Real Behavior in Virtual Environments: Psychology Experiments in a Simple Virtual-Reality Paradigm Using Video Games

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Abstract

The purpose of this research was to illustrate the broad usefulness of simple video-game-based virtual environments (VEs) for psychological research on real-world behavior. To this end, this research explored several high-level social phenomena in a simple, inexpensive computer-game environment: the reduced likelihood of helping under time pressure and the bystander effect, which is reduced helping in the presence of bystanders. In the first experiment, participants had to find the exit in a virtual labyrinth under either high or low time pressure. They encountered rooms with and without virtual bystanders, and in each room, a virtual person requested assistance. Participants helped significantly less frequently under time pressure but the presence/absence of a small number of bystanders did not significantly moderate helping. The second experiment increased the number of virtual bystanders, and participants were instructed to imagine that these were real people. Participants helped significantly less in rooms with large numbers of bystanders compared to rooms with no bystanders, thus demonstrating a bystander effect. These results indicate that even sophisticated high-level social behaviors can be observed and experimentally manipulated in simple VEs, thus implying the broad usefulness of this paradigm in psychological research as a good compromise between experimental control and ecological validity.

Introduction

"Help me!" shouts a distressed alien. Though improbable in real life, many people frequently encounter similar situations in computer games. Sixty-five percent of American households play video games,1 and in these they make sophisticated decisions and engage in complex social interactions. So it is surprising how few researchers have adopted simple video-game virtual reality (VR) for research, particularly as many games come with editors for easy content modification.

VR permits the controlled staging of situations that are difficult to set up in real life, whilst allowing real behavior. In addition, game VR is cheap, readily available, easy to manipulate and, due to its widespread use as a recreational medium, far less obtrusive than sophisticated fully immersive VR. Further, as the present experiments demonstrate, even classic findings on high-level social behaviors, like helping, can be observed and experimentally manipulated in simple game VR (see Figure 1), thus demonstrating that it is a widely useful tool for psychological research.

Helping others is a sophisticated high-level social behavior. Two classic factors that affect people’s real-world helping are time pressure and the presence of others. The Good Samaritan study2 demonstrated that people are less likely to help when in a hurry. Theology students, who were either on time or late for a talk on the Good Samaritan, encountered a man in need and helped less when late. Similarly, in a classic study,3 participants completed a questionnaire either alone or with bystanders whilst a simulated emergency occurred near by. Participants in the presence of others were less likely to help, thus exhibiting the widely replicated “bystander effect.”4,5

Virtual Environments: A Venue for Observing Complex Behavior

It has been argued6 that helping behavior research, like a lot of psychological research, faces a trade-off between experimental control and ecological validity. Studies using vignettes4.5 present participants with an artificial situation, potentially eliciting artificial responses. On the other hand, creating more realistic social situations, for example using confederates, reduces experimental control. Indeed, in the Good Samaritan study,2 some participants insisted on taking

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the confederate for a coffee during the experiment. Using immersive VR for psychological research has been suggested as a compromise.\textsuperscript{6}

In immersive VR, people see a virtual world through a head-mounted display (HMD) and can interact with this world via sensors in ways controlled by the experimenter. These environments can be highly realistic, as illustrated by a replication of Milgram’s\textsuperscript{7} classic experiment on obedience with a virtual victim.\textsuperscript{8}

However, the sophisticated apparatus needed to create an immersive virtual environment (VE), such as a large HMD and so on, makes the experimental environment highly salient and thus tends to offset realistic immersion.\textsuperscript{9} In contrast, sitting at a computer and playing a game, like participants may frequently do anyway, can make the experimental environment much less salient and allow more natural behavior. Thus simple game VR can reasonably replace fully immersive VR. In fact, real-world low-level social behaviors such as interpersonal proximity and gaze direction have been demonstrated in the online game \textit{Second Life}.\textsuperscript{10} Additionally, properties of video-game characters have been shown to influence attitudes measured in the real world.\textsuperscript{11}

The purpose of our research was to argue for the general usefulness of simple game VR in the experimental study of real-world behavior, rather than just treating VR as in interesting but distinct behavioral reality. We did this by testing whether high-level social decision making, like whether to help, can be observed in simple game VR. Our intent was to replicate the effects of bystanders and time pressure on helping behavior in an inexpensive game environment, the popular 3D shooter \textit{Half-Life} 2. We used this environment instead of the massively multiplayer online games like \textit{Second Life} or \textit{World of Warcraft}, because \textit{Half-Life} 2 can be more easily manipulated.

