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AUTHORS' RESPONSE

Immersive Virtual Environment Technology: Just Another Methodological Tool for Social Psychology?

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We reply to commentaries on our target article (Blascovich et al., this issue). We focus on the more critical comments, agreeing with some, disagreeing with some, and rebutting some. We conclude that the test of the value of immersive virtual environment technology is the degree to which it becomes diffused throughout the field.

The introduction of new methodological tools and paradigms has a long history in the sciences, including the behavioral sciences. In social psychology, Triplett's (1898) introduction of experimental methodology brought to the discipline a paradigm used in the physical sciences arguably since the time of Galileo. Later, survey research methodology brought powerful nonexperimental but scientific methods to our field. With somewhat less impact, social psychologists have borrowed methodology and technology from other psychological disciplines, particularly biological ones, such as physiology and, more recently, neuroscience, including neuroendocrinology and neuroimmunology. Social psychologists still debate the validity and utility of each of these introductions.

In our target article (Blascovich, Loomis, Beall, Swinth, Hoyt & Bailenson, this issue), we describe immersive virtual environment technology (IVET) as a methodological tool for social psychology. We argue that IVET has powerful research potential, including its apparent solution to major methodological problems that have more or less plagued social psychology, such as the experimental control–mundane realism trade-off, lack of replication, and unrepresentative sampling. We also suggest that social psychologists can use IVET not only as a technology supporting traditional experimental social psychological research but also as one supporting a different paradigm, one we label *reverse-engineering social interaction.* The commentaries on the article, pro and con, that appear in this issue, have helped us to focus our thinking on our claims and arguments. Here, we share some of those thoughts organized as replies to selected, mostly critical, comments from each of the commentary articles in turn.

"Virtually Immersive Environments" by Reis

Reis (this issue) rightly warns that the field not become enraptured of "clever new technologies whose ability to augment our core conceptual mission, understanding human social behavior in the real world, ends up limited or even ephemeral." We have given this much thought. We, and others, who see and understand IVET first hand, collectively can imagine hundreds, if not thousands, of experiments that social psychologists can perform. Identifying the important, groundbreaking ones, however, requires more thought. As Groom, Sherman, and Conrey (this issue) argue, IVET adds little to the armamentarium of social psychology if we use it only to replicate traditional experiments.

We believe that social psychologists can use IVET both to enhance and extend our methodological capabilities. Harre (1972) argued that scientists develop and benefit from both sense-enhancing and sense-extending instruments. The former include technologies that simply increase our natural observational powers (e.g., telescopes, thermometers). The latter include those that give us new observational powers (e.g., Geiger counters, electrical current detectors). We believe the value of IVET lies both in enhancing traditional experimental methodologies and in extending our methodological repertoire. As we report in our target article (Blascovich et al., this issue), IVET can enhance traditional experimental work by increasing mundane realism without sacrificing experimental control. As we also report, however, IVET allows us to extend experimental research because it allows manipulations that appear impossible or wildly impractical to do otherwise, such as social identity manipulations based on

organismic characteristics, subtracting or modifying (i.e., reverse engineering) subtle nonverbal cues without the sender's knowledge, and so on. Additionally, IVET will allow us to tease apart the subtleties of social presence, thereby establishing the concordances and discordances in social influence among Allport's (1954) sources of social influence, that is, the actual, implied, and imagined presence of others.

Reis (this issue) also raises the issue of temporality, suggesting that IVET, like much traditional experimentation, seems most amenable to studying behaviors whose determinants lie "in the moment." Although we can conceive of creating experiments and observational studies based on longitudinal experiences within immersive virtual environments, we expect that IVET alone will not allay social psychologists apparent reticence to perform such longitudinal work.

"Immersive Virtual Environment Technology: Issues Regarding Research on Person Perception and Stereotyping" by Smith

Smith (this issue) points out an apparent omission in our review of research relevant to IVET, specifically of the work of Reeves and Nass (1996). We have certainly considered their work and believe it important for the reasons that Smith articulates. In addition to treating known computer agents as social beings, people actually treat the computer hardware itself as such. We agree that this work supports our theory that behavioral realism can generate social influence even when the person knows the object exhibiting that realism is not a person. However, we would quickly add that Reeves and Nass failed to consider the important moderator variables that we have specified in our threshold model of social influence (i.e., self-relevance and response-system level). Clearly, the social influence of nonhuman agents is more complicated than even the groundbreaking work of Reeves and Nass suggests.

