- RQ2: What design strategies could further support positive disengagement in VR games?

To address these questions, we first conducted six co-design workshops with 18 VR players. This approach allowed us not only to gain an understanding of how players disengage from VR games but also to elicit and articulate potential design strategies that may support positive disengagement. In the second stage, we conducted an online survey with a broader population of VR players to preliminarily assess the design strategies for positive disengagement generated in the workshops. This mixed-methods approach enables us to gather new insights within an under-explored area of research.

Our findings show that physical discomfort, most notably fatigue and cybersickness, is a common driver of disengagement in VR games. Beyond these physical causes, however, disengagement triggered by affective overload, task completion & obstruction, and social synchronization becomes more complex under VR hardware and interaction constraints. For example, some players exited immediately when fear became overwhelming, while others adopted various strategies to restore physical-world awareness to evaluate whether they should continue or disengage. Based on these observations, we identified three design strategies that may support positive disengagement and conducted a follow-up online survey to evaluate them. Overall, all strategies received high ratings in satisfaction, closure, and agency. Although the 'dynamic lightweight interaction' strategy was rated slightly lower, it still achieved above-average scores. In addition, these strategies may help mitigate negative post-exit effects. For instance, using MR-based narrative spaces to ease forms of Game Transfer Phenomena (GTP), where perceptual or behavioral patterns from gameplay temporarily spill over into real-world actions.

In sum, we make the following contributions:

- We provide an empirical understanding of why and how players end VR play sessions by conducting six co-design workshops with 18 VR players and an online survey with a broader VR gaming population.
- We identify a set of design strategies for supporting positive disengagement in VR games and offer a preliminary evaluation of their perceived effectiveness through an online survey.
- We extend the understanding of game disengagement in VR environments by conceptualizing disengagement as a multi-stage, cross-reality process, as well as expanding VR exit research to the context of gameplay rather than transitions alone.

2 Related Work

In this section, we present current HCI and game research on disengagement, as well as discussions from different perspectives. In addition, we describe the features of VR games and summarize existing research on methods of existing VR experiences.

2.1 Disengagement in Games

2.1.1 ***Disengagement as a Critical Part of Player Experience.*** Game studies have long focused on creating enjoyable experiences that sustain players' engagement [9, 16, 48, 52]. Disengagement, commonly defined as the temporary or permanent cessation of interaction with a system [34], has often been framed as the opposite of engagement. Many early studies treated disengagement merely as the absence of participation or as a result of poor design [7, 34], closely associated with negative emotions such as anger, boredom, or frustration [13, 35]. However, as research on engagement and disengagement has deepened, scholars have recognized that engagement does not always make enjoyment or positive experiences [32]. Poorly designed engagement can lead to players feeling a loss of control, foster an obsessive passion [24], and be hard to disengage from the play session [8, 53].

Disengagement, by contrast, should not be narrowly defined from a negative perspective [3, 34]. For example, although not explicitly defined as "disengagement", prior work on narrative

and level design has emphasized the importance of providing a release phase after tension, enabling players to reflect and recover [26]. Gutwin et al. show that casual game experiences follow the Peak–End rule: players' overall evaluations are largely shaped by peak moments and how the play session ends [20], suggesting that designing positive disengagement moments can enhance overall experiences. In addition, O'Brien et al. reconceptualized engagement and disengagement by introducing the concept of User Engagement (UE) [38]. They further conceptualized four stages of engagement [34]: the point of engagement, sustained engagement, disengagement, and re-engagement. This framework offers a structured lens for understanding interaction experiences and underscores the potential of disengagement to be framed as a positive and meaningful aspect of play.

2.1.2 ***Exploring Disengagement in Games through Diverse Lenses.*** Building on the reconceptualization of disengagement, recent studies have investigated disengagement dynamics across diverse game types and perspectives. Alexandrovsky et al. used a mixed-methods approach to examine positive, negative, and neutral disengagement experiences in digital games, identifying satisfaction, closure, and agency as key factors supporting positive disengagement [3]. Additionally, multiplayer contexts have attracted much attention. Doan et al., for instance, examined Minecraft and framing disengagement as an essential dimension of user agency [17]. Similarly, Seim et al. studied League of Legends to explore how disengagement unfolds in competitive games [44]. Their findings revealed that disengagement dynamics are more complex than in single-player contexts, with team structures influencing player agency. Children's gaming experiences have also been foregrounded. Alsheail et al. called for a re-examination of the role of "disengagement design" in shaping children's play [4] and conducted a qualitative analysis to explore how children and parents experience and structure disengagement from games [5]. Furthermore, Opp et al. developed Snarky's Adventure as a case study for supporting disengagement [36], while Wolf et al. introduced Schlusslicht, an ambient display that communicates session progress, remaining playtime, and disengagement cues to children and their caregivers [50].

In sum, these studies underscore the importance of examining disengagement across genres and perspectives, providing valuable insights into how disengagement can be designed as a meaningful component of gameplay rather than merely an endpoint of interaction.

2.2 Exit from Virtual Reality

Research on exiting VR can be broadly grouped into three aspects: Switching friction between different realities, Transitional interface design, and Post-exit negative effects. Together, these studies reveal the unique complexity of leaving VR and provide critical background for understanding disengagement in VR games.

2.2.1 ***Switching Friction between Different Realities.*** HMDs create an enclosed environment that supports deep engagement in work or play [30, 33, 51]. Yet this enclosure also introduces transition friction when users switch between realities. Prior work shows that users often try to delay or avoid transitions. Wang et al. reported that users minimized switching whenever possible, and that synchronizing virtual and physical states reduced friction [49]. Von Willich et al, through qualitative research, identified friction points such as users delaying taking off or putting on the HMD as long as possible, and noted that HMD constraints generate fatigue [47]. They also found that players tend to use AR as an intermediate step when switching between PC and VR, or vice versa. Furthermore, Schröder et al. also found that what users avoid is not "reality itself" but specific transitions. For instance, users avoided VR to PC transitions, whereas AR to PC and VR to AR transitions were widely used [43]. These two studies suggest that AR (or MR) may be a key strategy for reducing friction between realities. Knibbe et al. evaluated the moment of exiting VR and found that participants prepare for transitions and that spatial disorientation plays a crucial role [25].

2.2.2 ***Transitional Interface Design.*** Beyond friction dynamics, another set of works examines how a transitional interface can support the passage between realities. George et al. compared portal metaphors in a cross-reality search task and found that handheld portals effectively support transition [19]. Pointecker et al. evaluated transition techniques for information-gathering tasks, showing that fade effects suited productivity tasks while portals suited hedonic applications such as games [40]. Other researchers explored visual transition techniques [23], cinematic cues [31], and players' preferences when exiting VR games into AR [39]. These studies treat VR exit offering rich toolkits for managing how to switch across realities. However, they pay less attention to how players manage disengagement as a game experience, including their motivations, strategies, and so on.

2.2.3 ***Post-Exit Negative Effects.*** Third, there is growing attention to post-exit negative effects that persist after leaving VR. At first, VR poses several fatigue-related risks, including eye strain [22] or motion fatigue [21]. However, cybersickness is one of the best-known risks that may persist after leaving VR [27, 41], and severe cases may even lead to vomiting [41, 42]. Moreover, Cheymol et al highlight the danger that VR experiences may produce side effects on users' memory, proposing coping strategies such as interactive reminders when exiting experiences likely to produce such effects [12]. In game contexts, VR exits may additionally trigger game transfer phenomena (GTP), where perceptual or behavioral patterns from gameplay temporarily spill over into real-world actions [15].

