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Using virtual reality technology in organizational behavior research

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Summary Conventional research methodologies that use written vignettes to present stimuli have been criticized as lacking in realism. We propose the use of highly immersive virtual reality (VR) technology to overcome limitations of written vignettes and other traditional methodologies. We also illustrate how VR technology can be effectively used to investigate various topics in organizational behavior and industrial/organizational psychology. © 1997 John Wiley & Sons, Ltd.

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Introduction

Laboratory and field research in organizational behavior (OB) and industrial/organizational (I/O) psychology often entails presenting study participants with written vignettes that describe people and their behavior. Researchers are concerned, however, about the lack of realism inherent in the use of 'paper people'. As a methodological alternative, and perhaps a more realistic mode of stimulus presentation, the use of videotapes has been encouraged to improve the validity of research findings. Videotapes might be more realistic than written vignettes, but other stimulus presentation modes are even more realistic. For example, consider presenting stimuli via fully immersing study participants into a virtual reality environment. Could being immersed in a virtual world elicit more realistic reactions than viewing a videotape? We believe so.

Virtual reality (VR) is defined as a computer-simulated, multi-sensory environment in which a perceiver, who is the user of the VR computer technology, experiences *telepresence*. Telepresence is defined as feeling present in an environment that is generated by a communication medium such as a computer (Steuer, 1992). In the context of VR, telepresence occurs when the VR user loses awareness of being present at the site of the human–computer interface and, instead, feels present or fully immersed in the VR environment (Durlach and Mavor, 1995). What factors determine telepresence? The vividness and interactivity of the VR technology. The more vivid and interactive the VR system, the more captivating it is of the user's visual, aural, olfactory, tactile, and proprioceptive senses and, hence, the more apt it is to produce telepresence. Highly

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immersive VR systems, or those able to produce telepresence, typically consist of (a) a treadmill, motion platform, and position tracker, (b) tactile feedback, speech recognition, and spatial audio systems, and (c) an exoskeleton, data gloves, and head-mounted video display worn by the VR user (Biocca, 1992a,b).

There are several domains where this immersive VR technology is currently used. In order to train pilots and astronauts, for example, the U.S. military and aerospace programs use VR to simulate cockpits during flight. And, in order to train surgeons, the medical field uses VR to simulate surgical operations. In addition, although they use less immersive technology, automobile manufacturers use VR to simulate design and production and the entertainment industry markets VR as an arcade game (Durlach and Mavor, 1995; Rheingold, 1991). To our knowledge, however, highly immersive VR technology is not currently used by researchers in OB or I/O psychology for the purpose of assessing cognitive, affective, attitudinal, or behavioral reactions to stimuli.

The primary questions we wish to raise are as follows: can empirical research in OB and related fields benefit from using highly immersive VR technology as an alternative research method and, if so, how and to what degree? In order to address these questions, we next discuss potential advantages and disadvantages of using highly immersive VR technology as a mode of stimulus presentation.

Advantages of Using Immersive VR Technology

We believe there are several potential advantages to using highly immersive VR technology, as opposed to a written vignette or videotape, to manipulate focal study variables. First, given that users can experience telepresence, VR technology could enhance the experimental and mundane realism and, consequently, the internal and external validity of an experiment. Experimental realism refers to the extent to which an experimental situation is perceived as realistic and believable by the study participants, and mundane realism refers to the extent to which events in an experiment are similar to those in the real world. Stimuli presented in a VR environment should be perceived as more realistic and similar to real world events compared to less vivid, less interactive stimuli presented on paper or videotape.

Second, VR technology allows for the manipulation of naturally occurring field variables in a controlled laboratory setting. Given that three-dimensional office environments with hallways, doors, rooms, and physical objects have been manipulated in VR (Regan and Price, 1994; Smith and Wilson, 1993), and that multiple users can be simultaneously immersed in the same virtual world (Biocca, 1992b), interpersonal processes that naturally occur in an organizational environment could be manipulated in a controlled VR environment.

Third, VR technology can be used as a dynamic research method in place of static or one-time assessment methods (e.g. self-reports in a cross-sectional design) that are commonly used to investigate dynamic organizational behavior. By immersing VR users in a simulated organization and then measuring their reactions to dynamic stimuli at several time points rather than a single time point, researchers would be able to examine more precisely organizational behavior that varies on a regular basis. As an illustration, a VR user's reaction to fluctuations in employee job performance could be assessed at multiple time points during a VR immersion.