Smith (this issue) articulates two possible logical problems affecting the use of IVET in social interaction research. The first involves attributions, the second, control. Smith argues that because individuals can freely choose their avatars (i.e., their representations), participants may naturally wonder why the interactant has chosen a particular avatar. Such wonderment would interfere with the focus of the investigation (e.g., the operation of stereotypes), turning social interaction studies into attribution ones.

We do not believe this is as much of a problem as Smith (this issue) suggests. First, choice of avatars can be constrained by investigators. Second, investigators can perform very interesting experiments to assess the criticality of consonance between avatars and their owners. To take a simple example, one could covary the race of the avatar and the race of its owner, making both clear to participants to study the effects of racial stigma. Thus, participants would know whether or not they were interacting with an avatar sharing socially identifying characteristics with its owner. Such a classic 2×2 design would allow determination of main and interactive effects that would allow us to disentangle the effects of the appearance of social identifying characteristics and actual ones. We could argue that main effects of appearance (e.g., a threat response) might be due to low-level or even automatic processing, whereas main effects due to actual identity might be due to higher level processing.

With regard to control, Smith (this issue) argues that in a participant interaction with an avatar, one cannot insure that the avatar's behavior will remain constant across all participants if it is to approximate a realistic social interaction. This is true enough for quite cognitively complicated contexts, such as an intellectual discussion about an important topic. However, we suggest that simplifying the interaction goal represents a possible way out of this problem. For example, let us suppose the participant interacts with another within a rich immersive virtual world in which the participant and avatar play a game of "hot and cold." The avatar's race or sex could be varied in whatever ways of interest to the investigator. In such a simply and structured (i.e., rule-bound) social environment, IVET technology would allow precisely controlled speech on the part of the avatar as a function of the participant's movements toward and away from the object to be found. The roles could also be reversed with the participant directing the avatar. One could conceive of any number of dependent variables that could be recorded (e.g., distance maintained between the participant and the avatar, number of utterances, vocal tone) without losing control over the avatars. We believe that IVET would provide significant advantages in this regard over more traditional techniques, such as imaginary vignettes.

"Virtually Interactive: A New Paradigm for the Analysis of Stigma" by Hebl and Kleck

Hebl and Kleck (this issue) provide several interesting ideas regarding the use of IVET for stigma research. For example, they suggest that investigators can use IVET easily to vary the degree of visual stigmatization (e.g., degree of overweightness, skin tones, extent of facial scarring) and observe the effects on stigmatization processes. Similarly, they suggest that investigators can use IVET to vary the environmental contexts in which stigmatization processes occur, thereby determining situational effects and interac-

tions (an idea consistent with the use of IVET within the realm of the situated cognition perspective described by Smith, this issue).

In their discussion of the limitations of IVET for social psychological research, Hebl and Kleck (this issue) and some of the other commentators raise the important notion of metacognitions in IVET-based research, asking "whether what study participants see in their glasses will be treated as any more real than what they experience in the typical social psychological laboratory." We believe that question can and will be answered empirically and relatively soon. At this time, however, we can speculate.

As we have stated, immersive virtual environments provide synthetic sensory information that surrounds the individual, providing them with a sense of presence in the environment created by that sensory information much as in real life. To the extent that such sensory information is rich and multimodal, individuals will be immersed and act accordingly. As we argued in our target article (Blascovich et al., this issue), the history of social psychology includes such rich immersive environments (e.g., the prison created by Haney, Banks, & Zimbardo, 1973). Today, we can create such environments digitally. We believe that the rich sensory information in immersive virtual environments occupies much of the attentional capacity of individuals within them. This does not rule out the operation of potentially interfering metacognitions, but we believe their influence will be substantially reduced over traditional experimental situations (e.g., a simple typed experimental vignette). The anecdotes of our participants, as well as the empirical data discussed in the target article, support this conclusion.

"Expanding the Boundaries of Psychology: The Application of Virtual Reality" by Rizzo and Schultheis

The commentary by Rizzo and Schultheis (this issue) complements our target article (Blascovich et al., this issue) by providing much useful information regarding the use of IVET in other areas of psychological research, particularly in what many might consider applied areas. Their descriptions of the use of IVET for the assessment of automobile driving ability after brain injury, for creating classroom experiences for teachers in training, and for clinical work are quite informative. Similarly, we find their discussion of technological items we did not cover informative, for example, the use of 360° video cameras to capture actual physical environments for use in immersive virtual environment creation.

