

Analysis of the Effects of Appearances of Avatars on User's Self-evaluation of Extroversion

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Abstract: Proteus effect is known as a phenomenon in which the personality and behavior of an individual, within online virtual worlds, is changed by the appearances of their avatar. This paper reports whether Proteus effect is applicable to accompanying avatars with whom a user's avatar interacts in a virtual world. The results indicated that Proteus effect was applicable to those who perceived the avatar was their alter-ego, while those who did not was not affected by the appearance of the avatar. The results suggest the importance of considering avatar's and agent's appearances and user's personality in serious games, online virtual worlds, and avatar-mediated online communications.

1 INTRODUCTION

Interacting with other players via avatars in virtual worlds and serious games have become our daily activities. There are wide variety of avatar's appearances, and users freely select avatars and use them. However, research in computer-mediated communication reports the impact of virtual space and avatar's appearance on users. Thaler et al. investigated gender difference in preference of users' own photo-realistic avatars' appearances. Their results suggested the male participants placed an importance on their avatar's photo-realistic texture, while the female participants on their avatars' body shape (Thaler et al. 2018).

Other research shows the effects of avatar's appearances and virtual world on user's behaviours. Pan et al. investigated the effect of avatars in a shared virtual environment. Their results suggested that avatar-mediated collaboration led to a better task performance and higher trust to each other than the non-avatar condition (Pan and Steed, 2017). Changing the background image and environmental sound in the 3D avatar chat space affected the number of pros and cons in the opinions in user dialogues (Takeuchi et al., 2016). Yee et al. suggested the appearance of the avatar used in online communication influences the user's behavioural characteristics, especially extroversion,

and named the effect as "Proteus effect". Specifically, in a laboratory immersive virtual environment, users who operated an attractive avatar talked frequently about themselves, interacted with the other avatar more confidently when their avatar was taller than the other avatar (Yee and Bailenson, 2007).

Yee's consecutive experiment indicated that Proteus effect is applicable not only in immersive virtual spaces but also in online communities in a virtual world, and this effect has been shown to persist in face-to-face interaction in real space (Yee et al., 2009). From these findings, there is a possibility that when attractive avatars are used in the virtual world, the users continue to perform interactions and actions with high extroversion in the virtual world, thereby affecting their behavioural characteristics in the real world. Another research that examined the Proteus effect showed that avatar's clothing in the virtual space (white / black, KKK, etc.) affected the attitudes and perceptions of the users by giving them a priming effect (Pena et al., 2009).

One of the reasons for user's behavioural change by changing the appearance of avatar is that the user sees avatar as their own alter-ego. Tokioka states an avatar is one in which a user him/herself creates his/her "alter ego" in a virtual world, and it can be regarded as the user's own "alter ego" in that it is created and operated by the user (Tokioka, 2014).

However, whether the Proteus effect can be found for users who do not recognize an avatar as their alter ego, and whether Proteus effect is applicable only by their own avatar but also by an accompanying avatar have not been examined.

Therefore, this research aims to examine the effect of the appearance of the self-operating avatar and the appearance of the accompanying avatar used in the virtual world on the user's self-evaluation of extroversion. Hypothesis 1 is "Those who regard their self-operating avatar ("self-avatar") as their own alter-ego, if their self-avatar and accompanying avatar are attractive, their self-evaluation of extroversion becomes higher compared to when the avatars are not attractive." Hypothesis 2 is "Those who do not regard their self-avatar as their alter-ego, their self-evaluation of extroversion does not change regardless of the self-avatar's or the accompanying avatar's appearances." In order to verify the hypotheses, we conducted an experiment using avatars with various appearances and compared the users' self-extroversion assessment by BIGFIVE personality questionnaire.

2 AVATAR DESIGN

We conducted a pre-experiment in order to select both male and female avatars' appearances with various attractiveness. The experimental procedure is as follows:

1) Ten Japanese university students (8 men and 2 women) participated in the pre-experiment, who did not participate in the main experiment.