In sum, existing research reveals the multiple complexities of VR exit behavior: physical burdens (removing/wearing the HMD, spatial reorientation), perceptual and technical friction (cross-reality switching), interface-led transition experiences, and post-effects following exit. However, these studies predominantly conceptualize VR exit as a momentary transition event, rather than as a stage within the broader game experience in which players decide, prepare for, and manage disengagement. Importantly, existing work has not examined how gameplay itself shapes disengagement practices, nor how VR game design might support positive disengagement. Therefore, building on prior VR exit research, our work extends this inquiry into the context of VR games, examining how

disengagement unfolds within gameplay and how game design can better support positive disengagement experiences.

3 Study 1: Co-Design Workshop

We first conducted co-design workshops to explore players' disengagement experiences in VR games, as well as the expected design strategies that support disengagement. This method not only supported participants in articulating and reflecting on their own experiences but also reduced individual recall bias by grounding reflection in group discussion [1]. Moreover, participants were positioned not as passive users but as active designers: they could propose ideas, critique one another's concepts, and collaboratively refine potential design strategies [46].

3.1 Participants

We recruited eighteen VR game players via social media and mailing lists. To ensure relevance to our research focus, we applied a single inclusion criterion: participants must have experience playing VR games on HMDs, defined as having played at least three VR game sessions within the past six months. Table 1 shows the participants' demographics: eleven males and seven females, with a mean age of 28 years (range: 22–45). Participants were primarily based in Asia (N = 16), with additional participants from the Americas (N = 1) and Europe (N = 1). Daily VR gameplay ranged from 0.25 to 6 hours (M = 1.99 hours), indicating heterogeneous levels of VR familiarity. Regarding game preferences, twelve participants chose action games, twelve chose adventure games, nine chose simulation games, seven chose casual games, seven chose role-playing games (RPGs), four chose strategy games, and three chose sports games. Popular titles included Beat Saber (N = 5), Asgard's Wrath 2 (N = 4), Half-Life: Alyx (N = 3), Vertigo (N = 3), A Fisherman's Tale (N = 2), VR Chat (N = 1), and so on. In terms of professional background, eight participants were VR game bloggers (three full-time, five part-time), with one employed game designer, one independent VR game developer, and one game narrative writer. The sample also included six university students (undergraduate to doctoral levels) and one research assistant. Participants exhibited varying degrees of VR experience, and their academic and professional expertise spanned fields such as computer science, digital media, and automation.

3.2 Procedure

We conducted both in-person and online sessions, which allowed us to gather insights from a diverse range of VR game players residing in geographically diverse locations. We conducted six workshops, each included 3 participants. Two groups of participants joined offline, while four groups joined online. We utilized Tencent Meeting for online workshops. The study took 2.5 hours on average to finish, and each participant was compensated with the local currency equivalent of 28 USD. The study received approval from the university ethics review board. Each co-design workshop was divided into four phases:

3.2.1 ***Ice Breaking and Introduction (10mins).*** The researcher invited participants to briefly introduce themselves, such as favorite VR game genres and titles, recently played games, and so on. Then, the researcher introduced the background and motivation for organizing this workshop.

3.2.2 ***Retrospection of Disengagement Experience (45mins).*** First, participants were asked to reflect on their disengagement experiences in VR games. They could reflect on recent, typical, or particularly memorable cases of exiting a game.

- **Materials introduction (5mins).** To facilitate systematic retrospection and documentation, we provided several guiding prompts: game's title and genre, along with questions such as: *"Why did you choose to exit the game?"*, *"How did you exit (including any preparatory actions and the exit itself)?"*, *"How did you feel after exiting?"*, *"What strengths and weaknesses do you perceive in the design of this exit process?"* We also emphasized that participants are not required to strictly follow the guiding questions. Instead, they are free to choose the mode of expression that feels most comfortable to them when describing their experiences.
- **Independent retrospection (20mins).** Then, participants are asked to independently reflect on and record their past disengagement experiences. During this stage, they are allowed to freely consult their own devices, such as mobile phones, PCs, or VR headsets, to revisit games they have played, in order to facilitate the retrospection of details.
- **Experience sharing (20mins).** After completing the independent retrospection, participants are invited to take turns sharing their disengagement experiences. During this process, they are encouraged to engage in in-depth discussion with others and elaborate on similarities or differences in their experiences.

3.2.3 ***Design for Disengagement Process (60mins).*** After completing the retrospection and discussion, participants were asked to envision design strategies that could foster positive disengagement experiences.

- **Materials introduction (5mins).** Participants were first invited to describe what they considered to be characteristics of VR games. This brief reflection helped align participants' understandings through shared examples rather than predefined definitions. When needed, facilitators offered brief and supplemental clarifications of terminology (e.g., embodied interaction), while emphasizing that these explanations were illustrative rather than prescriptive. Building on this shared understanding, we then provided several guiding prompts to support the subsequent design phase. These included broad prompts, such as *"What functions should be considered in different stages of disengagement (preparation and execution)?"* and *"How can exit strategies be designed to align with the unique characteristics of HMD-based VR, such as its enclosed environment and embodied interaction?"* We also offered more specific prompts, such as *"Exit methods: button, interaction, location, or others."*
- **Independent Design (30mins).** In this phase, participants were encouraged to base their designs on a game they were highly familiar with or one retrospected during the first phase. This approach allowed them to better connect the design with their prior gameplay experiences while also making their ideas easier for others to understand.
- **Design sharing (30mins).** After completing the individual design, participants are invited to take turns sharing their

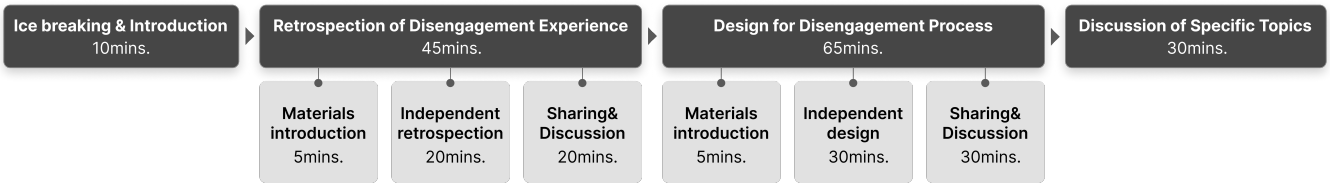

Figure 1: The Process of Co-Design Workshop

Table 1: Demographic Information of Participants in Co-Design Workshop.

