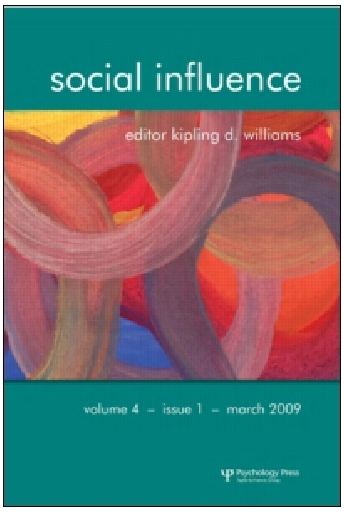

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Proxemic behaviors as predictors of aggression towards Black (but not White) males in an immersive virtual environment

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Proxemic behaviors as predictors of aggression towards Black (but not White) males in an immersive virtual environment

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This study investigated the relationship between participant proxemic behavior and overt aggression during interactions with Black and White agents in an immersive virtual environment. In a series of two tasks, participants first interacted with two male agents (each of the same race) and then engaged in a violent shooting game with those agents. Participants' proxemic behaviors (interpersonal distance and head movements) during the first task predicted aggressive and hostile participant shots against Black but not White agents in the subsequent task. Results supported the value of proxemic variables in predicting aggression and the utility of IVET for experimental social psychology.

Keywords: Aggression; Implicit attitudes; Proxemics; Prejudice; Nonverbal behavior.

Social psychologists have studied the attitude–behavior link for nearly a century, particularly regarding racial attitudes. Although societal attitudes towards Blacks have become more positive, this trend has not necessarily corresponded with a decrease in discriminatory behaviors (e.g., Dovidio, Gaertner, Kawakami, & Hodson, 2002; Plant & Devine, 1998; Wittenbrink, Judd, & Park, 1997). This discrepancy has motivated researchers to search for covert or implicit markers of racial attitudes, resulting in various priming and/or reaction time techniques (Fazio & Olson, 2003). Although some resulting measures correlate with nonverbal racist cues (e.g., facial

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expressions, gaze, interpersonal distance; see Dasgupta, 2004, for a review), the relationship between these subtle measures of prejudice and overt racist behaviors is unclear.

In the present study we focused on nonverbal behaviors as implicit markers of racial attitudes that could predict overt discriminatory behavior. We assessed proxemic behaviors (interpersonal distance, head orientation, and movement) during non-violent participant interactions with Blacks and Whites, and assessed their relationship to subsequent participant aggression toward them. Like others, we reasoned that proxemic behaviors can serve as implicit measures of racism. We further reasoned that proxemic measures might predict biased behavior in an aggressive context. We also believed that immersive virtual environment technology (IVET) would remove practical impediments to proxemics measurements.

ATTITUDES, MOTOR BEHAVIORS, AND PROXEMICS

The word "attitude" dates from the 1600s and is historically associated with body position, orientation, movement, and travel (Simpson & Wiener, 1989). Accordingly, early scholars related physical approach and withdrawal movements to psychological attitudes (Allport, 1935). Mead (1925, p. 271) referred to attitudes as "… expressions of countenance, positions of the body, changes in breathing rhythm, outward evidence of circulatory changes, and vocal sounds." This line of thinking launched a more modern notion of attitudes as "*a neuropsychic state of readiness for mental and physical activity*" (Allport, 1935, p. 799, italics his).

Hall (1959) coined and defined "proxemics" as people's socially and culturally influenced use of space including distance between speakers and listeners, speaker's orientation, touching, and eye contact. Others elaborated on Hall's notions. Argyle (1975) claimed that decreases in direct head orientation and direct gaze behaviors convey dominance, and that gaze avoidance while still keeping the target in view marks hostility. Mehrabian's (1969) immediacy principle suggested, simply, that people are drawn toward liked targets and move away from disliked ones. As such, touching, eye contact, forward lean, and torso orientation toward a target, all indicate a positive attitude.

The literature on prejudice has supported these claims (Dasgupta, 2004). Word, Zanna, and Cooper (1974) found that participants sat further away from Blacks than Whites. Hendricks and Bootzin (1976) replicated this effect and added that participants reported more discomfort when asked to approach Blacks than Whites. Bessenoff and Sherman (2000) found that attitudes toward obese people correlated negatively with seating distance from an overweight interaction partner. Dovidio, Kawakami, Johnson,

Johnson, and Howard (1997) found that participants' racial bias correlated negatively with visual contact during interactions with Blacks.

These data suggest that subtle nonverbal behaviors express attitudes, but the extent to which those behaviors predict more overtly biased responses is less clear. While the relationship between implicit and explicit expressions of attitudes has been explored in detail (see Dasgupta, 2004; Rudman, 2004), few experiments have looked directly at the relationship between subtly discriminatory nonverbal behavior (as measured by proxemic variables) and more overtly discriminatory behaviors (physical aggression). Given that implicit measures of attitudes appear to predict the explicit expression of bias in contexts in which individuals lack the motivation or resources to control responses (Dasgupta, 2004; Rudman, 2004), it seems likely that subtly discriminatory nonverbal behavior might predict more aggressive discriminatory behaviors in a high-stress or hostile environment.

