Understanding Task Resumption Strategies after Physical Interruptions in 360 VR Videos

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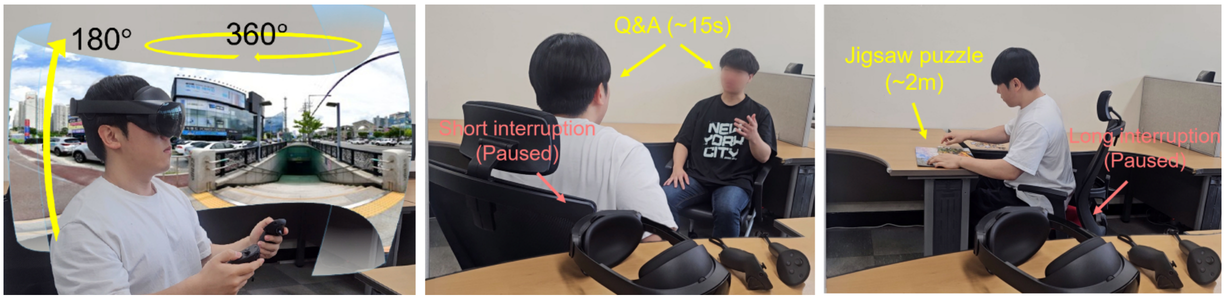

Figure 1: Study setup and interruption conditions. Left: A user seated at a desk engaging with a 360-degree VR video, simulating everyday knowledge work. Middle: The short interruption condition involving a verbal Q&A. Right: The long interruption condition involving a physical jigsaw puzzle task positioned behind the user.

Abstract

When real-world demands force users to remove their headsets, they can lose their spatial and narrative context upon returning to a suspended virtual task. To understand this disconnect, we conducted a formative study (N=8) exploring how users recover their place in 360-degree VR videos. By evaluating different video characteristics and interruption durations during unstructured viewing, we establish design criteria to inform future adaptive context-recovery systems.

Index Terms: Virtual reality, task resumption, interruptions, 360 video.

1 Introduction

As professionals increasingly adopt extended reality (XR) for everyday knowledge work [3], users face interruptions from the physical world. While minor distractions can often be managed while remaining immersed, significant real-world demands frequently require users to remove the headset. Returning from these physical interruptions to an unstructured 360-degree VR video can introduce a spatial and cognitive disconnect, as removing the device disrupts visual continuity. To understand how users spatially and narratively recover their context after this physical-to-virtual disconnection, we conducted a formative study yielding preliminary design criteria to guide the future development of context-recovery systems.

2 Related Work

As XR adoption grows, researchers manage real-world distractions using techniques—such as passthrough windows or fading notifications—that maintain awareness while the headset remains on [7]. Other work addresses more severe virtual disruptions, exploring interface metaphors to ease transitions between entirely different virtual environments [5] and studies the impact of physical location switches [4]. However, these approaches do not focus on resuming unstructured VR viewing once an interruption concludes. To assist with task resumption, augmented reality (AR) often uses spatial markers to reduce cognitive lag [2, 6]. While effective for structured tasks, these AR interventions rely on the real world remaining constantly visible. In contrast, our work explores the spatial and cognitive disconnect that occurs when a physical interruption forces users to remove a VR headset during unstructured viewing.

3 Formative Study

We conducted a formative study with eight participants (aged 20–26, $M = 22.0$). Seated on a rotating chair, participants experienced three counterbalanced 360-degree VR videos. During each video, participants faced two scheduled physical interruptions (see Fig. 1). When interrupted, the video was paused by the researcher; participants removed the headset, physically rotated to face a desk positioned behind them to complete a real-world task, and then rotated back to don the headset and resume viewing. This procedure forced a physical realignment that induced a realistic spatial disconnect upon reentry. We selected the following factors to explore how spatial reorientation differs across structurally distinct environments and, guided by memory-for-goals theory [1], to observe how varying interruption lengths impact goal activation decay and resumption needs.

- **Video Content:** Observing (Cooking: distinct spatial stations), Tracking (Soccer: visual clutter with a clear target), and Exploring (City: uniform environment without specific tracking goals)[1]
- **Interruption Duration:** Each video included both a Short (∼15s verbal Q&A) and a Long (∼2m physical jigsaw puzzle) task.