\section*{Experiment 1}

In this simple VR experiment, participants were instructed to get to the exit in a 3D labyrinth. Like in the Good Samaritan study,\textsuperscript{2} they were instructionally placed under high or low time pressure. Walking in first-person perspective through hallways and rooms, participants had several opportunities to assist a virtual person asking for help in the presence or absence of virtual bystanders.

\section*{Method}

\textbf{Participants.} Forty undergraduate psychology students from Cardiff University, 2 male and 18 female in the time-pressure condition and 6 male and 14 female in the no-time-pressure condition, participated for course credit.\textsuperscript{a}

\textbf{Design.} This study was a 2×2 mixed factorial design, with time pressure, high or low, as a between-subjects factor and the presence/absence of virtual bystanders as a within-subjects factor. The time pressure was manipulated via the instructions, and some rooms in the labyrinth had bystanders while others did not, counterbalanced across participants. Helping behavior was measured as the number of rooms in which help was provided.

\textbf{Materials.} The virtual labyrinth contained 18 rooms: an introduction room, two observation rooms, 14 assistance rooms, and an exit room. In the observation rooms, participants saw a virtual person assisting another virtual person. In the assistance rooms, participants could choose to help or not. A virtual person would ask them to break some crates, behind which he was stuck. Participants had a virtual crowbar to do so. There were virtual bystanders in seven of these rooms who displayed various casual movements like turning their heads but ignored requests for assistance.

\textbf{Procedure.} Participants were told that they were about to enter a virtual labyrinth and that their main task was to get to the exit. One instruction sheet warned the participants to progress through the labyrinth quickly, while the other said they had plenty of time. They were told about the virtual people in the labyrinth who might try to interact with them but were reminded that such interactions would take time. They also received instructions on the use of the mouse and keyboard to navigate and interact with the environment. Lastly, they were told that doors leading to the exit were designated by a red cage light. The participants then moved around the introduction room until comfortable with the controls and before being left alone to complete the task.

\section*{Results and discussion}

Participants under low time pressure ($M = 4.53, SD = 2.6$) helped significantly more often than participants under time pressure as shown in Figure 2 ($M = 1.18, SD = 1.65$), $F(1, 38) = 24.39, p < 0.001$, $\eta^2_p = 0.37$. However, the presence/absence of bystanders did not significantly influence helping ($M = 2.95, SD = 2.75$; $M = 2.75, SD = 2.77$), $F(1, 38) = 1.587, p = 0.215$, $\eta^2_p = 0.01$. Still, even under time pressure, participants did provide some help and did not just ignore the environment.\textsuperscript{b}

These results are partly consistent with previous research: like in the Good Samaritan study,\textsuperscript{2} participants in a hurry helped less. However, in contrast to previous research,\textsuperscript{b} bystanders did not seem to influence helping. One possible explanation for the absence of the bystander effect is that not all published studies have actually found the effect,\textsuperscript{12} and even

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fig1.png}
\caption{A room with 19 virtual bystanders.}
\end{figure}
this is conservative due to the widespread tendency for non-publication of null results. Similarly, our failure to find the effect in Experiment 1 could possibly have been due to a lack of power.

A more plausible explanation for the absence of the effect here is that the factors widely implicated in the bystander effect, namely diffusion of responsibility and fear of embarrassment, were relatively weak in Experiment 1 because the other “people” were so obviously computer controlled. It seems likely that participants felt relatively little embarrassment or lack of responsibility in the presence of these computer-controlled characters. Note that this is not a fundamental limitation of our proposed methodology as, at least potentially, other characters in the VE could be controlled by real people over a network. However, we tried a simpler approach, as it has been shown that being primed with even the image of a crowd is sufficient to produce a reduction in altruistic behaviors, and in addition the number of people in the crowd moderates the effect. Although we have not found any research on the effect that has directly evaluated what constitutes “a crowd,” it is plausible that the few virtual bystanders who sat in the corners of the perceptually large experimental labyrinth rooms did not invoke a particularly strong sense of a crowd. The manipulations in Experiment 2 were based on these observations.