ID	Gender	Age	Location	Occupation	Major	Prefered VR Game Genre	Prefered VR Game	Avg. Daily VR Time
P1	Male	25	Asia	VR Game blogger; Software Developer	Computer Science	Action, Casual, Adventure	*Asgard's Wrath 2; Vertigo; A Fisherman's Tale*	2h/day
P2	Male	36	America	VR Game blogger	Education	Simulation, Action, Adventure	*Red Matter 2; Vertigo 2; Half-Life: Alyx*	4.5h/day
P3	Female	28	Asia	VR Game blogger; Overseas promotion	Translation	Simulation, Casual, Sports	*Cooking Clash, Climb, Titans Clinic*	0.5h/day
P4	Female	26	Asia	VR Game blogger	Digital Transformation	Adventure; Simulation, Strategy	*Asgard's Wrath 2;Wall Town Wonders;Titans Clinic*	2.5h/day
P5	Male	34	Asia	VR Game blogger; Teacher	Musicology	Adventure, Simulation, Action	*H3VR; Dirt Rally2.0; Contractors Showdown*	1.5h/day
P6	Male	22	Asia	VR Game blogger; Media operations	Digital Media	Action, Casual, RPG	*VRChat; Breachers; Pavlov*	3.5h/day
P7	Male	29	Asia	VR Game blogger	Business Administration	Adventure, Casual, Simulation	*Arizona Sunshine; Paradise Hotel; The Walking Dead: Saints & Sinners*	2h/day
P8	Male	22	Asia	Undergraduate; VR Game blogger	Automation	Adventure, RPG, Action	*Virtual Virtual Reality; Vertigo2; Lone Echo*	2h/day
P9	Male	23	Asia	Undergraduate; Game developer	English	RPG, Action, Adventure	*Swords and Sorcery; Battle Talent VR; Asgard's Wrath 2*	2h/day
P10	Male	30	Asia	Ph.D. Student; Game developer	Computer Science	Action, RPG, Strategy	*Half-Life: Alyx; Beat Saber; The Room*	0.5h/day
P11	Female	29	Asia	Game writer & designer	Computer Science	RPG, Sports, Action	*Assassin's Creed; VR Escape Room; The Room*	2h/day
P12	Female	25	Asia	Research assistant; Game designer	Arts and Design	Action, Adventure, Puzzle	*Down the Rabbit Hole; Beat Saber; A Fisherman's Tale*	0.25h/day
P13	Male	45	Asia	VR Game blogger; Advertising	Automation	Action, Adventure, Simulation	*Pavlov VR; Contractors Showdown; Onward VR*	3h/day
P14	Female	26	Europe	AI Game product manager	Architecture; Interactive media	Simulation, Adventure; Casual	*Half-Life: Alyx; Job Simulator; Beat Saber*	0.5h/day
P15	Male	30	Asia	VR game producer	Computer Science	Adventure, RPG, Strategy	*Asgard's Wrath 2; The Light Brigade; Blade & Sorcery*	6h/day
P16	Male	26	Asia	Ph.D. Student	Human-Computer Interaction	RPG, Action, Adventure	*Beat Saber; Super Hot; Robo Recall*	0.5h/day
P17	Female	25	Asia	Master Student	Media Arts	Sports, Action, Simulation	*VR BigSpace; Horizon of Khufu; Notre-Dame de Paris*	1h/day
P18	Female	27	Asia	Master Student Game Developer	Media Arts	Adventure, Simulation, Strategy	*Robo Recall; Beat Saber; Cooking Clash*	1.5h/day

design. During this process, they are encouraged to engage in in-depth discussion with others.

3.2.4 ***Discussion of Specific Topics (30mins).*** At the end of the workshop, we prepared a set of semi-structured questions to conduct further discussion. These questions focused on: (1) how VR features influence disengagement (e.g., which features influence exit intentions and how); (2) key factors supporting positive disengagement; (3) the purpose and limits of exit design (e.g., whether proposed design ideas might increase player burden and how to balance this); and (4) questions noted by researchers during participant design and discussions.

3.3 Data Analysis

We followed thematic analysis to analyze our data [10]. All workshops were recorded and automatically transcribed using "Tencent Meeting". At first, four researchers read through the transcripts several times to develop an overall understanding of the disengagement dynamics in VR games. Two researchers then conducted the primary coding of the transcripts independently. We adopted a hybrid deductive–inductive strategy: We began with three main dimensions: disengagement reasons, disengagement practices, and expected design strategies, which were derived from our research questions. Within each main dimension, sub-themes and specific contents were inductively constructed by assigning keywords to participants' responses. Repeated or similar keywords were grouped together at a higher level. Throughout the process, the two coders regularly discussed their coding decisions and resolved disagreements to develop a refined set of codes. Additional meetings were held with all co-authors to reach an agreement on the preliminary coding results. All co-authors possess over three years of experience as VR game researchers or designers. Finally, the refined codes and sub-themes were synthesized into two overarching themes: (1) Disengagement in VR Games: Why and How Players Exit, and (2) Expected Design Strategies for Positive Disengagement, which structure the findings reported in this paper.

4 Results

4.1 Disengagement in VR Games: Why and How Players Exit

In our study, participants reported many disengagement reasons that they are familiar with from screen-based gaming, such as completing sessions, reaching goals, boredom, or being stuck. Exit processes also showed similarities: saving progress, disengaging during a slow-paced phase, and exiting via system-level actions such as removing the headset or clicking the quit option in menus. Besides, VR's hardware constraints and embodied interaction introduce unique drivers, processes, and strategies for disengagement. The following sections outline the motivations behind players' disengagement, followed by the strategies they employ to exit VR games.

4.1.1 ***Disengagement Driven by Physiological Discomfort.*** Physiological discomfort, particularly fatigue and cybersickness, were two frequently reported reasons of disengagement. In VR games, *"the body is the input"*, players engage through sustained embodied interaction, such as physical movement and gestural input. This mode of interaction makes it easy for players to feel physiological fatigue. VR hardware further compounds this load: the weight of VR headsets strains the neck, while in games requiring attention to details (e.g., Da Vinci's House), *"prolonged visual focus intensifies eye strain"* (P11).

Players adjust the exit timing and disengagement process according to the level of fatigue. When fatigue remained tolerable, participants preferred to adjust their exit timing to align with the game rounds and sessions. P14 said, *"I usually play 3-5 rounds in Trombone Champ. If I feel exhausted in a particular round, I tend to leave after finishing that round."* In such situations, participants typically did not rush to exit. Instead, they engaged in lightweight interactions that allowed their bodily rhythm to downshift before disengagement gradually. For example, confirming save status or organizing equipment; aimlessly *"wandering"* or *"manipulating objects"* without purpose. Notably, when fatigue subsided during this period, some participants sometimes chose to re-engage in another round rather than exit. However, when fatigue intensified to sweating or neck strain, participants usually avoided gradual transitional activities and proceeded directly to minimal necessary procedures: quick save confirmation and then immediate headset removal. P13 explained the urgency: *"Putting the headset back on while sweating feels terrible."*

However, the feelings of fatigue-driven exits are context-dependent. When co-occurring with achievement, participants reported positive affect, as P3 said, *"Even though I'm tired, breaking a new record always feels exciting."* Conversely, when accumulated during frustrating gameplay, fatigue compounded negative emotions, as P16 noted, *"Sometimes I keep playing until I'm bored, and then the exhaustion makes quitting feel really uncomfortable."*

Cybersickness represented an extreme form of body-driven disengagement. Unlike ordinary fatigue, cybersickness always forces immediate exit regardless of game state or player intention, and prompts uniformly negative experiences. As P18 said, *"I really wanted to keep playing, but the nausea caused by cybersickness forced me to leave."* P5 added, *"I don't want to stay for a second longer. I just want to take off the headset right away!"* A few participants attempted to *"train"* themselves by continuing to play through discomfort, but they acknowledged that this approach offered little short-term benefit. Ultimately, they still disengaged once the nausea became unbearable.

4.1.2 ***Disengagement Driven by Affective Overload.*** Several participants attributed disengagement to affective overload, particularly in horror or post-apocalyptic games, where emotions such as fear and tension were heightened. VR's multisensory immersion intensified these emotions, causing participants' disengagement.