Following the VR sessions, we conducted 20-minute semi-structured interviews. We asked participants to recall their cognitive strategies just before headset removal, explain their visual scanning behaviors upon reentry, and articulate specific spatial or narrative context loss across the different videos. To prompt discussion, we presented image mockups of four UI concepts (Mini Video Replay,

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[1] youtu.be/JpAdLz3iDPE, /nKpWd4P1XQk, /RDYMD_IZVbo

Animated Arrows & Trail, Attention Funnel, Panoramic Overview) as design probes to elicit critiques and novel ideas.

3.1 Findings

Causes of Spatial Disorientation: Participants requested resumption assistance primarily when actively following a specific narrative or task; in unstructured environments like the city tour, users did not report feeling lost. As P8 noted, "If the content doesn't have a continuous storyline, a feature that pauses and guides you back isn't really necessary." Furthermore, handling an interruption requires multiple physical movements (removing the headset, turning to a desk, and turning back). Because this new physical forward direction often misaligns with the previous virtual viewpoint, users experienced spatial disorientation and requested alignment markers to synchronize perspectives, with P7 suggesting a feature that "captures the last frame... and clearly indicates when my physical orientation aligns with that frame."

Memory and Coping Mechanisms: When reorienting, users typically did not seek their literal "last view." Instead, they relied on subjective anchors based on personal interest. Demonstrating this subjectivity, participants watching the same video relied on distinct details to find their place: P3 tracked a unique visual feature, P2 waited for a traffic light to change, and P6 observed a crowd. P8 highlighted that this personal interest was more important than the final view, noting that even when physically looking elsewhere when interrupted, their mind remained on "the chef on my left who was about to chop vegetables." Additionally, assistance needs scaled with interruption duration: 15-second breaks were supported by simple directional cues (P3), while 2-minute breaks required quick summaries to combat memory decay (P1). This aligns with memory-for-goals [1]; greater activation decay during longer interruptions demands richer contextual cues.

Requirements for Visual Assistance: Users relied on broad background landmarks to reorient. Videos with distinct areas, like the cooking stations, made this easier, whereas uniform scenes, like the all-green soccer field, made it "incredibly hard to distinguish where I left off" (P6). Consequently, users disliked interventions like the "Attention Funnel" that darkened screen edges; P1 noted it caused the background to blend together, and P2 emphasized it destroyed the "overall flow." Finally, participants resisted forced visual guides. P7 likened automatic interventions to unskippable video advertisements, stating, "I pay for YouTube Premium to avoid ads," and emphasized the need for manual optionality so system guides do not disrupt users who simply want to look in a new direction upon returning.

4 Design Criteria

Informed directly by our formative study findings, we define five core design criteria (DC) to guide the development of adaptive resumption aids in unstructured VR viewing:

- **DC1 (Realignment):** Address the spatial disorientation caused by multiple physical movements by providing mechanisms (e.g., frame-matching) that allow users to synchronize their physical forward-facing direction with the virtual target before playback resumes.
- **DC2 (Subjective Anchors):** Because users rarely seek their literal "last view," utilize subtle visual cues that stimulate episodic memory [8] to help them locate their subjective, personal points of interest rather than snapping the camera to exact previous coordinates.
- **DC3 (Adaptability):** Account for goal activation decay [1] by dynamically scaling the level of visual assistance based on the length of the interruption.
- **DC4 (Peripheral Context):** Maintain visible peripheral context without artificially restricting the field of view. Because users rely on broad background landmarks to reorient, systems should avoid interventions that artificially darken the screen edges, as these obscure the environment and disrupt the visual flow.
- **DC5 (User Agency):** Prevent disruption of the viewing experience by making spatial guides optional to avoid the frustration of automatic interventions when users simply want to look around upon returning.

5 Outlook

While these findings establish core design criteria for bridging the physical-virtual gap, they currently focus on observational viewing. As a next step, we will implement these criteria into a functional prototype, integrating adaptive visual cues and user-triggered alignment mechanics. Moving forward, we plan to investigate how resumption strategies shift during active VR tasks, such as spatial navigation or 3D object manipulation. By comparing recovery across these varied interaction paradigms, our future work aims to design a generalized resumption framework capable of supporting everyday XR workflows.

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