Fourth, VR technology would foster a more sound investigation of sensitive topics that are difficult to study experimentally in the field. Researchers who examine sensitive topics are often limited to conducting passive observational studies or laboratory experiments using written vignettes or videotapes. Given VR technology's ability to manipulate naturally occuring field

variables, researchers interested in studying sensitive topics could conduct 'field' experiments in a controlled VR environment. Examples of using VR technology to investigate two sensitive topics, workplace romance and sexual harassment, are provided in the last section of this article.

Disadvantages of Using Immersive VR Technology

At present, highly immersive VR technology has two potential disadvantages. First, immersive VR users sometimes experience sopite syndrome, which is a simulation sickness stemming from display update lags and image jumps that occur with low resolution head-mounted video displays. Symptoms are similar to motion sickness and include chronic fatigue, lethargy, headaches, eyestrain, lightheadedness, dizziness, and nausea. In a VR study, 61 per cent of the 146 participants reported experiencing headaches, eyestrain, and nausea during a 20-minute immersion period, and 5 per cent of the participants withdrew from the experiment because of nausea or dizziness (Regan and Price, 1994). Nevertheless, once the resolution of head-mounted displays improves, update lags and image flickers will be alleviated and, thus, simulation sickness should be surmounted.

The second potential disadvantage of highly immersive VR technology is its cost. For example, as of 1992, the most advanced high resolution full color head-mounted displays cost nearly $1,000,000. And exoskeletons, which are used to stimulate feelings in the muscles and joints to captivate the VR user's proprioceptive senses, cost between $100,000 and $300,000 (Biocca, 1992b). The good news for researchers interested in using immersive VR equipment is that its cost is expected to drop substantially once lower end systems include features previously available only on higher end systems (Biocca, 1992b; Kaiser, 1996). As an example, high resolution full color head-mounted displays are now priced in the $50,000–80,000 range.

One additional concern with respect to highly immersive VR technology: would its use require more stringent ethical standards compared to using a written vignette or videotape? It would appear so, as researchers would need to develop and use more thorough informed consent and debriefing procedures. As is the case with any new research tool, a discussion of the ethics of using VR technology is warranted (cf. Aguinis and Handelsman, 1997a,b).

VR has its advantages and disadvantages. Before one decides whether its use as a research tool would be beneficial or detrimental, consider the following examples where VR technology could be utilized to examine two pervasive organizational phenomena.

Immersive VR Technology in Action: Two Illustrations

One benefit of using VR technology is that it would allow for investigations of sensitive topics that are difficult to study experimentally in field settings. Researchers interested in obtaining data on workplace romance, for example, have relied primarily on passive observational methods such as case studies or telephone surveys (Pierce, 1997; Pierce, Byrne and Aguinis, 1996). With highly immersive VR technology, it would be possible to examine experimentally various aspects of the formation, impact, and management of workplace romances. As an illustration, a VR user could be immersed in a simulated organization to observe a supervisor–subordinate and peer romance within the same work group, and then his or her affective and attitudinal reactions to each type of romance could be assessed. Critical factors could also be manipulated in the VR environment

such as the employees' motives for participating in the romance, whether the romance is extramarital, and whether the organization maintains a policy against workplace romance.

Sexual harassment at work is another sensitive topic that is difficult to study experimentally in the field. Indeed, sexual harassment research has been criticized for its reliance on paper people, cross-sectional methods, and convenience samples. With highly immersive VR technology, it would be possible to examine experimentally the potential link between dissolved workplace romances and sexual harassment incriminations (Pierce and Aguinis, 1997). Also, VR technology would allow for the assessment of individuals' reactions to observing different types of sexually harassing behavior that is directed toward computer-generated human targets. The VR user's affective and attitudinal reactions could be examined as a function of factors such as sex composition of the work group, sex of the harasser and harassee, and whether the harassment occurred between a supervisor and subordinate or two peers.

The use of immersive VR technology is certainly not limited to workplace romance and sexual harassment research. A wide range of OB and I/O topics involving interpersonal processes could be investigated in a VR environment. Examples include leadership, group brainstorming, team decision making, conflict resolution and negotiation, realistic job previews, personnel selection and training, performance appraisal, managerial influence tactics, nonverbal behavior, and citizenship behavior.

In closing, from a proactive viewpoint, our main goal in writing this article was to raise awareness of the possibility of using highly immersive VR technology as a tool for conducting empirical research on OB and I/O topics. We hope that as VR technology progresses in terms of quality and cost efficiency, researchers will give serious consideration to its use over less realistic modes of stimulus presentation such as written vignettes or videotapes.

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