Do Avatars that Look Like their Users Improve Performance in a Simulation?

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Abstract. Recent advances in scanning technology have enabled the widespread capture of 3D character models based on human subjects. Intuition suggests that, with these new capabilities to create avatars that look like their users, every player should have his or her own avatar to play videogames or simulations. We explicitly test the impact of having one's own avatar (vs. a yoked control avatar) in a simulation (i.e., maze running task with mines). We test the impact of avatar identity on both subjective (e.g., feeling connected and engaged, liking avatar's appearance, feeling upset when avatar's injured, enjoying the game) and behavioral variables (e.g., time to complete task, speed, number of mines triggered, riskiness of maze path chosen). Results indicate that having an avatar that looks like the user improves their subjective experience, but there is no significant effect on how users behave in the simulation.

1 Introduction

The current work considers whether operating an avatar that is built to look like the user will affect enjoyment and performance in a simulation. Prior correlational research suggests that users will enjoy operating an avatar more if it looks like them (vs. someone else). Indeed, players report greater enjoyment of video games to the extent that they identify with the character being operated [e.g., Hefner, Klimmt, & Vorderer, 2007]. Beyond enjoyment, we consider the impact of using one's own avatar on performance. While the effect on performance has been unstudied, prior work suggests that having an avatar who looks more like the user can affect behavior. For example, users who played a violent video game using a character that mirrored their actual physical appearance were significantly more aggressive than those who played the game with a generic avatar [Hollingdale & Greitemeyer, 2013].

If there is a significant effect of operating one's own avatar on performance in a simulation, this could have important implications for certain applications. For example, users in such simulations might act more cautiously with an avatar that looks like them rather than a generic character. To achieve this in a high fidelity application, modern scanning technology that allows for rapid creation of 3D characters from human subjects could be used. While this is becoming more affordable, expenses would still accumulate if it was used on a wide scale across the armed forces. There-

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fore, we conduct research to establish the effects that using one's own avatar has on user engagement, liking, and enjoyment as well as behavior in the virtual environment, especially performance and care that is taken to prevent the avatar from harm.

2 Current Work

One hundred and six participants (65 males, 41 females) completed a study in which they were randomly assigned to complete the maze with an avatar that looked like them or another participant. Participants were recruited off of craigslist and participated for $25. All participants were first scanned using the method proposed in [Feng et al., 2015] to obtain an articulated 3D character from human subjects. We utilized the Occipital Structure Sensor to obtain the 3D avatar scan from the test subject. It is a depth sensor attached on the Apple iPad to allow portable 3D scanning. The body scanning capture and reconstruction takes 10 minutes. Participants were also asked to record 4 utterances for pain reactions (e.g. "Ow!", "Ouch!"). Before beginning the maze task, participants were instructed to navigate a maze as fast as possible while avoiding hitting the mines and the walls, and they would receive entries into a lottery based on their ability to do so. Participants next practiced navigating their avatar for one minute, and then started the maze. Navigation was controlled through a WASD keyboard configuration (a gaming standard similar to the arrow keys). Participants controlled their assigned avatar in a third-person view. Running into an obstacle (e.g. a wall or spiked trap) stopped avatar movement and triggered a sound effect of the avatar expressing pain. Participants in the experimental condition used the avatar that was just created from their scan, while those in the yoked control condition used the avatar that was created from the scan from the last gender-matched participant run. Likewise, in the experimental condition, the pain sounds were their own recordings, whereas in the yoked control condition, they were the recordings of the last gender-matched participant. The cover story suggested that the scanning procedure and the maze running task were unrelated, so that participants in the yoked control condition could have an ostensible explanation for using another avatar. Participants were given 15 minutes to complete the maze. Sixteen participants failed to complete the maze in the time given, and were therefore excluded from analyses below.

After the maze, participants were asked to answer 16 questions about their experience. All items were answered using a 5 point scale ranging from Strongly Disagree (1) to Strongly Agree (5). Participants were asked to complete a manipulation check (1 item) and indicate how realistic the avatar looked (4 items), as well as to report on: the extent to which they were feeling connected and engaged (4 items), how much they liked the avatars appearance (3 items), the extent to which they were feeling upset when the avatar was injured (3 items), and how much they enjoyed the game (1 item). A number of measures were also extracted from the game play during this maze running simulation. First, we measured the total time it took participants to complete the maze in seconds (up to 900 seconds, which corresponded to the 15 minute time limit). We measured the distance they navigated to complete the maze in (virtual) meters, and, thus, also their average speed across the maze in meters per second. We measured the number of times they collided with the maze wall or mines.

Finally, in the areas of the maze where participants had the choice between riskier and safer paths, we calculated the percent of the path that was taken that was risky. We computed the proportion of time spent in the risky zones: (0.5 * (time spent in 1 / time spent in 0, 1, 2)) + (0.5 * (time spent in 4 / time spent in 3, 4, 5)).

3 Results

Analyses are reported for the 90 participants who completed the maze within the given (15 minute) time limit. 2 (condition: experimental vs control) x 2 (gender: male vs female) ANCOVAs were run, controlling for the height of the participant's avatar.