IMMERSIVE VIRTUAL ENVIRONMENT TECHNOLOGY

Heretofore, proxemic attitude indicators have lacked precision and complexity. This fact is evident not only in self-reported proxemic measures (e.g., Hayduck, 1983) but also in behaviorally based measures such as seating choice (e.g., Word et al., 1979), the use of objects to demonstrate interpersonal distance (e.g., Knowles, 1980), and role-playing scenarios (e.g., Mehrabian, 1968). Orientation has generally been assessed qualitatively via coding by observers for characteristics such as friendliness or mutual gaze (e.g., Dovidio et al., 1997). Such measurements are time consuming, and in the case of self-reports, open to demand characteristics.

Recently, immersive virtual environment technology (IVET) has been proposed as a powerful methodological tool for social psychology (Blascovich et al., 2002). Blascovich and colleagues define a virtual environment (VE) as synthetic sensory information that leads to perceptions of environments and their contents as if they were not synthetic. An immersive virtual environment (IVE) perceptually surrounds individuals such that participants perceive themselves to be enveloped by, included in, and interacting within an environment that provides a continuous stream of stimuli (Witmer & Singer, 1998). Although IVEs can and have been created physically (e.g., Blascovich, Veach, & Ginsburg, 1973; Zimbardo, 1973), technology allows creation of digital IVEs three-dimensional representations of humans (Figure 1) and environments (Figure 3).

Proponents (Blascovich et al., 2002) for the use of IVET in psychological research note that IVET provides near total control over the context, including confederate behaviors and organismic characteristics (e.g., sex,

Figure 1. Black and White agents.

stature, ethnicity). Furthermore, IVET assures exact replications of confederate behaviors and appearance across participants within experimental conditions. While other authors have questioned the degree to which these increases in control are beneficial (Groom, Sherman, & Conrey, 2002), IVET also provides a wealth of covert, continuous, and on-line behavioral data as a function of the necessary continuous tracking of participants' physical movements (e.g., head orientation, body position) for rendering these movements within IVEs.

A typical IVET system (Figure 2) consists of a body location and head orientation tracker, a graphics-rendering computer, and an audiovisual display, typically a head-mounted display (HMD). Exact proxemic information (e.g., positions and orientations of participants' body and head) is recorded continuously at a high sampling rate (e.g., 20 Hz). Tracking data are used by the rendering computer to generate appropriate stereoscopic visual and auditory stimuli to display with the HMD. This occurs so quickly that participants remain unaware of any time lag between their movements and receipt of stimuli. This type of system allows

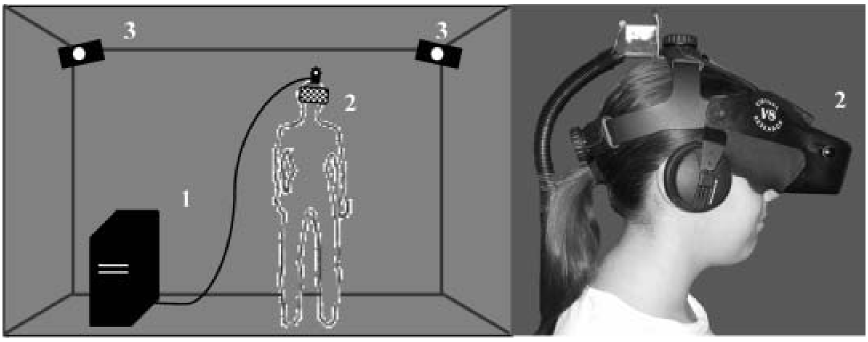

Figure 2. IVET system: computer (1), head-mounted display (2), position-tracking cameras (3).

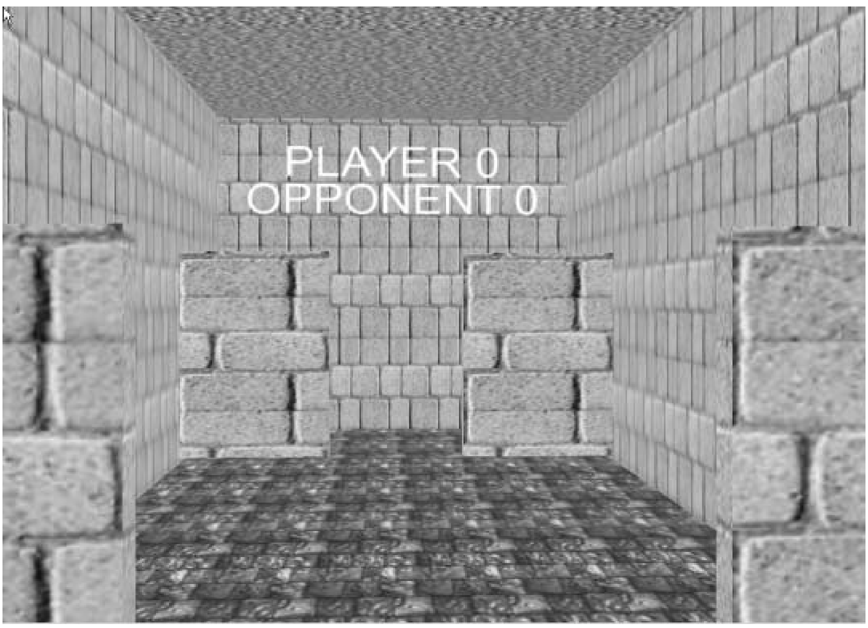

Figure 3. Screenshot of experimental IVE.

participants to move freely in the physical space in which the IVE experience takes place while experiencing their movements phenomenologically in the digital IVE they are navigating.

