The Effects of Avatar Personalization and Human-Virtual Agent Interactions on Self-Esteem

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Abstract

Extant literature has suggested that VR may be a potential avenue to enhance self-esteem. However, the understanding toward the underlying technological mechanisms and their corresponding effects on the self are still not comprehensive. To address this research gap, the current study designed a series of social interactions in VR where participants (N = 171) embodied either a personalized or non-personalized avatar and had either positive or negative interactions with a virtual agent. Findings showed that participants who embodied a personalized avatar experienced a positive change in self-esteem from pre- to post-simulation, regardless of the virtual agent interaction quality.

Keywords: Virtual Reality, virtual body ownership, virtual agents, 3D interactions, self-esteem.

Index Terms: Human-centered computing – Human computer interaction (HCI) – Empirical studies in HCI; Human-centered computing – Human computer interaction (HCI) – Virtual reality.

1 Introduction

Self-esteem is an important determinant of well-being and behavior. The concept of *self-esteem* generally refers to the way individuals appraise their self-worth [1]. Some studies have suggested that poor self-esteem is associated with anxieties and depression, as well as undesirable behavior [2]. Therefore, it is crucial to explore various interventions that may potentially enhance self-esteem and improve one's overall quality of life.

Avatar embodiment in Virtual Reality (VR) may be an avenue that could potentially influence individuals' self-evaluations. For instance, people who embodied an avatar that was taller than their actual selves reported increased appearance self-esteem after the virtual simulation [10]. One study also found that female users who embodied a sexualized avatar that featured their actual faces experienced greater self-objectification than those who embodied a non-sexualized avatar or an avatar that did not feature their actual faces [3]. Another study demonstrated a positive association between user-avatar similarity and users' self-awareness [4]. Additionally, some earlier studies have indicated that self-awareness is linked to decreases in self-esteem upon exposure to negative feedback, but self-awareness could enhance self-esteem when presented with positive feedback [5]. Altogether, these findings provide some indications that embodiment of an avatar with enhanced physical features or high resemblance with users' actual selves may trigger self-related thoughts that could elicit changes in self-evaluations. However, it is still empirically unclear how does embodying a high similarity avatar may influence one's self-esteem. Therefore, the following research question is posed:

RQ1: How does embodying a personalized avatar mapped with users' actual facial features influence self-esteem?

Next, interactions with human-like virtual agents may play a role in influencing users' self-esteem. Some studies have suggested that humans have the tendency to elicit reactions that are similar to real human interactions when interacting with human-like virtual agents [8]. Additionally, extant literature has suggested that positive social interactions may bolster self-esteem [9], while negative social interactions may have adverse effects on self-esteem [6]. Based on these findings, it is plausible that the quality of interactions with a human-like virtual agent may influence users' self-esteem. However, simulated social interactions with virtual agents may not necessarily yield effects that are similar to social interactions among actual humans due to potential factors, such as image fidelity and believability of the virtual agents [7]. Hence, the following research questions will be examined in this study:

RQ2: How does a) positive and b) negative interactions with a human-like virtual agent influence self-esteem?

RQ3: How does embodiment of a personalized avatar interact with the quality of interactions with a human-like virtual agent and influence self-esteem?

2 Method and Materials

A total of 171 participants were recruited for this study. The mean age of participants was 22.30 years (SD = 3.11 years). There were 64 cisgender males (37.4%), 97 cisgender females (56.7%), and 10 who identified with other gender categories (5.9%).

A 2 (avatar personalization: personalized avatar vs. non-personalized avatar) x 2 (virtual agent interaction quality: positive vs. negative) pre-post experiment was conducted to examine the effects on self-esteem. In the personalized avatar condition, participants either embodied a personalized avatar mapped with their actual faces or a non-personalized avatar with pre-determined facial features (see Figure 1). In the virtual agent interaction quality condition, interactions with the virtual agent presented in the form of text dialogues were designed to involve either positive or negative content. Participants were randomly assigned to the experimental conditions.

A virtual environment was used to examine the research questions of this study. The simulation was situated in a restaurant setting (see Figure 2). Users were assigned the role of a service staff who had to interact with a virtual agent customer. During the simulation, users had to fulfil various requests from the virtual agent, including taking food orders and serving the meal. Interactions with the virtual agent were facilitated through pre-scripted dialogues. Toward the end of the simulation, the virtual agent provided feedback about the users' service quality and left the restaurant after paying the bill.

Self-esteem was measured in both pre- and post-study questionnaire. The 10 statements were adapted from the *Rosenberg Self-Esteem Scale* [11], rated on a five-point Likert scale (1:

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strongly disagree; 5: strongly agree). An example statement is "I feel that I have a number of good qualities." The measure had high reliability scores across both pre- (α = .89) and post-study questionnaire (α = .92).

Figure 1: Personalized (left) and non-personalized (right) avatar.

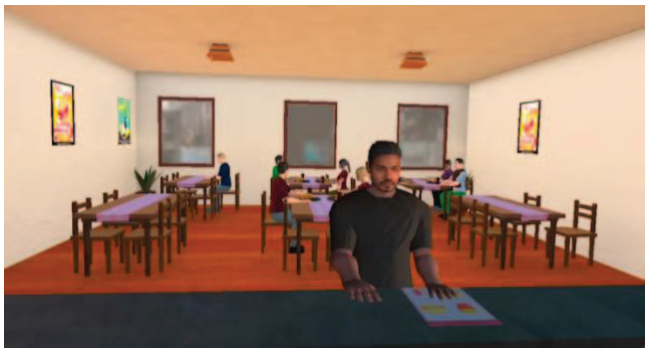

Figure 2: Overview of the restaurant in the virtual simulation.