The manipulation check showed that our manipulation was succesful (M = 4.39, SE = 0.16 vs M = 2.37, SE = 0.15; $F(1,85) = 85.69$; $p < .001$). However, this did not affect the extent to which the avatar seemed realistic (M = 4.06, SE = 0.10 vs M = 3.98, SE = 0.10; $F(1,85) = 0.36$, $p = .55$), so differences in perceived realism cannot account for any effects on subjective experiences. For both the manipulation check and realism, there were no effects of or interactions with gender (*F*s < 1.45, *ps* > .23).

We analyzed the subjective experiences of: feeling connected and engaged, liking the appearance of the avatar, feeling upset when the avatar was injured, and enjoying the game. First, participants who navigated the maze with their own avatar reported feeling more connected and engaged than those in the yoked control condition (M = 4.10, SE = 0.12 vs M = 3.46, SE = 0.12; $F(1,85) = 14.90$, $p < .001$). There was no effect of or interaction with gender (*F*s < 0.21, *ps* > .64). Furthermore, participants who navigated the maze with their own avatar also reported liking the appearance of their avatar more than those in the yoked control condition (M = 3.87, SE = 0.12 vs M = 3.26, SE = 0.12; $F(1,85) = 12.89$, $p = .001$). There was also a trend for women to like the appearance of the avatar less than men (M = 3.39, SE = 0.15 vs. M = 3.74, SE = 0.11; $F(1,85) = 2.90$, $p = .09$); however, this effect of gender did not depend on condition ($F(1,85) = 1.01$, $p = .32$). Apparently women liked the appearance of the avatar less -whether it was their avatar or someone else's- compared to how much men liked the appearance of the avatar.

Concerning either feeling upset or enjoyment, however, there were no main effects. Specifically, there was no effect of condition or gender on feeling upset when the avatar was injured by running into a mine or wall (*F*s < 1.27, *ps* > .26) or on enjoyment of the game (*F*s < 0.30, *ps* > .58). There was also no interaction of condition and gender for feeling upset when the avatar was injured ($F(1,85) = 0.04$, $p = .84$). However, there was a significant interaction between condition and gender for enjoyment of the game ($F(1,85) = 3.81$, $p = .05$). Men who were assigned their own avatar enjoyed navigating the maze more than men who used someone else's avatar (M = 4.36, SE = 0.16 vs M = 4.02, SE = 0.16), whereas women who used another player's avatar enjoyed the game more compared to those women who were assigned to use their own avatar (M = 4.25, SE = 0.21 vs M = 3.90, SE = 0.21).

In contrast to these effects on subjective experience of the users, there were no significant effects of experimental condition (own avatar vs. yoked control) on time to complete the maze, distance travelled in the maze, average speed, number of mines or walls hit, or percent of risky paths chosen (*F*s < 0.93, *ps* > .34). Only one effect of gender approached significance; women were marginally slower (M = 1.44 meters/second, SE = 0.08) than men (M = 1.65 meters/second, SE = 0.06; $F(1,85) = 3.55$, $p = .06$); because avatar height was controlled for, this marginal effect is not due to gender difference in height. All other effects of gender were not significant (Fs < 1.90, $ps > .17$), and it did not interact with condition (Fs < 1.22, $ps > .27$).

4 Discussion

From previous speculation, users piloting their own avatars (vs. someone else's) would be expected to show more engagement, liking and enjoyment, as well as better performance and care to prevent injury to their avatar. While the current work suggests that users do feel more engaged and connected and also liked their avatar more, the remaining possibilities were not supported. Only men enjoyed playing the game more with their own avatar than someone else's; women actually showed the opposite effect. Moreover, there were no significant effects of any kind on any behavioral factor. Users with their own avatars did not show differences in time to complete the maze, distance travelled, or speed. They also were no more careful with their avatar on any metric we considered – collisions with mines, collisions with walls, and ratio of riskier paths (shorter but with more mines) over safer paths.

Avatar appearance (own vs someone else's) may have no relevance to how users play the game. However, it is possible that there is an effect on user performance or behavior, but we failed to find it due to chance. Although there was no effect in a single player simulation, one might be found when two or more players pilot their own avatars in the same virtual environment simultaneously. Further research should address this possibility, as well as explore whether other types of virtual tasks (e.g., social tasks) show differences based on avatar appearance (own vs. someone else's).

Modern scanning technology that allows for rapid creation of 3D characters from human subjects could be used to increase engagement and motivation in training simulations. Users may not perform or behave differently in the simulation, but increased engagement and/or motivation from piloting their own avatars could encourage them to train more and, thereby, possibly improve learning.

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References

Feng, A., Casas, D., Shapiro, A. (2015). Avatar Reshaping and Automatic Rigging Using a Deformable Model. *Motion in Games, 2015, 57*–64.

Hefner, D., Klimmt, C. & Vorderer, P. (2007). Identification with the player character as determinant of video game enjoyment. *Entertainment Computing, 2007,* 39–48.

Hollingdale, J., & Greitemeyer, T. (2013). The changing face of aggression: The effect of personalized avatars in a violent video game on levels of aggressive behavior. *Journal of Applied Social Psychology, 43,* 1862-1868.