Rizzo and Schultheis (this issue) point out an important issue to which we paid scant, if any, attention. They raise the issue of the necessity of interdisciplinary collaboration for successful use of IVET. We certainly believe that successful IVET development and continued refinement requires interdisciplinary cooperation among a variety of disciplines, including computer science, graphic arts, engineering, and the perceptual sciences. Social psychologists generally do not have the skills to create IVET-based systems by themselves. On the other hand, members of these other disciplines, important as they are, are unlikely to be able to structure IVET systems that are very useful to social psychologists without knowledge of our discipline. Furthermore, the work that social psychologists do with and without IVET technology is clearly important to develop and implement immersive virtual environments to track and render virtual persons, whether agents or avatars, in realistic ways. That said, we believe that turnkey IVET systems will eventually meet the scientific demand for them. That is, investigators with not much more expertise than that necessary to use the multimedia graphics capabilities of personal computers will be able to use IVET systems effectively.

"The Affordances of Immersive Virtual Environment Technology for Studying Social Affordances" by Zebrowitz

Zebrowitz (this issue) examines the use of IVET within her own research domain, social affordances, thereby providing a clear example of the pros and cons of using this technology within a concrete area of research. Drawing on Gibson (2000), Zebrowitz defines *social affordances* as the opportunities for acting, interacting, or being acted on that the presence of others provides. She writes that two contextual influences underlie the emergence of social affordances: the social setting and the perceiver's attunement to available information.

Zebrowitz (this issue) critiques work on social affordances as lacking in the social domain. Furthermore, she points out that the research that does exist has relied on retrospective reports by passive perceivers. She argues that behavioral indicators would represent an advance in this area and that IVET would enable investigators to study perceived affordances across contexts and suggests interesting experiments that investigators such as she could perform. Zebrowitz suggests that her model of social affordances, based as it is on a broad ecological perspective, requires a methodology and technology that permits the manipulation and control of many variables and sources of sensory information, two inherent advantages of IVET.

"What IVET Can Offer to Social Cognition" by Groom, Sherman, and Conrey

Groom, Sherman, and Conrey (this issue) article presents quite interesting, albeit in our opinion uneven, reading. We disagree with their opening salvo of critiques. To us, many of these appear superficial and, frankly, not well thought through. For example, we find the comment of Groom et al. that "we have reservations about the plausibility and even the value of boosting mundane realism, replicability, and external validity through IVET" remarkable. Although the plausibility of IVET for better achieving these canons compared to more traditional experimental techniques may be questioned, as several of the commentators did, we are simply astounded that Groom et al. question their value. We are not ready to abandon mundane realism, external validity, and replicability, nor do we think the field should.

One of the most disturbing critiques here is Groom et al.'s (this issue) assertion or implication that somehow we propose using IVET only for causal description and that somehow we do not realize its value for causal explanation. We find this presumptuous and inaccurate. Furthermore, we find their implication that social cognition experiments better embody attempts at causal explanation than do other types of research sophomoric.

Groom et al. (this issue) also imply inaccurately that we promote IVET primarily as a way to replicate existing experiments. This claim is wholly unfounded. In fact, we made that point in our target article (Blascovich et al., this issue), describing many ways that social psychologists can use IVET creatively in many traditional research areas within social psychology. In addition, we suggest IVET potentially provides a whole new research paradigm (i.e., reverse-engineering social interaction). Interestingly, Groom et al. do provide additional positive examples of the use of IVET within the social cognition approach to various topics, appearing to undercut their own initial criticisms.

Groom et al. (this issue) argue that using IVET somehow increases participants' metacognitions regarding being in an experiment, "the participant realizes that their every movement is under scrutiny." We refer to our previous discussion of metacognitions. We argue further that such metacognitions occur with less frequency in IVET-based experiments than in other types of experimental settings where participants are confronted by and aware of devices such as one-way mirrors, staring experimenters, video cameras, and written examples on surveys. On the other hand, the participant in an immersive virtual environment shares a more veridical sense of presence in the experimental world, oftentimes forgetting entirely that they are in a laboratory. External stimuli, including the experimenter, are removed from their senses.

Summary

Overall, we are quite gratified by the reception of our target article (Blascovich et al., this issue) by the commentators. We believe they have brought up many useful issues and problems that IVET shares with other experimental methods and technologies in social psychology. Although we believe that IVET can solve many methodological problems, we do not believe it a panacea. We believe that IVET will have an important impact in social psychology as the technology becomes diffused throughout the field. The degree of that diffusion will provide a pragmatic test of its utility.

Note

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