Automatic tracking generates precise proxemic measures synchronized with participant and virtual confederate behaviors. For example, Bailenson and colleagues (Bailenson, Blascovich, Beall, & Loomis, 2003) successfully used interpersonal distance measures to examine social influence within IVEs.

OVERVIEW OF PRESENT EXPERIMENT

Our intent was to use IVET to generate literature-based proxemic measures to determine whether subtle nonverbal behavior would predict overt acts of aggression. The experiment involved two critical tasks. Within an IVE, participants first met and circumambulated two same-race computer-generated agents in a "get acquainted" procedure. Second, participants competed against the agents in a virtual gunfight. Agent race (Black or White) was manipulated between conditions.

During the first task we gathered data on the interpersonal distance between participants and agents as well as participants' head orientations toward (or away from) the agents. During the second task we recorded the number and location of participants' gunshots to determine the aggressiveness of participants' shooting patterns. Given the evidence that greater interpersonal distance and avoidant physical orienting indicate negative attitudes, we hypothesized that these variables would predict aggressiveness or hostility of participant gunshots. Because of the prevalence of negative attitudes toward Black men (e.g., Nosek, Banaji & Greenwald, 2002), we anticipated this relationship to be the strongest in the Black agent condition.

METHOD

Participants and design

A total of 47 (35 male, 12 female) undergraduates received course credit for participation. Of these, 32 self-identified as White, 8 as Latino, 4 Asian, 1 as multiracial, and 2 provided no identification. We randomly assigned participants to either the Black or White agent condition.

Instrumentation

Hardware and software. Participants head and body movements were tracked via a Worldviz© (Precision Position Tracker 1.1) system. Participants' head orientations were tracked by an Intersense© (model IS300) sensor (Figure 2). Tracking data enabled the rendering of the appropriate virtual scene so that when participants moved their heads the scene would change appropriately. The IVE was rendered via a Virtual Research© (Model V8) stereoscopic head mounted display (HMD) with 680×480 dpi resolution LCD panels with a 60 Hz refresh rate, a horizontal span of approximately 50° degrees, and a vertical span of approximately 38°. All software was written in Vizard© 2.0.

Agents and room. The agents had photorealistic heads created using Biovirtual 3DMeNow Professional© software. The Black and White male heads were pre-tested for attractiveness, competitiveness, and likeability. These ratings were similar for the White and Black agents, with the latter rated slightly but not reliably more positively.

Both tasks occurred in the same IVE (9 m × 3.6 m × 3.4 m; Figure 3). Two pairs of short walls divided the room. The introduction task occurred behind one wall (3.6 m × 2.0 m × 3.4 m). The gunfight occurred across the room length with participant and agents at opposite ends. A scoreboard displayed player and opponent scores. Participants used a gun controller complete with trigger, the orientation and position of which were tracked to animate a virtual gun visible in the IVE.

Gunfight. We adapted a gunfight IVE (Persky & Blascovich, 2007) designed to be easy to play. Participants, performing individually, shot at two opponents at the opposite end of the IVE. Participants could hide behind either of two virtual walls.

Procedure

Participants were informed that they would play a violent video game in an IVE. After providing informed consent, participants were told that they would meet two computer-generated agents with whom they would subsequently engage in a virtual gunfight. After explaining these tasks, an experimenter explained how to put on the HMD, and instructed participants to do so. Subsequently, participants adjusted the HMD position and focus and familiarized themselves with the IVE.

During the first task participants stood on one side of the room (Figure 4). An agent appeared 2 meters away facing the participant (Figure 4). Participants were instructed to walk toward the agent, look at a number on his back, and then report the number. Next, the agent disappeared and the participants returned to their original position. The same procedure was followed during a meeting with the second agent. Subsequently participants received the gun controller and practiced shooting a bull's-eye target at the opposite end of the room. After participants could hit the bull's-eye three times in succession, the game began.