Some players relieved emotional tension by directly removing the headset. For sudden overwhelming fear, such as from jump scares, some participants emphasized that VR constrained the partial avoidance strategies available in PC games. P1 recalled: *"In PC games, I could cover the screen with one hand while using the mouse to escape the terrifying room with the other hand."* VR's enclosed headset eliminated this option, forcing players to completely exit for emotional relief. For many, removing the headset became *"an instinctive choice"* (P16, P2), as P2 said,

> *"Even closing my eyes did not fully mitigate the discomfort...I feel that the zombies are still screaming in my ears and biting me."*

Players with higher tolerance to disturbing VR scenarios preferred reaching a safe zone before exiting, as the sense of safety and calm pacing provided a space for self-regulation. As P9 said, *"I prefer to leave the game after I've calmed myself down."* Some participants sought explicitly bounded safe zones, such as lobbies, bases, hubs, or safe houses. For example, P7 said, *"in many horror games, there is always a safe house where I don't need to worry about zombies attacking me."* Others relied on intuitions and positioned themselves in places that they perceived as safe, even without clear boundaries. As P11 said,

Expected Design Strategies		Goals	
Dynamic, Lightweight Exit Tasks and Interactions	1. Dynamic Lightweight Exit Tasks 2. Dynamic Lightweight Exit Interactions	Exit:	Regulate players' physiological & emotional pacing
		Post-Exit:	Regulate players' physiological & emotional arosal
MR-Based Narrative Space	1. MR-Based Narrative Safe Zone 2. MR-Based Achievement Sharing & Display Space	Exit:	Reorient players to the physical world & support a smooth transition
			Sustain satisfaction & social connection after exit
		Post-Exit:	Mitigate Emptiness
			Mitigate Game Transfer Phenomena (GTP)
Embodied Diegetic Exits and Social Rituals	1. Embodied Diegetic Exit 2. Mirrored Entry–Exit Flows 3. Game Machanics-Supported Social Exit Rituals	Exit:	Create a sense of closure, role identification
		Post-Exit:	Mitigate Emptiness

Figure 2: Expected Design Strategies for Positive Disengagement

> *"When playing open-world games, I often place 'myself' in a relatively safe location before exiting. It does not necessarily have to be a house; it could also be under a tree or by a riverbank, anywhere I feel unlikely to be attacked."*

This strategy also addressed re-engagement concerns: players who exited abruptly worried about resuming directly into intense scenes. As P17 said, *"If I reopen the game, I'll probably be dropped right back into the scene where I left, I don't think I can face it."*

However, these disengagements were not uniformly negative. Participants who deliberately sought horror experiences described these intense emotions as integral to VR's appeal, even though they occasionally disengaged when the intensity exceeded their tolerance.

4.1.3 ***Disengagement Driven by Task Completion and Task Obstruction***. Completing tasks or goals was a common reason for exiting a game. However, deciding whether these points were appropriate for disengagement required dual information. Players relied on in-game structural markers (e.g., chapter endings) while also assessing their own subjective state, such as how long they had been playing, physical-world status, and fatigue level (Sec. 4.1.1). However, the enclosed environment created by VR headsets temporarily obscures players' awareness of physical-world time and information. Because of this, many participants worried about *"not knowing how long I've been playing"*(P2) or *"missing important messages."* (P4).

Therefore, to restore awareness of the physical world, participants adopted several strategies. Some participants intentionally kept partial access to real-world cues, such as lowering game volume, to maintain a light connection to their surroundings. P2 mentioned that *"When I hear my mother finish cooking, I realize I've played long enough and it's time to leave."* But he also acknowledged that this approach sometimes disrupted the atmosphere of the game. Most participants, however, relied on more explicit checking behaviors. Common strategies included switching to the system-level MR menu to check the time or messages, or removing the headset entirely. Yet despite this, the vast majority of players in our study preferred not to fully remove the headset unless necessary, as doing so was perceived as disruptive and effortful. Therefore, others preferred lightweight physical checks. For instance, P11 was accustomed to *"gently lifting the headset to glance at phones through the gap."* Although less disruptive than full headset removal, she still described this method as *"inconvenient to access more information clearly."*

In addition to task completion, another common factor that often leads players to disengage is task obstruction, such as being stuck or repeated failure. In screen-based games, participants mentioned that they often sought external help, such as consulting guides or asking friends, before deciding to exit. However, in VR games, hardware and interaction constraints limited these partial strategies. For example, P14 said that she can *"switch screens repeatedly to check walkthroughs"* when playing most screen-based games. In VR, however, the enclosed headset made such parallel processing more difficult. As P6 illustrated, while he could lift the headset slightly to glance at phone messages, accessing detailed information like walkthroughs required full removal: *"Even checking in MR doesn't work, the text is too blurry."* Consequently, some participants persisted without external assistance, amplifying frustration upon potential subsequent failure. Others repeatedly took off and put on the headset to consult guides, which made the experience feel fragmented and tiring.

4.1.4 ***Disengagement Driven by Social Synchronization*** . In social VR, disengagement was often shaped by peers' departure. Many participants described that when friends announced they were about to leave, they naturally ended their session as well. P6, as a VRChat player, noted that *"when my friends say they're exiting, I usually leave with them...it feels natural to end together."*

Notably, in VR games, the process of collective disengagement is no longer merely through texts or voice, but introduces spontaneous social rituals shaped by avatar identification. Participants described

exchanging farewells, such as *"waving," "bowing," "giving virtual hugs"* to lighten the moment. Some social VR users even mentioned casual group singing or small improvised gestures to *"keep the atmosphere joyful"* before everyone exited. These behaviors helped mark the end of a shared session and softened the transition out of co-present social interaction.

4.2 Expected Design Strategies for Positive Disengagement

4.2.1 ***Dynamic, Lightweight Exit Tasks and Interactions.*** As described in Sec. 4.1.1-4.1.2, players often engage in regulating their physiological and emotional pacing, allowing themselves to transition back to the physical world in a calmer state. Many participants felt that games could provide targeted interactions and tasks tailored to different types of physiological or emotional load to further support this regulation process.

They also believed that this could potentially reduce physiological and emotional arousal after disengagement. Because of physiological or emotional load, they might be unable to concentrate on real-world tasks after directly exiting. As P13 reported,

> *"Sometimes after finishing a sports game, I still find it hard to focus on my tasks. I need both my body and emotions to calm down."*

Therefore, they provide two design strategies:

(1) Dynamic Lightweight Exit Tasks. Some participants suggested providing lightweight exit tasks that help players gradually regulate their state before exiting. Importantly, they emphasized dynamic: tasks should adjust to the game genre and to players' momentary physical or emotional condition. For example, in sports VR, participants imagined exit tasks aligned with bodily recovery, such as stretching or deep-breathing interactions. P9 proposed:

> *"Players could unlock a treasure chest through deep-breathing interactions, similar to the mechanics in Breath Tech."*

In educational VR games, some emphasized the value of reflection-oriented tasks, turning the moment of disengagement into one of summarization and review. P11 offered an example:

> *"If I learned daily Japanese pronunciations in Nowtown Language, the exit challenge could involve matching these pronunciations to unlock a door."*

Moreover, rewards could encourage voluntary participation, as P9 said, *"It feels nice to collect one last reward before exit."* Finally, to prevent players from repeatedly entering and exiting the game solely to collect rewards, participants recommended limiting challenge frequency. As P8 suggested: *"One challenge should close once it's finished,"* ensuring that exit tasks function as meaningful transitional activities rather than farmable resources.