2) Eight male avatars and eight female avatars are created by using Unity Assets. The participants evaluated each avatar's attractiveness with a 7-point Likert scale.

3) Avatars with the two highest evaluation scores and the two lowest scores in average were selected for the main experiment. The male and female avatars selected by the pre-experiment are shown in Figure 1 and 2, respectively.

3 MAIN EXPERIMENT

3.1 Experiment Overview

The main experiment was conducted by participants operating their self-avatar in a virtual world. The self-avatar and an accompanying avatar (set to the opposite gender of the participant) converse each other



Figure 1: Male avatars (attractive and unattractive).



Figure 2: Female avatars (attractive and unattractive).

as they move around the virtual downtown. The virtual downtown and avatars were developed by Unity 5.4.1, JavaScript and C#. The conversation scenario is prescribed. The self-avatar and the accompanying avatar stop by multiple spots. i.e., a cafe and an art museum in a first-date situation. They are invited to answer a questionnaire at each stop-by spot. The participants (their avatars) can get some incentive items to make their first date successful (i.e., a free ticket for the virtual café or the museum) by answering the questionnaire.

The questionnaires consist of the BIGFIVE extroversion questions and dummy items (i.e., what is your favourite food?) so as to make personality questions as natural as possible. BIGFIVE is widely used to measure one's personality traits. BIGFIVE consists of five factors, but we used 12 questions regarding extroversion factor in this experiment. Those questions use adjectives, i.e., sociable, talkative, cheerful, amiable, outgoing, assertive, and energetic, with 7-point Likert scale (Gough and Heilbrum, 1983).

The participants are Japanese university students (17 males, 5 females) from 21 to 23 years old. They were instructed to evaluate the performance of a questionnaire platform using avatars in a virtual world. The true objective of the experiment was told after the experiment. The conditions of the experiment are the four conditions shown in Table 1,

and the conditions are presented to the participants at random.

Table 1: Four experimental conditions.

	Attractive self-avatar	Not-attractive self-avatar
Attractive accompanying avatar	AT/AT	NAT/AT
Not-attractive accompanying avatar	AT/NAT	NAT/NAT

3.2 Experiment Procedure

The procedure of the experiment is as follows.

- 1) Pre-experiment questionnaire: Prior to the experiment, participants who were participating in another experiment on another day answered the BIGFIVE personality questionnaire (pre-questionnaire) in order to assess the nature of the participants' personality and not to let the participants notice the true purpose of the experiment on the day of the main experiment.
- 2) Main experiment: The participants selected the most/least attractive avatars as their self-avatars from the 4 selections of the same gender, and the most/least attractive avatars as their accompanying avatars from the 4 selections of the opposite gender (4 avatars in total).
- 3) Participants operate their self-avatar according to the prescribed dialog scenario. Figure 3 shows an example greeting dialogue. Figure 4 shows a dialogue and scenes at a museum.
- 4) Main questionnaire: They answer a questionnaire at three designated stop-by spots (see Figure 5). The questionnaire consists of BIGFIVE extroversion questions and dummy questions.
- 5) The participants changed the self-avatar and accompanying avatar, and repeat 3-4. Conditions are selected at random.
- 6) Post-questionnaire: After completing all the conditions, the participants answer a post-experiment questionnaire. The question was "whether each participant regarded the avatars as his/her alter-ego" with a 7- point Likert scale (1: not at all – 7: very much).



Figure 3: Example of Avatars' Interaction (greetings).



Figure 4: Example of Avatars' Interaction (at a museum).