Participants were instructed to score as many points as possible by shooting opponents as many times as possible and avoiding being shot. Participants received one point for each agent hit regardless of the hit location. Participants knew they had unlimited ammunition and could stand behind the blocking walls (Figure 3) for protection. During the game the agents fired repeatedly at participants while dodging back and forth from behind their own blocking walls. When hit, participants saw a flash of red and heard a sound suggestive of a bullet wound. When hit, agents would cry

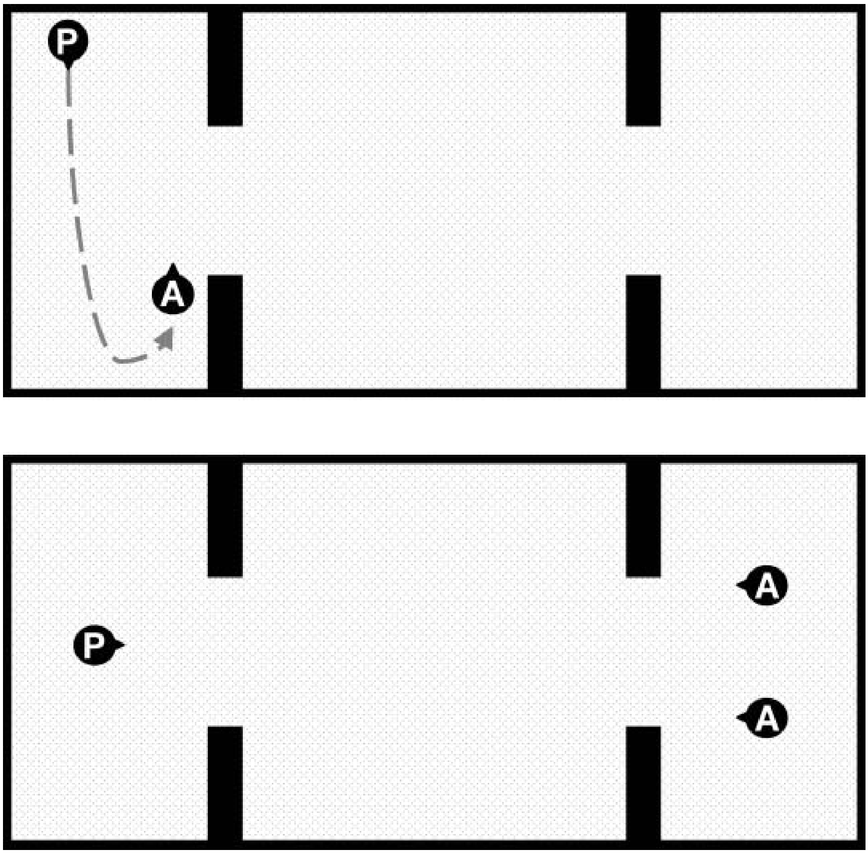

Figure 4. "Bird's eye" view of IVE during introduction (top) and gunfire exchange (bottom) tasks.

out, fall back, and a blood splatter would appear at the shot's location. Agents' and participant's guns made gunshot sounds when fired. The game lasted 3 minutes. Subsequently, participants removed their HMD and entered a separate room to complete a questionnaire. Finally, participants were probed for suspicion and debriefed.

Dependent measures

Proxemics. During the introduction task participants' body locations and head orientations were recorded at 8 Hz. Location was indexed by the three-dimensional polar coordinates (x, y, and z) of the light on the top of the participant's HMD. Orientation was indexed by a sensor on top of the HMD.

Shooting data. Location was recorded for every agent hit and classified according to one of four categories: (1) head; (2) torso; (3) legs; or (4) feet. Total hits were also recorded. Based on theoretical rationales and validational data (see below), head shots were regarded as more aggressive and hostile than shots to other bodily zones.

We have several theoretical rationales for claiming that head shots are more aggressive and hostile. For one, such shots are thought to be more likely to cause serious injuries and fatalities. For another, disfigurements of the face are identity destroying and, hence, are more personal and vicious. Furthermore, within the context of the digital representations of the agents, skin color, hair, and facial characteristics were only visible via the head and face. Hence, race was represented visually via the head and face making this bodily region the most identifiable racial target.

In a preliminary validational experiment participants were exposed to a series of animations in which pairs of computer-generated figures (similar to those used in the study, but with White faces) were "shot" in various parts of the body. Participants viewed animated shots paired on different body locations (e.g., head vs torso) and identified which shot in each pair was higher on each of several dimensions. Luce's Choice Model (Luce, 1959) was used to derive scale values for each zone across the 72 participants. Binomial tests demonstrated that head shots were chosen as significantly more aggressive, angry, mean, violent, cruel, hateful, personal, and less calm than shots directed at the torso, legs or feet, all $zs>2.87$, all $ps<.01$. Table 1 summarizes these data and significance tests.

TABLE 1
Scaled rankings for descriptors of animated gunshots

	Location of shot on target's body			
Descriptor	*Head*	*Torso*	*Legs*	*Feet*
Aggressive	1.00**	0.11***	0.02***	0.00
Angry	1.00***	0.21***	0.04***	0.01
Mean	1.00***	0.19***	0.03***	0.03
Violent	1.00***	0.09***	0.01***	0.00
Calm	1.00	3.67***	20.00***	17.72***
Calculated	1.00	0.59*	0.41	0.66
Cruel	1.00***	0.23***	0.06***	0.02
Hateful	1.00***	0.21***	0.03***	0.02
Intelligent	1.00	0.67	0.69	0.75
Personal	1.00**	0.49***	0.09	0.10

Scale values were produced from pairwise comparisons using Luce's choice model. Significance was calculated using binomial tests. Asterisks refer to downwards comparisons such that significance refers to significant differences between that body part and the next highest ranking body part for the given descriptor. *$p<.05$. **$p<.01$. ***$p<.001$.