3 Results

A two-way ANOVA was conducted to examine the main effects of avatar personalization and human-virtual agent interaction quality on participants' post-simulation self-esteem, controlling for pre-self-esteem scores. There were no main effects of personalized avatar embodiment on post-simulation self-esteem, $F(1, 170) = 1.22$, $p = .27$, $\eta_p^2 = .01$. Similarly, there were no main effects of virtual agent interaction quality on post-simulation self-esteem, $F(1, 170) = 1.14$, $p = .29$, $\eta_p^2 = .01$. Altogether, there were no interaction effects between personalized avatar embodiment and virtual agent interaction quality on post-simulation self-esteem, $F(1, 170) = 0.08$, $p = .78$, $\eta_p^2 = .00$.

Post-hoc analyses were conducted using paired-samples *t*-tests to examine the within-subjects changes. There was a significant positive change in self-esteem from pre- ($M = 3.14$, $SD = 0.82$) to post-simulation ($M = 3.32$, $SD = 0.85$) among those who embodied a personalized avatar and had positive interactions with the virtual agent, $t(43) = 3.66$, $p < .001$, $d = 0.32$. Similarly, there was a significant positive change in self-esteem from pre- ($M = 3.20$, $SD = 0.76$) to post-simulation ($M = 3.31$, $SD = 0.68$) among those who embodied a personalized avatar and had negative interactions, $t(40) = 2.11$, $p = .04$, $d = 0.32$. However, participants who embodied a non-personalized avatar and had positive interactions with the virtual agent did not show significant changes in self-esteem from pre- ($M = 3.28$, $SD = 0.74$) to post-simulation ($M = 3.38$, $SD = 0.81$), $t(43) = 1.62$, $p = .11$, $d = 0.40$. Those who embodied a non-personalized avatar and had negative interactions with the virtual agent also did not show significant changes in self-esteem from pre- ($M = 3.29$, $SD = 0.76$) to post-simulation ($M = 3.35$, $SD = 0.79$), $t(41) = 1.33$, $p = .19$, $d = 0.28$.

4 Conclusion

Findings from the current study provide some preliminary indications that embodiment of a personalized avatar mapped with one's actual facial features may potentially enhance self-esteem. However, the underlying mechanisms that led to the increased self-esteem should be examined in future studies. It is plausible that the embodiment of a personalized avatar may have enhanced self-awareness, which thereby enabled participants to gain greater appreciation toward the positive aspects of their self-appearance. It is also possible that simply embodying an avatar that resembles one's actual selves may induce positive emotions that could benefit self-esteem. The null findings across experimental conditions may be attributed to the administered scale, which was intended to measure global self-esteem and is less sensitive in detecting temporal changes in self-esteem. These assumptions and issues should be examined in future studies. Virtual agent interaction quality did not appear to influence self-esteem. Further research should seek to understand the underlying mechanisms of human-virtual agent interactions that may influence self-evaluations.

5 References

[1] J. Blascovich, & Tomaka, J., "Measures of self-esteem," *Measures of personality and social psychological attitudes,* vol. 1, pp. 115-160, 1991.

[2] K. A. Ethier, Kershaw, T. S., Lewis, J. B., Milan, S., Niccolai, L. M., & Ickovics, J. R., "Self-esteem, emotional distress and sexual behavior among adolescent females: Inter-relationships and temporal effects," *Journal of Adolescent Health,* vol. 38, no. 3, pp. 268-274, 2006, doi: 10.1016/j.jadohealth.2004.12.010.

[3] J. Fox, Bailenson, J. N., & Tricase, L., "The embodiment of sexualized virtual selves: The Proteus effect and experiences of self-objectification via avatars," *Computers in Human Behavior,* vol. 29, no. 3, pp. 930-938, 2013, doi: 10.1016/j.chb.2012.12.027.

[4] R. Hooi, & Cho, H., "The virtual "me" is the actual me: Self-disclosure in virtual environment," *2013 46th Hawaii International Conference on System Sciences*, pp. 883-892, 2013, January, doi: 10.1109/HICSS.2013.546.

[5] W. J. Ickes, Wicklund, R. A., & Ferris, C. B., "Objective self awareness and self esteem," *Journal of Experimental Social Psychology,* vol. 9, no. 3, pp. 202-219, 1973, doi: 10.1016/0022-1031(73)90010-3.

[6] K. Keefe, & Berndt, T. J., "Relations of friendship quality to self-esteem in early adolescence," *The Journal of Early Adolescence,* vol. 16, no. 1, pp. 110-129, 1996, doi: 10.1177/0272431696016001007.

[7] O. D. Kothgassner, & Felnhofer, A., "Does virtual reality help to cut the Gordian knot between ecological validity and experimental control?," *Annals of the International Communication Association*, vol. 44, no. 3, pp. 210-218, 2020, doi: 10.1080/23808985.2020.1792790.

[8] N. Krämer, Kopp, S., Becker-Asano, C., & Sommer, N., "Smile and the world will smile with you—The effects of a virtual agent's smile on users' evaluation and behavior," *International Journal of Human-Computer Studies,* vol. 71, no. 3, pp. 335-349, 2013, doi: 10.1016/j.ijhcs.2012.09.006.

[9] H. V. Krause, Baum, K., Baumann, A., & Krasnova, H., "Unifying the detrimental and beneficial effects of social network site use on self-esteem: A systematic literature review," *Media Psychology,* vol. 24, no. 1, pp. 10-47, 2021, doi: 10.1080/15213269.2019.1656646.

[10] G. Leung, Ng, A. K., & Lau, H. Y., "Effect of height perception on state self-esteem and cognitive performance in virtual reality," *International Conference on Human-Computer Interaction*, pp. 172-184, 2021, July, doi: 10.1007/978-3-030-77932-0_15.

[11] M. Rosenberg, *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press, 1965.