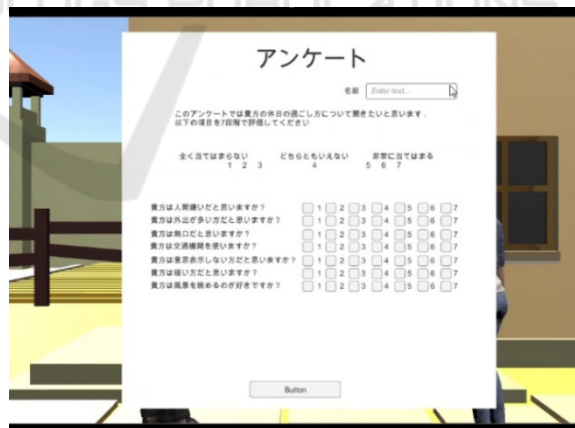


Figure 5: Questionnaire (in front of the museum): Questionnaire consists of BIG FIVE extroversion questions and dummy questions* (6 point scale) Questions asked above are: I like talking to others. / I often go out for some activities. / I am talkative. / I like traveling.* / I am good at expressing myself. / I am shy. / I like taking photos.*

4 RESULTS AND DISCUSSION

4.1 Analyses of the Results

Firstly, we classified the participants into three groups according to their answers to the post-experiment questionnaire. Nine participants whose answers were 7, 6, 5 (in the 7-point Likert scale) to the questions of "I regarded the avatar as my alter-ego." are classified as "high group," 5 participants as "middle group" (score=4), and 8 as "low group" (scores 3, 2, 1). The following analyses used scores of the high group and the low group only in order to compare the answers of the opposite groups. We conducted a 2-way ANOVA (repeated measures) to the answers of BIGFIVE extroversion questions. The factors are "avatar (combination of the attractiveness of the self-avatar and the accompanying avatar (AT/AT, AT/NAT, NAT/AT, NAT/NAT) " and "participant group (high/low)." In addition, a one-factor analysis of variance was conducted on the extroversion answers of the pre-experiment questionnaire and the main questionnaire.

There are significant main effects and interactions on the evaluation of extroversion in terms of sociable, talkative, cheerful, amiable, outgoing, assertive, and energetic. We show preliminary results of sociable, cheerful and amiable below.

The evaluation result of "sociable" is shown in Figure 6. The main effect was observed in the participant group conditions. The high group's sociable evaluation was significantly higher than that of the low group (Score=4.8-3.1, $F=11.13$, $p<0.01$). The result of multiple comparisons showed that the high group's sociable evaluation scores were significantly higher than those of the low group under 4 avatar conditions made in the virtual world (AT/AT: $F=16.76$, $p<0.01$, AT/NAT: $F=13.77$, $p<0.01$, NAT/AT: $F=8.5$, $p<0.05$, NAT/NAT: $F=4.56$, $p<0.05$). However, there was no significant difference in the sociable evaluation between the real and virtual conditions. High group's sociable evaluation of the NAT/AT condition was significantly lower ($F=4.66$, $p<0.05$) than that of the AT/AT condition, and similar tendency was shown between the AT/AT and the NAT/NAT condition ($F= 4.29$, $p<0.1$). On the other hand, there was no significant difference in the evaluation among the avatar conditions in the low group.

The evaluation result of "cheerful" is shown in Figure 7. The main effect was observed in the participant group conditions. The high group's cheerful evaluation was significantly higher than that of the low group ($F=7.74$, $p<0.05$). The result of

multiple comparisons showed that the cheerful evaluations of the high group were higher in the AT/AT ($F=7.09$, $p<0.05$), the AT/NAT ($F=9.71$, $p<0.01$), and the NAT/AT condition ($F=4.76$, $p<0.05$) than those made by the low group. The high group's cheerful evaluation of the NAT/NAT condition was significantly lower ($F=6.28$, $p<0.05$) than that of the AT/AT condition, while there was no significant difference in the evaluation among the avatar conditions in the low group.