Questionnaire data. A computerized questionnaire assessed demographic information, experience with video games, experience of aggression and threat during the gunfight, feelings of immersion, and feelings towards the agents.

RESULTS

Data collection

Primary data were recorded automatically by the IVET system. Proxemic data included interpersonal distance and head orientation measures as described above. Questionnaire data were collected via computer.

Scoring

Interpersonal distance. The minimum distance participants maintained between themselves and the agent (within 180° of the vertical plane of the agent's eyes) was recorded during the introduction to the first agent. Minimum distance measured how closely the participant approached the agent and is not skewed by the amount of time spent in any one place or by the participant's origin location (Bailenson et. al., 2003; Hayduck, 1983).

Head orientation. With agent as the reference point, we divided the participant's field of view (50° while wearing the HMD) into three equivalent sections on the horizontal span (16.67° each). Time facing the agent was defined as the proportion of time in which the center of the agent's body was visible within the center portion of the HMD (the 16.67 central degrees of the horizontal span). Finally, the variance of yaw orientations (rotations from side to side) and pitch orientations (upward and downward rotations) were calculated for each participant.

Shots. The IVET system calculated total shots and shots hitting agents, and categorized the location of the latter.

Questionnaire data. Experiences of aggression during the game were assessed using a questionnaire (Persky & Blascovich, 2007) that instructed participants to rate their experience on items related to aggressive emotions (aggressive, aggravated, dominant, angry, mean, violent, mad) and items related to non-aggressive emotions (peaceful, kindly, agreeable, sociable, calm, cheerful, bored; Cronbach alpha=0.81). Feeling of immersion was assessed by items to which participants responded on Likert-type scales (Cronbach alpha=0.88). Feeling of threat was obtained via a single

TABLE 2
Means of dependent measures by condition

	White agent condition	*Black agent condition*
Proxemic measures		
Minimum distance (meters)*	0.50	0.66
Percentage of time facing agent	0.40	0.45
Variance of yaw (meters)	18.11	17.32
Shooting measures		
Proportion of head hits	0.10	0.12
Proportion of torso hits	0.46	0.50
Proportion of leg hits	0.40	.34
Proportion of feet hits	0.04	.03
Total hits	87.46	87.35
Self-report measures		
Aggression scale	2.62	2.51
Immersion scale	4.99	4.94
Experience of threat	2.35	2.36
Video game experience (hrs/wk)	4.63	5.36

$^*p<.01$.

Likert-type scale. Videogame experience was reported as frequency of reported play.

Analyses

Initial analyses. We subjected all dependent measures to t-tests comparing the two experimental conditions. The only dependent variable to reach significance was minimum distance such that participants in the Black agents condition maintained greater minimum distance ($M=.66$ m) than participants in the White condition ($M=.50$ m), $t(43)=3.42$, $p<.01$.[1] As expected, feelings of immersion, feeling of threat, and video game experience did not differ by condition (see Table 2).

Relationships between proxemic measures and shooting behavior. A multivariate regression using condition and interpersonal distance as predictors of the proportion of head hits during the gunfight was significant $R^2=.211$, $F(2, 42)=5.63$, $p<.01$, with minimum distance as the only significant predictor ($b=.225$, $p<.005$). As such, the further participants stayed from the agents during the introduction task, the higher their

[1] Two participants' data were lost due to technical difficulty.

percentage of the aggressive head hits during the game. Given our hypotheses and the interaction trend found between condition and minimum distance (b=.260, p=.11), we proceeded with within-condition analyses of these data. In the Black agents condition, minimum personal distance correlated significantly with head hits, b=.308, $t(41)$=3.44, p=.001. However, this relationship was not significant for participants in the White condition, b=.048, $t(41)$=.37, *ns* (Figure 6). Figures 5a and 5b depict participants' paths during the introduction task as a function of whether or not they were above or below the median in head hits in the subsequent gunfire exchange separately by condition.

We conducted another regression, this time using condition and time spent facing the agents during the introduction task as predictors of head hits. The main effects at the first level of this regression were not significant, R^2=.089, $F(2, 42)$=2.05, p=.14, although a significant interaction between condition and time spent facing the agents emerged, b=.295, p<.05. To examine this interaction, we looked at the relationships between looking behaviors and shooting patterns in the individual conditions. In the Black agents condition the less time participants faced the agents, the more they shot their heads during the game, b=−.256, $t(41)$=−2.48, p=.02. This