(2) Dynamic Lightweight Interactions. Beyond explicit tasks, many participants proposed providing ambient, non-goal-oriented, lightweight interactions that support self-regulation. For instance, in horror games, players imagined access to *"safe"* objects designed for tension release. P1 said that he wants to *"I often throw the disks onto the floor or burn books with a lighter before exiting."* In sports games, P6 imagined calmer, constructive interactions: *"In Marine Verse Sailing Club, there could be a model boat at the dock. I could assemble it."*

Participants further noted that such exit tasks or interactions need not appear in fixed locations. Instead, serendipitous or context-triggered encounters could gently cue players toward exit consideration after extended play. As P11 imagined: *"As I was wandering, I 'happened to' encounter an exit task opportunity… and I started thinking maybe I should finish one last thing and then leave."*

4.2.2 ***MR-Based Narrative Transitional Spaces.*** As described in Sec.4.1.3, players employ various strategies to reconnect with the physical world when deciding whether to disengage. However, these strategies (e.g., lifting the headset, lowering volume, or switching to the MR menu) often interrupt immersion and provide only limited support for a smooth transition. Many participants therefore emphasized that MR spaces could serve as a more seamless, narratively coherent bridge between virtual and physical contexts, naturally prompting disengagement by exposing real-world cues. For example, P11 described that in Mythic Realms,

> *"When I return to the MR space after completing a level, I notice not only the game elements but also many aspects of the real environment. This makes it easier for me to think: Since I'm already back to reality, why not just exit right now?"*

Two participants further suggested that MR may help mitigate the GTP by gently assisting players in reorienting to their physical surroundings after prolonged immersion. Furthermore, the transition based on MR was also perceived as reducing emotional emptiness that can follow a sudden transition out of a rich virtual world. As P9 explained, *"Sometimes leaving an elaborate virtual environment and suddenly finding myself in an empty room feels a bit hollow, but if there is a transition, like MR, it might feel better."* However, because integrated VR-MR transitions remain relatively uncommon in existing games, participants proposed two design considerations:

(1) MR-Based Narrative Safe Zone. Many participants expressed a desire for game safe zones, such as lobbies, hubs, or bases, to be designed as MR-based spaces. They envisioned entering the game through MR and exiting through MR, allowing transitions to occur at clearly defined structural points in the gameplay. Participants felt that this alignment could reduce the abruptness of an MR transition and mitigate the break in immersion caused by suddenly returning to the physical world.

Moreover, participants emphasized that MR transitions must be narratively coherent; otherwise, MR can appear abrupt or break immersion. P8 commented:

> *"In Asgard's Wrath 2, some levels were designed to transition into MR combat...personally, this design lacked sufficient narrative buildup and therefore felt fragmented."*

By contrast, P9 praised The First Met, where the VR–MR shift is framed as *"breaking through a wall into another dimension,"* making the transition feel intentional and meaningful. P6 envisioned similar narrative grounding in future games, for example, using MR as a *"crew lounge"* that players exit through diegetic interactions. As P6 imagined:

Figure 3: Typical game cases of embodied exit can be designed: (a) The Wizards - Enhanced Edition, (b) Superhot VR, (c) Under the Presents

> *"In Marine Verse Sailing Club, the MR space may serve as a crew lounge...When I push open a virtual door, I immediately enter the open sea for sailing."*

Overall, participants expected MR spaces to have a clear narrative and structural purpose, not merely to function as space transitions.

(2) MR-Based Achievement Sharing and Display Space. Participants also proposed using MR as a place to sustain satisfaction and social connection after play. They envisioned extending the display of achievements beyond the virtual world into MR spaces. For example, P5, who regularly plays *"extraction shooter"* games, typically spends considerable time organizing his rewards during the exit phase. He envisioned:

> *"Could I place these items on my real bookshelf, my desk, or even hang them on the wall? That would give me a strong sense of satisfaction."*

P6 added that players might be able to use a button to switch between achievements earned across different games. P4 further argued that such a strategy could also encourage players to organize their physical environment, since *"no one would want a messy space to host these beautifully rendered elements."* They also suggested that in a shared MR environment, players could invite friends to view their achievements from different games, thereby enhancing their sense of satisfaction.

4.2.3 ***Embodied Diegetic Exits and Social Rituals.*** Participants expressed a desire for exits that feel intentional, coherent, and grounded in the game world rather than purely operational. Many participants envisioned that players could exit through embodied and diegetic interactions. They expressed: *"this is what makes VR games different."* By embedding exit interactions into the game world, the process could foster a stronger sense of role identification and closure, and a sense of ritual.

In addition, participants felt that such designs could reduce the emotional emptiness that sometimes follows disengagement, because they provide a narratively justified reason for leaving. P3 took an example: *"In Cooking Clash, I'm logging off the game since my shift here is over."* Specifically, the suggestions of the participants can be grouped into three strategies:

(1) Embodied Diegetic Exit. Participants envisioned exit methods that are embedded and diegetic, allowing players to exit through actions that align with the narrative context. They emphasized: *"this is what makes VR games different."* These embedded diegetic exits ranged from role-aligned gestures to manipulating diegetic objects. Some participants proposed role-aligned gestures that symbolically conclude the play session. P2 imagined *"drawing a circle in the air to open a portal in The Wizard,"*(Figure 3 a) and P14 hoped to finish Maestro: The Masterclass by *"tracing an arc with the baton, then performing a final bow."* P16 agreed with P14's design and remarked that even without explicit game mechanics, he sometimes spontaneously performed a bow at the end of this game.

In addition to gestures, interacting with diegetic objects that symbolize the end could serve as a trigger to exit. While this approach already exists in certain games, most still follow a click-based logic, treating objects merely as carriers for buttons. For example, placing a button on a book. Although participants acknowledged that this approach ensures clarity of function, they emphasized that future designs should leverage the inherent properties of game objects. For example, P5 imagined *"lifting the cockpit door to end a flight simulation, mirroring real-world routines"*

Additionally, players could even exit the game by performing a series of interactions with multiple objects. P4 recalled, *"In Job Simulator, you don't just click a button to quit. Instead, you summon a briefcase, pull out an 'Exit' burrito, eat it, and trigger exit."* Similarly, P4 envisioned an exit process in Cooking Clash:

> *"Maybe I could mimic the real-life routine of a chef: turning off the stove, cutting the electricity, and closing the gas valve to trigger the exit."*

P6 agreed, adding that such exit designs would be especially valuable in games for learning and training. He explained that this type of "ending process" could help learners form habitual behaviors. Moreover, he suggested introducing mild penalties to reinforce such a process:

> *"If players forget to turn off the electricity before exiting, they might have to pay a higher electricity bill the next time they log in."*

(2) Mirrored Entry–Exit Flows. Many VR games feature carefully designed entry experiences, yet most lack the corresponding exit designs. Therefore, some participants proposed the *"mirrored correspondence"* strategy, in which players exit the game in correspondence to their entry. Three participants recalled that in Superhot, they entered the white combat world by *"inserting a disk and wearing a virtual headset,"* (Figure 3 b), but the exit lacked a comparable design. As P4 said, if players could conclude the game by *"removing the virtual headset and ejecting the disk,"* the experience would feel more complete. Similarly, while Assassin's Creed VR impressed many players with its use of an MR environment for game entry, they regretted that this design was not extended to the

exit stage. In contrast, P11 considered Mythic Realms to be more coherent, as both its entry and exit were structured through MR environments. Overall, this mirrored structure reinforces a sense of closure by echoing the player's journey into the game, thereby creating a cyclical "beginning–ending" experience.