Experiment 2

This experiment was designed to intensify the bystander-effect manipulation in Experiment 1 by increasing the number of bystanders, as several previous studies have argued that the presence of more people—whether physical, imagined, or in online chat rooms—makes helping less likely due to greater diffusion of responsibility and, potentially, due to a stronger sense of being in a crowd. Furthermore, people seem more likely to be socially influenced in VR the more human they consider the characters. So participants were instructed to imagine that the virtual characters were real people.

Method

Participants. Twenty-nine participants from the same population as the first study (9 males and 20 females) participated in this experiment.

Design, materials, and procedure. This experiment was similar to the low time-pressure condition in Experiment 1, except that here participants were told to “imagine that the virtual people in the labyrinth represent real people.” In addition, bystander-present rooms had 19 instead of 4 people (see Figure 1).

Results and discussion. Increasing the number of bystanders and imagining that the virtual people were real resulted in significantly less helping in the presence of bystanders compared with in the absence of bystanders ($M = 3.45, SD = 2.66, M = 4.14, SD = 2.80$, $t(28) = -2.281, p = 0.03$, two tailed, $\omega^2 = 0.127$. So these intensifying manipulations resulted in a bystander effect, consistent with studies set in the real world.

General Discussion

Both the bystander effect and time-pressure reduced helping occurred in a virtual gaming environment, though several key factors influencing these effects were likely moderated by beliefs about the reality of this environment. Our results emphasize the usefulness of simple game VR as a venue for psychological experimentation, particularly as representing a reasonable trade-off between experimental control and ecological validity. Although the environment and controls in our experiments were simplistic, even in relation to the full potential of the game we used, participants behaved similarly to previous experiments conducted in real-life settings with human actors. This suggests that a wide variety of behavioral effects, from bystander apathy and time pressure to prototype effects in categorization to various associative learning phenomena, can be observed and effectively manipulated in this environment.

But why should using VEs be better than using vignettes? After all, effects like the bystander apathy can be observed using simple questionnaires. But questionnaires only measure intentions to help, which is arguably very different from actually helping, even if the person is not real. Yet, the present study demonstrated that it is possible to obtain measures of real-world behavior under well-controlled conditions using simple VEs.

Clearly further research is needed to identify the factors that make behavior in simple VR less or more like behavior in reality. For example, it is not clear whether it was the change in instructions or the increase in bystanders that contributed to the occurrence of the bystander effect in the second experiment but not in the first. In addition, manipulating the plausibility that VR characters are representative of and controlled by other human beings, like in Second Life, seems likely to be important.

A key advantage of even simple VR is that it can be used to study things that are hard to manipulate in the real world. For example, one study used the simple VR in Half-Life 2 to observe people’s building-escape behavior during a fire. Even ethically questionable paradigms like Milgram’s research on obedience can be replicated in a VE, allowing researchers to manipulate the realism of the situation and thus potentially the discomfort of participants. This suggests future research possibilities such as replications of the ethically problematic Stanford Prison Experiment and even extreme manipulations such as virtual gender reassignment.

A strong argument against using VEs in psychological research has traditionally been the high cost and technical
difficulty of using the apparatus. Further, the complexity of the technology in terms of HMD, cables, and so on may actually offset any feeling of environmental immersion. Again, the present research emphasizes that inexpensive video games with free content editors provide a practical solution to these problems for broad areas of psychology. If simple computer games can be used to research high-level social behavior, then they are likely to be at least as useful for such diverse areas as learning, memory, reasoning, and perception.

Notes

a. Our results showed some indications of greater male than female helping behavior, but there were not enough male participants to reach firm conclusions. Yet this is unlikely to have affected the results as the male/female distribution was not significantly different across conditions ($\chi^2 [1, N = 40] = 2.5, p = 0.11$).

b. After the experiment, the participants were given a short questionnaire, which determined whether they had a lot or little experience of playing computer games, whether they were familiar with the bystander effect, and whether this familiarity had influenced their behavior. None of the factors had a significant effect on the results.

c. Maximum number supported by our hardware.

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References


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