The evaluation result of "amiable" is shown in Figure 8. The main effect was observed in the participant group conditions. The high group's amiable evaluation was significantly higher than that of the low group (Score=5.3-3.9, $F=6.12$, $p<0.05$). The result of multiple comparisons showed that the high group's amiable evaluation scores were significantly higher in the AT/AT ($F=10.24$, $p<0.05$), and the NAT/NAT condition ($F= 10.5$, $p<0.05$) than those made by the low group. In addition, the high group's evaluation of their amiableness in the AT/AT (Score=4.6-5.6, $p=0.07$) and the NAT/NAT (Score=4.6-5.6, $p<0.05$) conditions were significantly (in NAT/NAT) higher than their amiable evaluations in the real world. On the other hand, there was no significant difference in the evaluation among the avatar conditions in the low group.

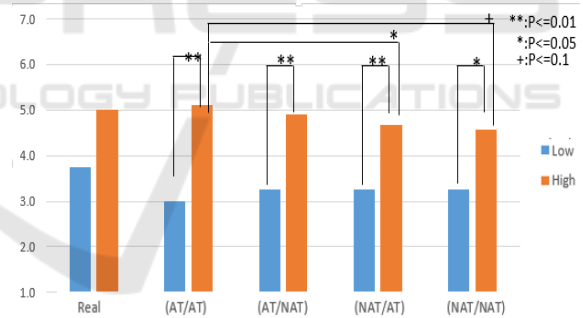


Figure 6: Comparison of sociable evaluation.

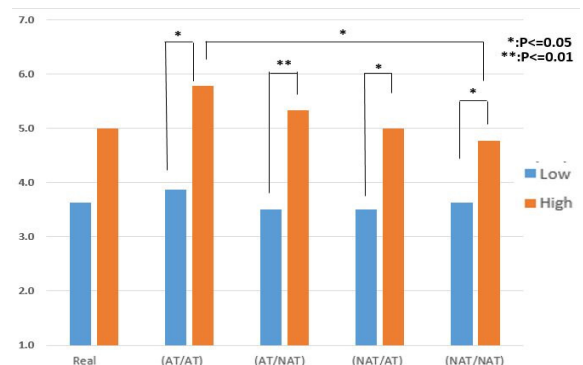


Figure 7: Comparison of cheerful evaluation.

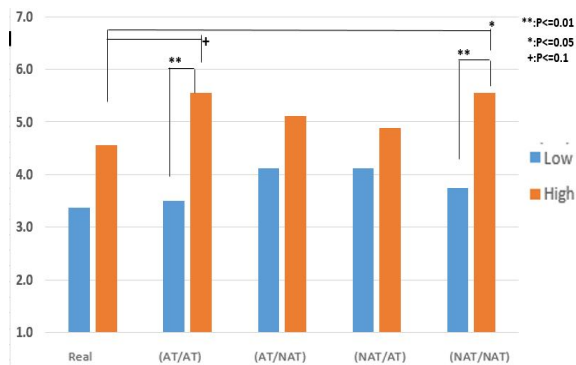


Figure 8: Comparison of amiable evaluation.

4.2 Discussion

In term of the sociable evaluation, comparison between the participant groups and the avatar conditions showed that the sociable evaluation scores of the high group were significantly higher than those made by the low group in all four avatar conditions. In addition, the sociable evaluation score of the NAT/AT and the NAT/NAT condition were lower than that of the AT/AT condition in the high group. This suggests the possibility that the high group's evaluation of their sociable-ness in the virtual world was affected by the attractiveness of their self-avatar, regardless of the attractiveness of their accompanying avatar. On the other hand, the appearance of the avatars did not influence their sociable evaluation scores in the low group, where their scores were always lower than the high group, and were always lower than the median value.