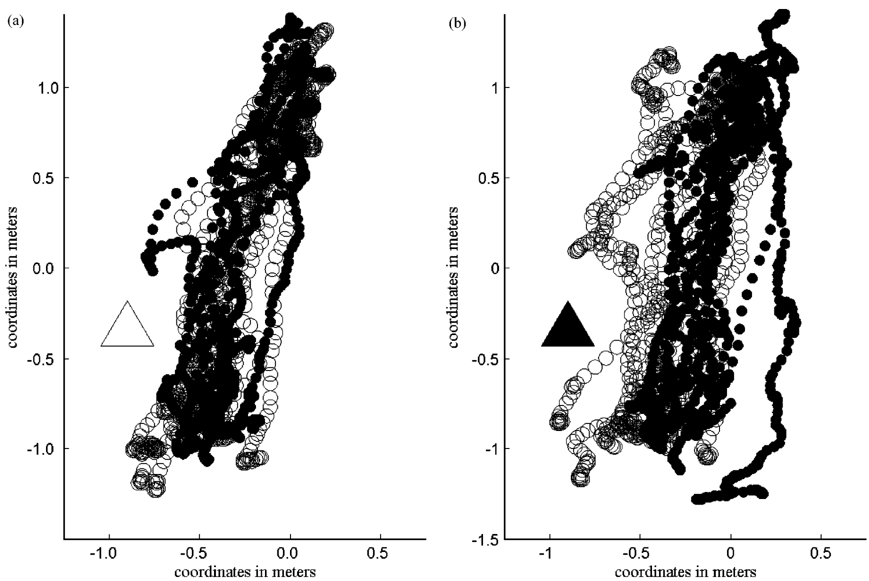

Figure 5. (a) Participants' paths in the introduction task as a function of head hits (above or below median) during gunfire in the White agent condition. (b) Participants' paths in the introduction task as a function of head hits (above or below median) during gunfire in the Black agent condition. •=above-median head hits, ○=below-median head hits.

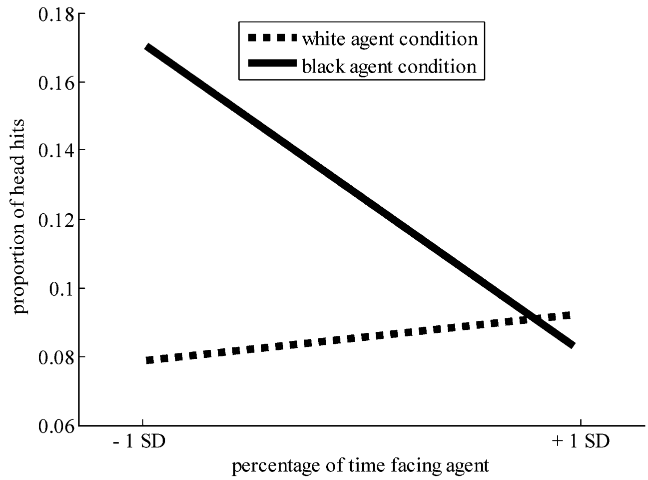

Figure 6. Percentage of time facing Black and White agents as a predictor of head shots.

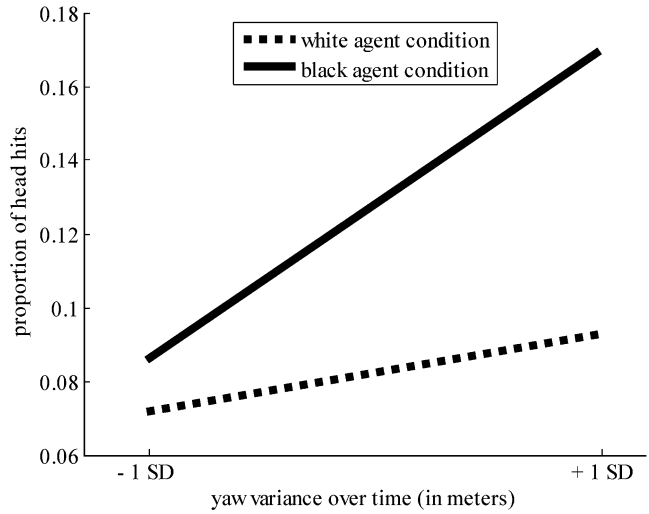

Figure 7. Yaw variance as a predictor of head shots for Black and White agent conditions.

relationship did not emerge in the White agents condition, b=.039, t(41)=.38, *ns* (Figure 7).

A regression using the variance in yaw orientation and condition as predictors was significant, R^2=.164, F(2, 42)=4.11, p=.02, with a significant main effect of yaw orientation, b=.006, p=.019. As such, the more that participants moved their heads around during the interaction, the more they delivered head hits during the gunfight. There was no interaction between condition and yaw variance in this model.

We conducted further analyses to examine the relationship between the proxemic measures and the less aggressive gunshot (toward the feet, legs and torso). Among these regressions the only significant relationship to emerge was with condition and interpersonal distance as predictors of shots toward the feet, R^2=.164, F(2, 42)=4.11, p=.02, where interpersonal distance was the significant predictor, b=−.108, p=.01. The further participants stayed from the agents, the less they shot their feet. None of the other proxemic variables predicted shots toward the feet, legs, or torso (all ps>.14). Similarly, none of the proxemic variables significantly predicted the total number of hits (anywhere on the agents' bodies), all ps>.5.