(3) Game Mechanics-Supported Social Exit Rituals. As noted in Sec. 4.1.4, many players already engage in spontaneous social rituals when exiting. Several participants expressed a desire for more game-supported exit rituals to enhance the sense of closure and reduce the emptiness that often follows collective disengagement. P1 referenced a memorable experience in Under the Presents, where players collectively followed NPC actors through a short sequence of synchronized actions before leaving the scene (Figure 3 c) . He described it as *"really magical, impressive, and highly ritualistic,"* suggesting that such social exits can transform ordinary quitting into a performative, emotionally resonant moment. He proposed extending this exit process through cooperative tasks, such as each player using their own unique key to unlock a shared exit door. P2 further emphasized that social exit rituals need not be limited to pre-existing friend groups. In open social VR spaces, a player preparing to leave could *"invite nearby strangers to join a brief and temporary exit ritual,"* creating lightweight but meaningful social interactions at the boundary of disengagement.

Practical considerations. While participants expressed strong expectations for embodied diegetic exits, they also highlighted several principles that should guide their practical implementation. First, exit actions should be clearly distinguishable from core gameplay interactions and require a minimal degree of deliberate effort. These could help avoid accidental triggers during fast-paced or repetitive actions. For example, P2 suggested that,

> *"When players create a portal using gestures, they should draw a circular gesture in the air at least three times before the exit is triggered."*

Second, embodied exits should accommodate variation in players' spatial and postural conditions, ensuring that exit actions can be performed comfortably in both standing and seated positions, and within small or constrained play areas. As P6 said,

> *"if I am standing, I can walk through a portal; If I choose to sit, I can push a controller forward."*

Finally, embodied exits must preserve player agency and safety by coexisting with system-level alternatives. Automatic saving and confirmation prompts remain essential for urgent situations. P2 expressed that *"When there are urgent matters or messages to attend to, using the controller to exit quickly is the most appropriate way."* These principles suggest that embodied exit interactions should enrich the VR experience without compromising usability, comfort, or safety.

5 Study 2: Survey

Based on findings from the first phase of our study, we initially identified design strategies that foster positive disengagement. Because these strategies were still conceptual, we adopted an exploratory sequential mixed-methods approach [14], using Study 1 insights to guide a preliminary evaluation with a broader group of players. This early exploration enabled us to assess the perceived value and feasibility of the proposed strategies before proceeding to more detailed design implementation and validation.

5.1 Survey Design.

The survey consisted of two parts:

5.1.1 ***Demographics.*** Participants reported whether they were VR players, their gender, age, industry, favorite VR game genres and titles, and gaming frequency.

5.1.2 ***Strategy Evaluation.*** In Sec. 4.2, we identified three main strategy themes and seven concrete design strategies for supporting positive disengagement (Figure 4). To ensure accessibility, strategy descriptions in the survey avoided academic terminology and included brief examples. For instance, the strategy "mirrored entry–exit flows" was described as *"exiting the VR game in a way that echoes how you entered. (e.g, entering via an elevator and leaving via an elevator; going to work and coming out of work).* Participants evaluated each strategy on a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*) across three dimensions of positive disengagement drawn from prior work [3]: Satisfaction, Closure, and Agency (Figure 4).

Our qualitative findings also suggested that main strategies (Sec 4.1.1, 4.1.3, 4.1.2) may help reduce post-VR negative states (Figure 4). Therefore, participants additionally rated these strategies on their perceived ability to mitigate post-VR negative feelings. For example, *"Exiting the game in an MR environment may help alleviate the sense of emptiness after leaving VR"*), evaluated by a 7-point Likert scale (1 = *Strongly disagree*, 7 = *Strongly agree*).

After developing the survey, we conducted a pilot test with three VR players and researchers to ensure clarity. We iterated the survey design based on their feedback. For example, unclear terms, such as GTP, were revised to *"post-exit illusions (e.g., game elements overlapping with reality)"* in the questionnaire. The survey took approximately 5-10 minutes to complete, and participants were compensated with 1 USD. Following pilot testing and iteration, the survey was distributed via social media to various VR gaming communities to reach a broader sample.

5.2 Data Analysis

Based on prior work examining sample size norms in HCI, survey-based studies, particularly those conducted remotely, typically recruit around 300 - 400 participants [11]. However, our research focuses specifically on disengagement in VR gaming, a domain with a substantially smaller and more specialized participant pool compared to general HCI populations. Also, prior studies investigating game disengagement have used more modest sample sizes [3], such as 116 participants, reflecting the narrower target population of recruiting active VR gamers. Following this precedent, we aim to recruit approximately 120 respondents for our study, accounting for an anticipated 10% loss rate to ensure sufficient usable data.

Data were analyzed using Jupyter Notebooks with Python 3.11, including pandas, numpy, and matplotlib packages. Before analysis, the data were cleaned, i.e., re-coded into metrics. We provide descriptive statistics for all assessed items, and provide bar chart to facilitate visual inspection of our data as well as distribution thereof.

Main Strategies	Specific Strategies	Label
4.2.1. Dynamic, Lightweight Exit Tasks and Interactions	Dynamic Lightweight Exit Tasks	Dynamic_Task
	Dynamic Lightweight Interactions	Dynamic_Interaction
4.2.2. MR-Based Narrative Transitional Spaces	MR-Based Narrative Safe Zone	MR_Narrative
	MR-Based Achievement Sharing & Display Space	MR_Sharing
4.2.3. Embodied Diegetic Exits and Social Rituals	Embodied Diegetic Exit	Embodied_Diegetic
	Mirrored Entry–Exit Flows	Embodied_Mirror
	Game Machanics-Supported Social Exit Rituals	Embodied_Ritual

Positive Disengagement
Satisfaction
Closure
Agency
Post-VR Effect
Physical & Emotional Arousal
Game Transfer Phenomenon (GTP)
Emptiness

Figure 4: Summary of label of strategy categories and their corresponding strategies, Positive Disengagement, and Post-VR Negative Effect