In terms of the cheerful evaluation, the high group's evaluation scores were significantly higher in the three avatar conditions than those of the low group. The high group's cheerful evaluation of the AT/AT condition was significantly lower ($F=6.28$, $p \leq 0.05$) than that of the NAT/NAT condition, while there was no significant difference in the evaluations among the avatar conditions in the low group. This suggests that the high group evaluated their cheerfulness higher when their self-avatar's appearance was attractive than they did when their self-avatar was not attractive. However, in the low group, no significant difference was observed in all avatar conditions and the evaluation scores were lower than the median value. Therefore, similar to the sociable evaluation, the appearance of avatars did not affect the low group's low self-evaluation of cheerfulness, where their scores were always lower than the high group.

In terms of the amiable evaluation, the evaluation of the AT/AT and the NAT/NAT

conditions were significantly higher in the high group than those in the low group. In addition, the high group's evaluation of their amiableness in the AT/AT and the NAT/NAT conditions were significantly higher than their amiable evaluation in Yee and Bailenson the real world. This suggests that when the attractiveness of the self-avatar and the accompanying avatar is balanced, the high group evaluated themselves as more amiable than they did in other conditions where the attractiveness of the avatars are not balanced. On the other hand, there was no significant difference in the evaluation among the avatar conditions in the low group. This result suggests that the low group has low appraisal of self's amiableness regardless of the avatar's appearances.

Those results suggest there is a dichotomy between the participant groups in terms of self-assessment of extroversion. The tendency is that the extroversion evaluation of self is influenced by the appearance of self-avatars in the high group, although not all evaluations of BIGFIVE extroversion scores rose in the conditions when attractive self-avatars were used. Even when the appearance of the self-avatar is not attractive, if the attractiveness of the self-avatar and the accompanying avatar is balanced, the extroversion evaluation of self is influenced in the high group.

Thus, part of the hypothesis 1 "Those who regard their self-avatar as their own alter-ego, if their self-avatar and accompanying avatar are attractive, their self-evaluation of extroversion becomes higher compared to when the avatars are not attractive." was partially supported. In other words, the high group has a tendency of evaluating their self-extroversion higher when their self-avatar is attractive. Their extroversion evaluation is also affected by the combination of self and accompanying avatar's attractiveness, regardless of the attractiveness of the accompanying avatar alone.

On the other hand, no significant difference was observed in the evaluation scores of the BIGFIVE extroversion in the low group. This suggests that extroversion evaluation of the low group is not affected by the appearance of the avatars. Thus, Hypothesis 2: "Those who do not regard their self-avatar as their alter-ego, their self-evaluation of extraversion does not change regardless of the self-avatar's or accompanying avatar's appearances." was supported. Compared with the high group, the low group has a low BIGFIVE extroversion evaluation in real world, and their evaluation is constantly low regardless of the appearance of the avatars in the virtual space. This result can be explained that the

low group did not regard their self-avatar as their alter ego, so the avatars' appearances does not affect their low extroversion evaluation in the virtual world, which is also low in the real world.

Future directions of this research are as follows; it is necessary to classify the reason as to whether the avatars are regarded as their alter-ego by user attributes, i.e., by personality test result other than extroversion, frequency of playing online games, years of online game experience, etc. Moreover, we should consider gender effect in more details, namely, we should examine the Proteus effect by considering the gender of the participants more precisely. We had only Japanese participants in the current study. However, we should consider other cultures' preferences on avatar and agents appearances.

5 CONCLUSION

In this research, we examined the influence of the appearance of the self and accompanying avatars on the participants' extroversion evaluation in the virtual world. The participants were divided into two groups depending on whether they regarded the self-avatar as their alter ego. The result indicated that there is a dichotomy between the participant groups in terms of self-assessment of extroversion. The high group (who regarded the avatar as their alter-ego)'s extroversion evaluation was affected by the appearance of the self-avatar, thus Proteus effect was applicable. On the contrary, the group that did not regard the self-avatar as their alter ego did not change their low extroversion evaluation according to the appearance of their self-avatar nor their accompanying avatar. The results suggest the importance of considering avatars' and agents' appearances and user's personality in serious games, online virtual worlds, and avatar-mediated online communications.

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