Regression with combined proxemic measures. To further examine the relationship between the proxemic and shooting data for participants in the Black condition we performed a multivariate regression, entering the three proxemic variables (minimum distance, percentage of time facing the agent, and variance in yaw) simultaneously. Together, these variables accounted for 50% of the variance in proportions of head hits, R^2=.497, F(3, 19)=6.26, p<.004. The standardized partial regression coefficients reveal both minimum distance (β=.476, p<.02) and percentage of time facing the agent (β=−.356, p<.05) contributed significantly to the model; variance in yaw did not contribute significantly (β=.146, p>.45). These findings suggest a pattern whereby highly aggressive shooters either kept greater distance from Black agents during the introduction task or oriented away from Black agent during that task. The same regression analysis for participants in the White condition proved non-significant at all levels (p>.85).

Correlations with game data and questionnaire. In line with our validated contention that head shots are indicative of greater aggression, the higher the proportion of head hits delivered during the game, the more highly participants scored on retrospective self-reported aggression, r(43)=.35, p<.02. Proportions of head hits were also correlated with retrospective self-reports of finding the game threatening, r(43)=.30, p<.05. In terms of individual scale items, feeling dominant, r(43)=.43, p<.005, violent, r(43)=.41, p<.006, and mean, r(43)=.36, p<.02, correlated positively with proportion of head hits. Feeling peaceful correlated negatively, r(43)=−.36, p<.02.

DISCUSSION

Immersed in a realistic IVE, participants "met" and subsequently engaged in gunfire with Black or White opponents. Participants' interpersonal distance and head orientation during the meeting predicted 50% of the variance in aggressive gunfire for Black, but not White, opponents. There were no differences by condition in participant's self-reported immersion, or feelings of threat or aggression. These results indicate that participants' avoidant proxemic behaviors toward Black agents predicted hostility in a violent context.

While some authors have argued that the benefits of IVET for experimental control in social psychological research are limited (Groom et al., 2002), it is difficult to imagine a similar experiment being conducted outside of a digital simulation. Furthermore, evidence suggests that the immersion provided by this technology elicits more aggression than an equivalent game on a computer desktop (Persky & Blascovich, 2007), making the current virtual environment a better proxy for real-world hostility.

The current results also support the Blascovich et al. (2002) claim that IVET makes practical the collection of interpersonal proxemic data as markers of psychological constructs such as attitudes. The head-tracking data employed in these analyses afforded an unusually comprehensive account of the participants' nonverbal behavior during their initial interactions with the agents. The predictive strength of these data is particularly promising given that the meeting task in this study was a relatively pared-down interaction. One can easily imagine how similar data might benefit analyses of more complex interactions (e.g., a job interview).

Regardless, the current findings raise several questions. For one, the fact that no differences emerged between the Black agents and White agents conditions in either amount or aggressiveness of gunfire may seem counter-intuitive given the body of evidence demonstrating a "weapon bias" (Correll, Park, Judd, & Wittenbrink, 2002; Payne, 2006). In comparable studies on that phenomenon, participants (regardless of their own ethnicity; Correll et al., 2002) are faster to shoot armed Black targets and more likely to mistakenly shoot unarmed Black targets when given the task to decide whether or not those targets are holding a weapon. Evidence strongly suggests that this bias is dependent, at least in part, on the automatic influence of stereotypic associations on snap judgments (Payne, 2006). In the current study, however, no such judgments were required. Instead, the participants' goal was simply to shoot the targets as much as possible and to avoid being shot. It seems likely, then, that bias observed in the current paradigm may be less dependent on semantic pairings and more dependent on affective responses. However, more research is necessary to support this claim.

Another counterintuitive effect in these data was the fact that no significant relationships emerged between proxemic measures and behavioral aggression in the White agents condition. Why did avoidant proxemic behavior predict aggression towards Blacks but not Whites? While the data do not speak directly to this question, we believe that an automatic negative response to Blacks (Nosek et al., 2002) elicited a more cohesively aggressive response among more racially biased participants. This response, in turn, produced both an avoidant nonverbal response and a more hostile shooting pattern. The White agents condition may have failed to produce the same correlation between proxemic and shooting behaviors because there was no comparably systematic negative response. While the current data do not speak to this claim, we would predict that agents who elicit any kind of hostile reaction from a subsection of participants would produce the same predictive relationship between the subtle nonverbals and more overt aggression.

One potential confound in this study is the fact that White participants (the majority of participants) in the Black agents condition were tokens in the virtual world in so far as they were the minority among the players, whereas White participants in the White agents condition were not. To the extent that the experience of tokenism is threatening, it may have contributed to behavioral responses of White participants in the Black agents condition. The proxemic data that we analyzed in this study, however, were gathered during the participants' interaction with the first agent, an interaction that occurred before participants had seen the other opponent and before they could have become aware of their token status. As such, we hold to the claim that the proxemic data belied attitudes that were, in turn, expressed through aggression toward Black agents in the subsequent gunfight.

