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The Unbearable Likeness of Being Digital: The Persistence of Nonverbal Social Norms in Online Virtual Environments

NICK YEE, M.S.,[1] JEREMY N. BAILENSON, Ph.D.,[1] MARK URBANEK, B.S.,[1]
FRANCIS CHANG, M.S.,[3] and DAN MERGET, M.S.[2]

ABSTRACT

Every day, millions of users interact in real-time via avatars in online environments, such as massively-multiplayer online role-playing games (MMORPGs). These online environments could potentially be unique research platforms for the social sciences and clinical therapy, but it is crucial to first establish that social behavior and norms in virtual environments are comparable to those in the physical world. In an observational study of Second Life, a virtual community, we collected data from avatars in order to explore whether social norms of gender, interpersonal distance (IPD), and eye gaze transfer into virtual environments even though the modality of movement is entirely different (i.e., via keyboard and mouse as opposed to eyes and legs). Our results showed that established findings of IPD and eye gaze transfer into virtual environments: (1) male-male dyads have larger IPDs than female-female dyads, (2) male-male dyads maintain less eye contact than female-female dyads, and (3) decreases in IPD are compensated with gaze avoidance as predicted by the Equilibrium Theory. We discuss implications for users of online games as well as for social scientists who seek to conduct research in virtual environments.

INTRODUCTION

A significant portion of the world's population spends time online every day, using email, chat-rooms, instant messaging, and websites to interact with one another. In one type of these online environments, known as massively-multiplayer online role-playing games (MMORPGs), millions of users spend on average 22 h a week interacting with each other through avatars.[18,38,39] In the current work, we were concerned with examining the subtle nonverbal and verbal behaviors of avatars in MMORPGs and other online forums, and comparing online behavior to typical face-to-face behavior. There are two main reasons for studying the similarities between user behavior in online environments and typical behavior in physical environments—to determine the positive and negative effects that online environments have on users in a media effects tradition, and to validate online games as a platform to study physical social interaction, both on the micro and macro level.

The first concerns a "Media Effects" tradition within behavioral science. According to this paradigm, in order to understand the impact that a certain medium has upon an individual, it is important to understand how well he or she differentiates the media from actual reality. For example, early work by Bandura[7] demonstrated that children would imitate violence that they watched on

Departments of [1]Communication and [2]Computer Science, Stanford University, Stanford, California.
[3]Department of Computer Science, Portland State University, Portland, Oregon.

television. Demonstrating this one-to-one mapping between mediated behavior (i.e., behavior seen on television and video games) and actual behavior is one of the cornerstones of the media effects tradition. Similarly, a vast majority of behavioral science within virtual environments is predominantly concerned with the construct of presence. Presence[9,23,26–28] is a latent construct that roughly measures how 'real' one believes a mediated environment is in terms of nonverbal behaviors,[17] physiological responses,[36] and other measures. In sum, to understand how large the potential a medium has to change an individual, researchers have typically measured how realistically a user behaves while inside of that medium.

The second main motivation for comparing online behavior in Second Life with the types of behaviors people exhibit in the physical world concerns the use of such online arenas as a testing platform. In other words, if it is the case that behavior online is largely similar to physical behavior, then it becomes possible to use these online worlds to test behavioral science theories that are predominantly concerned with physical behavior, both at the micro level and at the macro level. At the micro level, people have utilized this paradigm within the laboratory to study a number of types of social interaction behaviors. For example, by being able to take advantage of the experimental control, precise measurement abilities, and ease of replication that is intrinsic to virtual environments,[10] researchers have learned more about learning,[24] human conformity, therapeutic potential,[16,32] and nonverbal behavior.[1,8] Alternatively, at the macro level, there is the potential to use online forums to explore economics[13] and legal issues.[6,25] For example, if one wants to test a theory about currency and inflation, these online environments can function as a much more generalizable simulation than a mathematical model. A researcher can simply change the value of an online currency and witness the effects it has on the online community. In another example, researchers interested in studying the effect of parental investment on gender and dating behavior can simply change the rules of the online forum such that males are forced to carry a child instead of females, or to change the gestation period from 9 months to a shorter period. Because online forums allow manipulations that are not possible to implement in the physical world, they allow us to examine unique research questions. However, before attempting such elegant manipulations, it is crucial for us to demonstrate that behavior in these online worlds has some similarity to typical behaviors in physical worlds.

Second life

Second Life is the virtual world where we conducted our current study. Its maker, Linden Labs, describes it as "a 3D online persistent space totally created and evolved by its users."[35] Users navigate, interact, and view the world through their own customized avatar—a digital representation of themselves. Every object in the world, including the avatars, the trees, the buildings, and the roller coasters are 3D objects rendered in real-time. Users communicate via typed chat and pre-recorded animations. More elaborate animations allow more complex behaviors, such as dancing. Users interact with objects via a graphical user interface that is largely mouse-driven.

