Avatar Exposure and Strategic Coordination in Virtual Reality: Evidence from a Threshold Public Goods Experiment

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Digital platforms have become central to organizing collective action across diverse domains, from crowdfunding and open-source software development to sustainability initiatives. However, fostering effective collaboration among geographically dispersed users who interact through digital interfaces rather than face-to-face remains a persistent challenge. This difficulty becomes particularly pronounced in threshold collective action settings, where success depends on achieving a critical mass of contributions—if too few participants contribute, collective efforts fail entirely. Despite the growing importance of these platforms, fundamental questions remain about how specific interface design features influence users' ability to coordinate effectively in such contexts.

Virtual Reality (VR) offers promising opportunities to address these challenges by recreating key elements of face-to-face interaction through avatar-based representations in immersive environments. By enabling peer visibility and non-verbal communication cues, VR can enhance co-presence—the sense of being with another person in a mediated setting. Prior research suggests that social presence plays a central role in strengthening trust and better overall behavioural outcomes in digital and virtual settings. However, empirical evidence on whether minimal forms of avatar-based interaction are sufficient to generate meaningful coordination effects remains limited. This study therefore examines whether brief and controlled avatar exposure can influence coordination outcomes in threshold public goods contexts.

We conducted a randomized controlled experiment with 188 participants organized into 94 pairs, each engaging in an immersive environment using Meta Quest 3 VR headsets. Within a two-player threshold public goods provision framework, we examine whether brief exposure to peer avatar representation increases perceived co-presence and improves coordination outcomes. In order to ensure that each participant was accustomed to using the VR equipment, a standardized training session was conducted at the beginning of each experimental session.

We manipulated a single design feature: avatar visibility during a preliminary task. Each user selected from a predefined set of 30 avatar options. Participants in the Pre-Task Avatar treatment briefly met and interacted through avatar representations in a shared virtual space before the main task, which was then carried out individually. Those in the No Pre-Task Avatar treatment completed an equivalent preliminary activity individually without peer visibility. This minimal intervention allowed us to isolate the causal effect of social representation design on subsequent coordination behaviour while holding constant all other system features, task characteristics, and environmental factors. Critically, Virtual Reality enabled us to reintroduce realistic social context into laboratory experimentation while maintaining experimental control, by excluding verbal communication during the task.

During the main decision phase of the experiment, participants engaged in a five-minute time-constrained real-effort recycling task designed to reflect sustainability-oriented digital platforms that require coordinated user contributions. Each participant sorted 56 items by material type, choosing for each whether to recycle it (contributing to the public good) or dispose of it in the black bin as unsorted waste (not contributing, but reducing individual recycling effort). The total contributions from both players had to reach a specified minimum of 84 correctly recycled items for the pair reward to be obtained; below that threshold, the group reward was not provided. This

structure captures the strategic interdependence inherent in threshold public goods problems: insufficient contributions lead to collective failure, while excessive contributions beyond the threshold represent inefficient over-provision.

In addition to behavioural data, we measured multiple dimensions of user experience and perception using post-experimental questionnaires standardly used in the field of Human–Computer Interaction. Co-presence (i.e., first-order social presence) was assessed using the Networked Minds Social Presence Inventory (Biocca & Harms, 2003). Physical presence within the VR environment was measured using both the Igroup Presence Questionnaire (Schubert et al., 2001) and selected items from the revised Witmer-Singer Presence Questionnaire (Witmer & Singer, 1998).

Our experimental findings reveal important insights into how social representation features influence coordination in collaborative systems. We find strong evidence that brief avatar exposure significantly increases perceived co-presence, demonstrating the effect of minimal design features even in the absence of sustained verbal communication. However, avatar representation does not directly increase individual contribution quantity; instead, it improves strategic coordination. Participants in the Pre-Task Avatar treatment placed more items in the black bin (reducing recycling effort) yet achieved significantly higher social welfare, indicating better coordination to avoid wasteful over-contribution beyond the threshold. This finding illustrates a critical distinction often overlooked in collaborative platform research: more contribution does not always lead to better outcomes in threshold scenarios. Additionally, we identify VR presence—users' sense of "being there" in the virtual environment—as a more robust predictor of task performance than co-presence itself, suggesting that investments in immersion quality and environmental realism may be as important as investments in social features for certain collaborative tasks. Together, these results highlight the complementary roles of social and spatial presence in shaping collaborative behavior in virtual environments.

This research contributes to Information Systems theory by establishing causal pathways from specific design features to presence and coordination outcomes, demonstrating VR as a rigorous experimental methodology for IS research, and providing actionable insights for designing collaborative platforms that support sustainability initiatives and threshold collective action problems. Finally, the study illustrates how immersive technologies can enhance users' understanding of the collective consequences of individual decisions, offering methodological advantages that are difficult to achieve in standard laboratory settings.