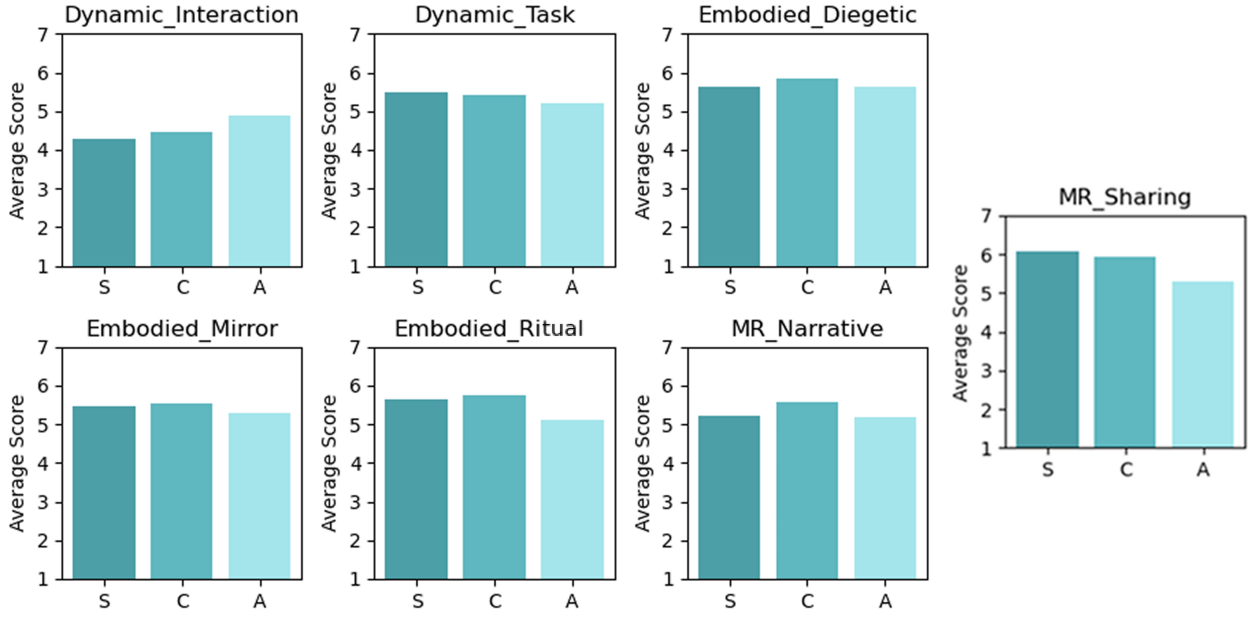

Figure 5: Average score on exit strategies on positive disengagement

5.3 Results

5.3.1 ***Participants Characteristics.*** A total of N = 115 survey entries were present in the dataset after parsing. Respondents had a mean age of M = 24.8 (SD = 4.27), with ages ranging from 19 to 51. 50 participants self-identified as male, 65 self-identified as female. Participants came from a variety of professional backgrounds. The most frequently reported sectors were Information Technology / Software / Internet (N = 31), Education / Research (N = 22), and Manufacturing / Engineering (N = 17). Smaller numbers of respondents reported work in finance, hospitality/tourism, arts/media, government/public administration, and healthcare.

Analysis of game frequencies showed that Beat Saber was most frequently mentioned among the sample (N = 57). Adventure games such as Moss (N = 7) and Half-Life: Alyx (N = 18) were the next most commonly mentioned. Regarding VR usage frequency, respondents showed a wide range of engagement patterns. N = 41 participants reported using VR every day, while N = 68 participants indicated that they use VR every week. An additional N = 5 respondents engage with VR on a monthly basis, and N = 1 participant reported using VR only once per year. In terms of average VR gaming duration, respondents reported a broad distribution across time intervals. N = 13 participants used VR for less than 1 hour per day. An additional N = 39 respondents who engaged in VR for 1 to 2 hours daily. The largest group consisted of N = 43 participants who used VR for 2 to 3 hours per day, followed by N = 10 participants who reported 3 to 4 hours of daily use. A small subset of N = 6 respondents indicated using VR for more than 4 hours per day.

5.3.2 ***Strategies for Positive Disengagement.*** For each specific design strategy, a consistent pattern emerges in how participants evaluated Satisfaction, Closure, and Agency. Closure is consistently the highest or near-highest rating across all conditions (Figure 5). Satisfaction remains moderately high in most categories, particularly in Dynamic Task (M = 6.49, SD = 1.07), Embodied Diegetic (M

= 6.55, SD = 1.18), and Embodied Mirror (M = 6.68, SD = 0.72). In contrast, Agency is the lowest dimension in nearly all categories, with the sharpest drops appearing in Embodied Ritual (M = 5, SD = 1.77) and MR Sharing (M = 5.31, SD = 1.39).

5.3.3 ***Strategies for Mitigating Post-VR Effect***. Across the three categories, participants' evaluations reveal an overall positive attitude toward proposed strategies for mitigating Post-VR Effect. Introducing dynamic lightweight tasks and interactions for regulating physiological and emotional arousal received a relatively high average score (M = 5.27, SD = 1.68). Participants regard designing an MR-based narrative transitional space as a moderately positive strategy for addressing emptiness (M = 5.02, SD = 1.36) and GTP (M = 4.72, SD = 1.19). Design embodied diegetic exits and social rituals is also regarded as a potential solution in mitigating emptiness (M = 4.64, SD = 1.12).

6 Discussion

In this section, we first examine why and how players end a play session in VR games (RQ1). We then discuss design strategies that support positive disengagement (RQ2). Finally, we situate our findings within the broader landscape of VR exit and transition research.

6.1 RQ1: What motivates players to disengage, and how do they end a play session in VR games?

Our work shows that in VR games, physical discomfort, such as fatigue and cybersickness, is a typical factor shaping disengagement decisions. Fatigue-driven disengagement depends largely on its intensity. Players do not exit immediately when feeling tired. Instead, they actively seek relief through lightweight interactions or self-paced activities. However, once fatigue escalates to sweating, the discomfort introduced by the headset becomes overwhelmingly pushing players to disengage, aligning with the findings of Alexandrovsky et al [3]. Cybersickness, by contrast, represents a more extreme form of bodily discomfort. It produces an immediate, overriding need to exit that surpasses gameplay-related motivations such as completion or achievement, and is consistently negative.

Other reasons, such as completing tasks or regulating strong emotions, are similar to those found in screen-based games. However, VR alters how players act on these reasons. These changes arise primarily from the enclosure of the headset and the friction of transitioning between virtual and reality. On one hand, the immersive enclosure amplifies emotional responses, especially in horror contexts, a phenomenon supported by prior work on presence and fear in VR [28, 29, 45]. At the same time, the headset constrains the regulatory tactics players typically use in non-VR play, making headset removal the only viable way to down-regulate emotional overload. On the other hand, the enclosed environment obscures awareness of the physical world, prompting players to perform brief VR-physical or VR–MR transitions to restore physical-world awareness and reassess their disengagement decisions. The friction of these transitions further discourages players from removing the headset, especially when they need to switch contexts frequently (e.g., checking guides), leading to delayed disengagement. This pattern is consistent with Jonathan et al.'s work [47], suggesting that headset-induced transition friction manifests similarly across contexts. Finally, our findings show that embodied interaction enriches social disengagement practices in VR. Players often create spontaneous, ritual-like exit actions, such as gestures, movements, or playful performances. These behaviors provide a shared sense of closure beyond verbal farewells and reflect the potential of social affordances [18] in the disengagement process, such as the body and interactive objects.

6.2 RQ2: What design strategies could further support positive disengagement in VR games?

Our study identified three potential design strategies that may foster positive disengagement in VR. In this section, we first draw on qualitative insights and related literature to interpret the score patterns observed in the survey, and then further discuss key considerations for implementing these strategies.