Relevant nonverbal theories

Nonverbal communication has been recognized as a key component of interpersonal interaction.[3,19] One aspect of nonverbal communication that has received a great deal of attention is proxemics, also known as interpersonal distance.[22] This line of research began with Hall's observation that people maintain personal buffer spaces around themselves and each other.[19] Others have shown that the size of this personal space can be moderated by other factors, such as culture,[20] race and gender,[34] age,[37] and affiliation.[15] Several theories and findings within the proxemics literature guided our predictions for the current study.

Gender and interpersonal distance. Research on the effects of gender on interpersonal distance (IPD) has been mixed. Some researchers have argued that IPD is largest among male-male dyads, smallest among female-female dyads, and between those extremes for mixed dyads. And to a certain extent, this has been demonstrated,[1,2] however, meta-analyses have shown how mixed the overall data is. In a review of 110 studies,[22] only 27 were found to support this hypothesis. The other 83 found mixed results or no gender differences at all. While the literature on the effect of gender on IPD is inconclusive, we hypothesized, in accordance with the dominant theoretical proposition in the literature,[22] that male-male dyads in an online environment would have larger IPDs than female-female dyads.

Equilibrium theory. According to research,[3,12,21,30,33] the degree of intimacy within a dyadic interaction is maintained by compensatory changes in gaze or IPD. In other words, if we get too close to a person with whom we do not want to share high amounts of intimacy, we can avert our gaze to reduce that undesired intimacy and return to an equilibrium state (such as not standing face-to-face in an elevator). Thus, in our current study, we predicted that this equilibrium effect could be documented in an online environment. We hypothesized that mutual gaze and IPD would be inversely correlated in an online environment. Within the accepted social distance of 12 feet,[19] the closer two avatars are, the less likely they will maintain mutual eye contact.

Gaze and turn-taking. Eye gaze also plays an important role in regulating turn-taking behavior in conversations.[3] In particular, eye gaze signifies attention.[11] Thus, we hypothesized that mutual gaze in a dyad in an online environment would be more likely to occur if one of the two interactants was talking. Previous research has also demonstrated gender differences in mutual gaze. In particular, female-female dyads are more likely to exhibit mutual gaze than male-male dyads and mixed dyads.[29] Thus, we hypothesized that this same pattern of gender difference would be observed in a virtual environment.

Previous studies in immersive virtual environments. Another reason to suspect that these social norms do carry over into online environments is because previous research in immersive virtual environments (IVE)[10] has shown that participants given digital representations behave according to well-known IDP norms. In an IVE, a user moves through the virtual environment by moving in the physical world and having their movements tracked and rendered via a series of sensors and displays. Studies in IVEs have shown that the amount of IPD changes with situational aspects of the relationship such as familiarity[4] and mutual gaze is inversely correlated with IDP as predicted by the Equilibrium Theory.[5] In the same way that media interfaces are treated as social actors,[31] we hypothesized that the social norms of the physical world would be observed in virtual environments such as Second Life.

METHODS

Data collection

A triggered script was used to collect information from avatars in the world. When triggered by a designated key press, the script would collect the name, Cartesian coordinates (x, y), and yaw of the 16 avatars closest to the user within a virtual 200-meter radius. The script would also track whether the avatars were talking at that given moment. The script would then store the information as a text file.

Six research assistants, paid at an hourly rate for 10 h a week, collected data within Second Life over a period of 7 weeks. There were 688 zones (discrete locations) in Second Life, and undergraduates were each assigned to 115 zones. These research assistants were instructed to systematically explore the zones and trigger the script near locations where a group of at least two people were interacting. Several types of locations were excluded from the data collection because of activity-specific positional configurations. These were (1) dance clubs, (2) sex clubs, (3) classrooms, (4) casinos and parlor games, and (5) similar locations where physical architecture constrained position and orientation (such as movie theatres).

Measures

The following variables were captured or calculated for each snapshot. Because our analyses of interpersonal distance and mutual gaze were based on dyads, we parsed the data to extract all unique dyads. For example, in an interaction among A, B, and C, there are three unique dyads.

Gender. After each triggered script snapshot, the research assistance noted down the gender of each avatar that had been captured. This was necessary because the gender of an avatar is not retrievable via the scripting system in Second Life. In many cases, however, the gender of avatars was unable to be determined, as users chose to be androgynous or non-human. Each dyad was then coded as male-male, female-female, or mixed.

Interpersonal distance. The distance between avatars in each unique dyad was calculated (in meters) from the positional data.