In sum, this study presents evidence that suggests that subtle "everyday" discriminatory nonverbal behavior may correspond with more obviously hostile and aggressive expressions of prejudice. We believe these data provide a link between implicit proxemic measures of attitude and actual racial discrimination within a violent context.

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REFERENCES

Allport, G. W. (1935). Attitudes. In C. Murchison (Ed.), *Handbook of social psychology* (pp. 798–794). Worcester, MA: Clark University Press.

Argyle, M. (1975). *Bodily communication*. New York: International University Press, Inc.

Bailenson, J. N., Blascovich, J., Beall, A. C., & Loomis, J. M. (2003). Interpersonal distance in immersive virtual environments. *Personality and Social Psychology Bulletin*, *29*, 819–834.

Bessenhoff, G. R., & Sherman, J. W. (2000). Automatic and controlled components of prejudice toward fat people: Evaluation versus stereotype activation. *Social Cognition*, *18*, 329–353.

Blascovich, J., Loomis, J., Beall, A., Swinth, K., Hoyt, C., & Bailenson, J. (2002). Immersive virtual environment technology as a research tool for social psychology. *Psychological Inquiry*, *13*, 103–125.

Blascovich, J., Veach, T. L., & Ginsburg, G. P. (1973). Blackjack and the risky shift. *Sociometry*, *36*, 42–55.

Correll, J., Park, B., Judd, C. M., & Wittenbrink, B. (2002). The police officer's dilemma: Using ethnicity to disambiguate potentially threatening individuals. *Journal of Personality and Social Psychology*, *83*, 1314–1329.

Dasgupta, N. (2004). Implicit ingroup favoritism, outgroup favoritism, and their behavioral manifestations. *Social Justice Research*, *17*, 143–169.
Dovidio, J. F., Gaertner, S. L., Kawakami, K., & Hodson, G. (2002). Why can't we just get along? Interracial biases and interracial distrust. *Culture Diversity and Ethnic Minority Psychology*, *8*, 88–102.
Dovidio, J. F., Kawakami, K., Johnson, C., Johnson, B., & Howard, A. (1997). On the nature of prejudice: Automatic and controlled processes. *Journal of Experimental Social Psychology*, *33*, 510–540.
Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology*, *54*, 297–327.
Groom, C. J., Sherman, J. W., & Conrey, F. R. (2002). What immersive virtual environment technology can offer to social cognition. *Psychological Inquiry*, *13*, 125–128.
Hall, E. T. (1959). *The silent language*. Garden City, NY: Doubleday.
Hayduck, L. A. (1983). Personal space: Where we now stand. *Psychological Bulletin*, *2*, 293–335.
Hendricks, M., & Bootzin, R. (1976). Race and sex as stimuli for negative affect and physical avoidance. *Journal of Social Psychology*, *98*, 111–120.
Knowles, E. S. (1980). Convergent validity of personal space measures: Consistent results with low correlations. *Journal of Nonverbal Behavior*, *4*, 240–248.
Luce, R. D. (1959). *Individual choice behavior: A theoretical analysis*. New York: John Wiley & Sons, Inc.
Mead, G. H. (1925). The genesis of the self and social control. *International Journal of Ethics*, *35*, 251–277.
Mehrabian, A. (1968). Relationship of attitude to seated posture, orientation and distance. *Journal of Personality and Social Psychology*, *10*, 26–30.
Mehrabian, A. (1969). Significance of posture and position in the communication of attitude and status relationships. *Psychological Bulletin*, *71*, 359–372.
Nosek, B. A., Banaji, M., & Greenwald, A. G. (2002). Harvesting implicit group attitudes and beliefs from a demonstration web site. *Group Dynamics: Theory, Research, and Practice [Special Issue: Groups and Internet]*, *6*(1), 101–115.
Payne, B. K. (2006). Weapon bias: Split-second decisions and unintended stereotyping. *Current Directions in Psychological Science*, *15*(6), 287–291.
Persky, S., & Blascovich, J. (2007). Immersive virtual environments versus traditional platforms: Effects of violent and nonviolent video game play. *Media Psychology*, *10*(1), 135–156.
Plant, E. A., & Devine, P. G. (1998). Internal and external motivation to respond without prejudice. *Journal of Personality and Social Psychology*, *75*, 811–832.
Rudman, L. A. (2004). Sources of implicit attitudes. *Current Directions in Psychological Science*, *13*(2), 79–82.
J. A. Simpson, & S. C. Weiner, (Eds.). (1989). *The Oxford English dictionary*. London: Oxford University Press.
Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, *7*, 225–240.
Wittenbrink, B., Judd, C. M., & Park, B. (1997). Evidence for racial prejudice at the implicit level and its relationship with questionnaire measures. *Journal of Personality and Social Psychology*, *72*, 262–274.
Word, C. O., Zanna, M. P., & Cooper, J. (1974). The nonverbal mediation of self-fulfilling prophecies in interracial interaction. *Journal of Experimental Social Psychology*, *10*, 109–120.
Zimbardo, P. G. (1973). On the ethics of intervention in human psychological research: With special reference to the Stanford prison experiment. *Cognition*, *2*, 243–256.