6.2.1 ***Strategy-1:Dynamic, Lightweight Exit Tasks and Interactions.*** Participants first suggested using well-designed, lightweight exit tasks and interactions to help regulate physiological and emotional states. These mechanisms were intended to address disengagement driven by physical discomfort or emotional overload, as well as to reduce post-exit effects such as physiological arousal. Our survey results indicate that both Lightweight Interactions and Lightweight Exit Tasks have potential for supporting positive disengagement. Tasks elicited higher perceived satisfaction, likely due to the presence of rewards or explicit completion states. Completing such a task naturally signals the end of a round, a play session, thereby enhancing players' sense of closure, a structure that potentially echoes how small, bounded tasks delineate session boundaries in snack-style games [2]. However, Lightweight Interactions were rated relatively lower on satisfaction. We speculate that this is because they are embedded in the environment, lack rewards, and are generally detached from the core gameplay. In addition, these interactions may risk re-engaging players once their physical or emotional state stabilizes; as noted in Sec. 4.1, when fatigue subsides, the appeal of continued play may again outweigh the motivation to disengage. Overall, the effectiveness of these strategies requires further investigation through controlled experiments.

6.2.2 ***Strategy-2: MR-Based Narrative Transitional Spaces.*** Participants suggested that MR spaces could support players in reorienting to the physical world while providing a smoother transition out of VR. At its core, this strategy aims to create an in-game mechanism for restoring a sense of connection with reality. Survey results show that MR-based strategies hold potential for supporting disengagement, which aligns with previous evidence that users prefer transfer into AR/MR [43, 47]. Among these features, the ability to share achievements within the MR space received particularly high ratings for satisfaction and closure. We speculate that this may be because in-game achievements are no longer confined to the virtual environment. Instead, they acquire additional social value,

such as becoming topics of conversation outside the game. This may also explain why Strategy-2 received relatively high ratings for alleviating feelings of emptiness after disengaging. However, over longer-term use, introducing social visibility may also complicate disengagement. If shared achievements become a source of peer comparison or social pressure, players may feel compelled to continue playing rather than leave [37]. Additionally, Strategy-2 was evaluated positively for helping reduce post-exit goal-tether persistence (GTP). Yet prior research shows that MR transitions can be a double-edged sword: under certain conditions, they may also trigger or exacerbate GTP by reinforcing continuity between virtual and physical contexts [37]. Finally, in qualitative findings, although participants provided suggestions for MR features such as lobbies, hubs, or bases, the optimal placement of MR within different game spaces, the specific spatial functions it should serve, and its precise effects on player engagement and disengagement remain unclear, warranting further investigation.

6.2.3 ***Strategy-3: Diegetic Embodied Exit and Social Rituals.*** Participants also suggested that narrative, embodied exit flows, and social rituals in VR can help create a stronger sense of closure. In our survey, the three embodiment-related strategies (embodied diegetic exit, mirrored entry–exit flows, and game-mechanics-supported social exit rituals) all received relatively high and comparable ratings for supporting positive disengagement. Notably, they tended to yield particularly strong scores on perceived closure. We speculate that this is because narrative- and embodiment-based strategies strengthen players' connection with their in-game characters and foster a clearer sense of in-game identity, making it feel more reasonable and legitimate to disengage "through" the character. This pattern is especially evident for the mirrored entry–exit strategy, where the narrative of entering and leaving the game is symmetrically linked, thereby reinforcing a coherent and satisfying sense of closure. Overall, these findings indicate that the exit boundary itself can serve as a site for richer experiential design rather than merely a termination point.

In addition, in the context of social VR, participants expressed an expectation for rituals supported by in-game mechanisms. Prior work has suggested that social VR applications should provide more structured activities to facilitate social interaction [18]. In the context of disengagement, it is worth exploring whether designers can actively create ritualized support for collective exit. This could include dedicated spaces, objects, or tasks. Such approaches may help enhance the disengagement experience and deserve further exploration.

6.3 Situating Player Disengagement in the Context of VR Exit and Transition

6.3.1 ***Transitional Interface under VR Game Context.*** In prior work, research on transition interfaces has largely focused on enabling players to exit virtual environments smoothly and comfortably [19, 23, 31, 40]. However, our findings show that, in game contexts, players extend their expectations of the exit boundary beyond mere comfort. They envision exit transitions that incorporate narrative and embodied elements. For example, opening a portal with a hand-gesture circle or "clocking out" of the game world by riding an elevator, mirroring how they entered. These expectations imply that transition interfaces must account not only for the moment of disengagement itself but also for the narrative, spatial context, and player flow leading up to it. For instance, if "the elevator doors opening" signifies returning to reality, this narrative cue cannot be meaningfully expressed through minimal visual wipes or fades typically reported in prior VR transition research [23]. Thus, in game settings, it becomes crucial for exit transitions to be designed in alignment with the game's narrative structure and embodied interaction logic, rather than treating disengagement solely as a technical or comfort-oriented boundary.

6.3.2 ***Post-VR Negative Effect Regulation under VR Game Disengagement.*** Prior VR exit research has also examined negative states that may occur after disengagement, such as cybersickness and fatigue, and has proposed various methods to help users recover [12, 27, 41]. Our findings suggest that, in game contexts, some of these mitigation approaches could be meaningfully integrated within the gameplay experience itself. Through in-game interactions and tasks (e.g., Sec. 4.2.1), players may be guided into a more natural, downregulated state before disengagement, thereby potentially reducing post-VR discomfort. For example, prompts identified in prior work as helpful for easing transitions could be embedded diegetically, delivered by an in-game character or framed as part of a mission, rather than appearing as system-level notifications. By leveraging game rules, narrative framing, and player-state cues, designers can encourage players to self-adjust in ways that feel intentional and coherent with the gameplay, instead of relying solely on standardized, system-driven recovery procedures after exit.

7 Limitation and Future Work

The sample in our study may not fully capture the diversity of VR players in terms of demographics, gaming experience, or cultural background, which limits the generalizability of the findings. Second, our study relied on self-reported data from co-design workshops and surveys, introducing potential biases such as memory errors. Third, although we considered multiple VR games in our workshop and survey, the effectiveness of disengagement strategies may vary across different game types, and needs further discussion. Some proposed strategies were based on participants' imagined scenarios rather than real in-game implementations, which may affect ecological validity. Therefore, the future work could address these limitations by involving larger and more diverse samples. Finally, although our online survey provided an initial assessment of the perceived effectiveness of these design strategies, their actual impact on player disengagement in real VR gameplay remains to be empirically examined. Future work should incorporate prototyping and in-situ testing, combining behavioral metrics (e.g., session duration, re-entry rate) with physiological indicators (e.g., heart-rate recovery) to more systematically evaluate the effects of these strategies within real gameplay contexts.

8 Conclusion

We conducted a co-design workshop and an online survey to investigate why and how players end a play session in VR games, and to identify design strategies that may support more positive disengagement experiences. Drawing on feedback from 18 VR players,

we found that physical discomfort was a primary driver of disengagement, and that VR uniquely shaped the practices and decisions surrounding exit, such as restoring physical-world awareness, judging appropriate exit moments, cross-reality switching, delayed disengagement, and more. We further identified three player-proposed strategies for fostering positive disengagement: 1. Dynamic, Lightweight Exit Tasks and Interaction, 2. MR-Based Narrative Transitional Space, and 3. Diegetic Embodied Exit and Social Ritual. Participants also perceived these strategies as having the potential to mitigate post-VR negative states. In the subsequent online survey, we conducted an initial evaluation of these strategies in terms of promoting positive experiences and reducing negative aftereffects. Quantitative results showed generally favorable attitudes toward all strategies. Building on these findings, we discuss the dynamics of disengagement in VR, the opportunities and challenges of the proposed design strategies, and how a game-design perspective expands current understandings of VR exit processes. Overall, this work represents an initial step toward developing design approaches that support positive disengagement in VR gameplay.

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