Mutual gaze. From the captured data, we calculated the gaze angles of avatars in each dyad. A gaze angle of 0 degrees means that the avatar was looking directly at the other avatar. A gaze angle of 180 degrees means that the avatar was looking directly away from the other avatar. And of course, the gaze angles of the two avatars in a dyad need not be congruent. We summed these two gaze angles for each dyad to create a new variable *gaze sum* that measured how much the two avatars were looking at each other, as Figure 1 demonstrates.

Talking. From the captured data, we were also able to determine whether the avatars were "talking" the moment the screenshot was captured. Second Life

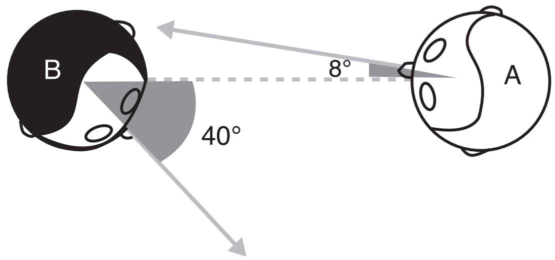

FIG. 1. Avatar A is gazing at avatar B at an angle of 8 degrees. Avatar B is gazing at avatar A at an angle of 40 degrees. Their gaze sum is 48 degrees.

provides an animation while users are typing (and thus before their message itself is finished and seen). If users were in this "is typing" mode, they were coded as "talking." We coded these as binary. We summed these two binary numbers to create a new variable talking sum that measured whether the amount of talking between two avatars.

Location. The research assistants also noted whether the interaction occurred in an indoor or outdoor location. Because indoor spaces are necessarily smaller than unbound, outdoor spaces and thus would affect IPD, we included this factor in our analyses.

RESULTS

Our sampling method produced 417 snapshots. From the snapshots, we extracted 8418 unique dyads. Because our snapshot script captured avatar data in a radius of up to 200 m, we applied an exclusion criterion to filter out individual avatars that were too far away to be in a social interaction. Hall[19] estimated that social distance extends up to 12 feet (or 3.66 m). For the following analyses, we used a social distance of 3.66 m as the cut-off for whether two avatars are considered to be a dyad. Altogether, our sampling method produced 835 unique dyads after applying this exclusion criterion.

Interpersonal distance

Using this data composed of unique dyads, we ran an analysis of variance (ANOVA) with gender composition (male-male, female-female, mixed) and location (indoor and outdoor) as fixed factors, gaze sum and talking sum as linear covariates, and distance between the two avatars as the dependent variable. The effect of gender composition was significant, $F[2,827] = 6.40$, $p = 0.002$, $\eta^2 = 0.014$. A comparison of the estimated marginal means revealed that avatars in the mixed-gender condition ($M = 2.09$, $SD = 0.91$) stood closer together than avatars in the male-male condition ($M = 2.36$, $SD = 0.82$) and female-female condition ($M = 2.34$, $SD = 0.87$), p's < 0.005. The effect of gaze sum was also significant, $F[2,827] = 8.32$, $p = 0.004$, $\eta^2 = 0.01$. The correlation coefficient between gaze sum and distance was -0.10 ($p = 0.001$). In other words, within the range of 3.66 m, the closer two avatars were, the less likely they were maintaining eye contact.

The effect of location was not significant, $F[2,827] = 1.36$, $p = 0.24$, $\eta^2 = 0.002$. The effect of talk sum was also not significant, $F[2,827] = 0.16$, $p = 0.65$, $\eta^2 < 0.001$. There was also no significant interaction effect between gender composition and location, $F[2,827] = 0.28$, $p = 0.75$, $\eta^2 < 0.001$.

Mutual gaze

We also ran an ANOVA with gender composition (male-male, female-female, mixed) and location (indoor and outdoor) as fixed factors, distance and talking sum as linear covariates, and gaze sum as the dependent variable. The effect of gender composition was significant, $F[2,827] = 4.37$, $p = 0.01$, $\eta^2 = 0.01$. Comparing the estimated marginal means, we found that avatars in male-male dyads ($M = 140.30$, $SD = 74.98$) were significantly less likely to look at each other than those in female-female dyads ($M = 127.64$, $SD = 50.43$) and mixed dyads ($M = 127.64$, $SD = 96.85$), p's < 0.05. The effect of location was also significant, $F[2,827] = 4.74$, $p = 0.03$, $\eta^2 = 0.01$. Comparing the estimated marginal means, we found that avatars in indoor locations ($M = 135.48$, $SD = 65.30$) were significantly more likely to be maintaining eye contact than avatars in outdoor locations ($M = 123.80$, $SD = 63.54$).

The effect of the covariate talk sum was also significant, $F[2,827] = 8.50$, $p = 0.004$, $\eta^2 = 0.01$. The correlation coefficient between talk sum and gaze sum was -0.08 ($p = 0.007$). In other words, the more that two avatars were talking, the more likely they were looking at each other. The effect of the covariate of distance was also significant and has already been discussed above.

Finally, there was a significant interaction effect of gender composition and location, $F[2,827] = 4.26$, $p = 0.01$, $\eta^2 = 0.01$. The gaze sum of male-male dyads in indoor locations was significantly higher than all other dyads in both indoor and outdoor locations, p's < 0.05. For means and standard

TABLE 1. MEANS AND STANDARD DEVIATIONS OF GAZE SUM BY GENDER COMPOSITION AND LOCATION

	M-M dyad, M (SD)	*F-F dyad, M (SD)*	*Mixed dyad, M (SD)*
Indoor	158.21 (60.12)	127.29 (60.07)	120.95 (60.19)
Outdoor	122.39 (60.27)	128.00 (60.26)	121.00 (60.39)

deviations, see Table 1. In other words, male avatars are less likely to be maintaining eye contact with other male avatars in indoor locations as compared with all other gender composition and location combinations.

DISCUSSION

Our findings supported many of our hypotheses. IPD was significantly larger in male-male dyads than in female-female dyads. The data also supported the Equilibrium Theory. Within the social distance of 3.66 m, mutual gaze was inversely correlated with IPD. The closer that two people were, the less likely they were looking at each other. We also saw support for the hypothesis that eye gaze regulates conversational flow. The more that two avatars were talking, the more likely they were looking at each other. Moreover, we replicated the gender difference in mutual gaze. Male-male dyads were less likely to maintain mutual gaze than female-female dyads and mixed dyads. Finally, these gender differences in mutual gaze were influenced by location. Male-male dyads were significantly less likely to look at each other in indoor locations as compared with all other gender composition and location combinations. This interaction between gender and location makes sense, given that male-male dyads prefer less intimacy, and large IPDs are not allowable in many indoor contexts due to size of the room.

Overall, our findings support our hypothesis that our social interactions in online virtual environments, such as Second Life, are governed by the same social norms as social interactions in the physical world. This finding has significant implications for using virtual worlds to study human social interaction. If people behave according to the same social rules in both physical and virtual worlds even though the mode of movement and navigation is entirely different (i.e., using keyboard and mouse as opposed to bodies and legs), then this means it is possible to study social interaction in virtual environments and generalize them to social interaction in the real world.

This possibility greatly extends the vision of using IVEs as platforms for social research.[10] Every day, millions of users are interacting and collaborating via avatars in a variety of online gaming environments.[38] These social interactions can be easily tracked and aggregated by the servers and analyzed. There are also more flexible platforms, such as Second Life, that allow researchers to create their own experimental scripts. From this perspective, these online gaming environments are both a goldmine of longitudinal social interaction data as well as experimental research platforms that have a far larger population and broader demographic than the typical undergraduate pool.

On the other hand, our study had several limitations. First of all, we only examined one virtual world out of the many that currently exist. It is possible that our findings are driven by the idiosyncrasies and particular mechanics of Second Life and that different norms might emerge in other instantiations of virtual worlds. On the other hand, the congruency of social norms in Second Life and the real world are quite striking and are probably not due to chance or idiosyncrasy alone. Secondly, we were unable to take much of the context into account for our analyses. Some avatars may be meeting for the first time, others may be in a weekly meeting, but our sampling method was unable to take these different contexts into account. Being able to take the context into account may provide another way to explore the social interaction in these worlds. Another limitation of the current data is the size of the effects. In most cases, our observed relationships are only accounting for small percentages of the overall variance in behaviors. However, the effect sizes should get larger as we engage in active manipulations in these worlds, as opposed to mere field observations.

Future studies may pursue several issues. First of all, given that Second Life is just one of many virtual environments currently available, perhaps our findings do not generalize to other virtual worlds. Studies in the future might explore and compare social interaction in different worlds. Patterns of IPD may be different in highly social environments, such as Second Life, and highly instrumental environments, such as the online role-playing games where users need to collaborate to achieve goals.

Many early scholars of cyberspace heralded the freedom that virtual environments would bring. Ironically, users have always insisted on embodiment in virtual environments. Perhaps the documented case of a rape in the textual virtual world LambdaMOO best illustrates our insistence on embodiment and its consequence.[14] Thus even as our identities became virtual, we insisted on embodiment. And in doing so, the rules that govern our physical bodies in the real world have come to govern our embodied identities in the virtual world.

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Address reprint requests to:
Nick Yee
Department of Communication
Stanford University
Stanford, CA 94305

E-mail: nyee@stanford.edu