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Player-avatar similarity and game experience: game efficacy, game enjoyment, and immersion

Abstract: A particular element of computer games which significantly affects the gaming experience is avatars, i.e., representations of virtual players. In particular player-avatar similarity is related to the game experience, however, the results of previous studies are not conclusive. There is also a lack of research in which participants actually create their own avatars. The first aim of this study is to check whether there is a relationship between the player-avatar similarity and the game experience: game efficacy, game enjoyment and immersion. As a second goal the study examines gender as the mechanism responsible for the relationship between avatar player-similarity and game experience: game enjoyment, game efficacy and immersion. In the study (N = 130) participants created their avatars, played designed computer game *Characterium* and assessed their experience. The results demonstrate that player-avatar similarity was positively related to immersion level (but not to game efficacy and game enjoyment). Gender was not a significant moderator of the relationships between avatar similarity and game efficacy, game enjoyment and immersion. We consider this study to be a step forward in better understanding the mechanisms underlying the relationship between player-avatar similarity and game experience. For the first time, the relationship between player-avatar similarity and immersion was demonstrated in the condition of creating an avatar by the subjects and controlling it in the game. We also identify potential reasons why our hypotheses have not been confirmed.

Keywords: *avatar similarity, game efficacy, game enjoyment, immersion*

For many years, computer games have been of interest to psychologists, who for a long time only addressed their negative consequences, such as aggression and violence (Cooper and Mackie, 1986; Ferguson, Rueda, Cruz, et al., 2008; Zhang, Cao and Tian, 2021), addiction (Grüsser, Thalemann and Griffiths, 2007; Van Den Eijnden, Koning, Doornwaard Van Gorp and Ter Bogt, 2018) or the weakening of interpersonal relationships (Kowert, Domahidi, Festl and Quandt, 2014). However, in recent years, apart from focusing on the advantages of playing computer games (Granic, Lobel and Engels, 2014), psychologists have started to analyze them in a more neutral manner as a widespread and global phenomenon which concerns each and every age group, including increasingly young users.

A particular element of computer games which significantly affects the gaming experience is game character. Avatars can be seen as game elements, people in the virtual world, or representations of users with whom they fully identify (Bowman and Banks, 2021). Players are

involved in relationships with the game characters to a different extent. According to Bartle (2003) there are four levels of the relationship. On the first level, called Player, the game character and the player are two separate identities. On the second level, called Avatar, game character is the player's representative in the virtual world. Avatar is a tool that allows player to be active in the game. On the third level, called Character, game character becomes player's representation. It is an extension of a player's self. On the last level, called Persona, the player's identity is the game character's identity. The relationship between the avatar and the player may be related to the similarity between them, as gamers who customize their avatars often do so with some degree of resemblance to themselves. However, the preference for similar avatars is not specific to computer games, but is also relevant in other areas, e.g. user-like avatars increase their motivation to be active (Navarro, Peña, Cebolla and Baños, 2022) and learn (Wallace and Maryott, 2009) and are more trusted by them (Clerke and Heerey, 2021). The

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players use a mix strategy: they create avatars similar to them, but also those that increase their chance in the game (Trepte, Reinecke and Behr, 2011). The similarity between an avatar and its creator is a very broad topic and can be seen as a continuum: from a similarity based on one element, e.g. shoes (van Gisbergen, Sensagir and Relouw, 2020) or voice (Kao, Ratan, Mousas and Magana, 2021), to a much more realistic reflection (or representation) of a whole person (Lucas, Szablowski, Gratch et al., 2016). Similarity can be based on physical (Jang, Kim and Ryu, 2010), psychological (Trepte and Reinecke, 2010) traits, or both (Hooi and Cho, 2012). Moreover, scientists consider all traits as equally important in similarity assessment (Trepte and Reinecke, 2010), or they assign weights to them (Rahill and Sebrechts, 2021).

The similarity of an avatar to a player is associated with a higher level of game efficacy, game enjoyment and immersion depth. However, the results of these studies are not conclusive and methodology needs to be improved as suggested by Trepte and Reinecke (2010).

GAME EFFICACY

The association between avatar similarity and a player's game efficacy is not perfectly clear. Jang, Kim and Ryu (2010) established that the greater the similarity between avatars and test subjects, the higher the level of game players' effectiveness. In an online survey, players assessed their game efficacy and their similarity to their avatar. Similarity was assessed by referring to characters that these players had created in MMORPG games in the previous six months; efficacy was assessed in terms of how often players finish quests, win battles against monsters, or advance to new levels. Therefore, similarity and game efficacy were assessed by players subjectively. In a study conducted by Rahill and Sebrechts (2021), players' performance was measured in two ways: subjectively (participants rated their gameplay in relation to the avatar) and objectively (game results). It was found that participants who played with avatars similar to themselves scored on average 5.37 points more in the game than participants who played with dissimilar avatars. Moreover, players who played with similar avatars assessed their performance as better than players with non-similar avatars; similarly, this effect was stronger for avatars created by players than for avatars created by the experimenter. In Rahill and Sebrechts' study (2021), avatar similarity was assessed objectively by the researcher: an adequate number of points was assigned to different traits, e.g., gender compliance was given three points, whereas eye color compliance was given one point. A positive association between avatar similarity and game efficacy was also pointed out by Kao, Ratan, Mousas and Magana (2021). These researchers demonstrated that players who controlled avatars with a voice similar to their own had better in-game results than players whose avatars had a dissimilar voice. They established that voice similarity leads to stronger identification and that result is related to better performance. The results that support the hypothesis about the relationship between the player-avatar similarity

and the effectiveness of the actions taken come from research on pedagogical agents (Rosenberg-Kima, Plant, Doerr and Baylor, 2010). In contrast, Lucas, Szablowski, Gratch et al. (2016) did not find any association between avatar similarity and game efficacy (measured as, among others, mines avoided, speed, maze completion time). The researchers explain the lack of such a relationship in terms of how the players feel the similarity. Although avatars were prepared in a very realistic and detailed manner, the study subjects could not experience avatar similarity strong enough due to the fact, that less attention was devoted to provide the quality of the character's motion, to game background creation and to ensure that the avatar's face is constantly visible. The researchers also argue that it is possible that such a relationship simply does not exist, given that players who controlled a similar avatar showed no more concern for its harm than those who played the dissimilar avatar. The aforementioned lack of a relationship was also pointed out by Wauck, Lucas, Shapiro et al. (2018). The researchers measured game efficacy by using players' in-game score (the number of lifted levers). They find their game very immersive and point to that as the reason for distracting players from the avatars. Another distractor mentioned is the inability to influence the player's social reputation through actions taken by the avatar. The researchers also point out that the lack of confirmation of the hypothesis may be due to the fact that the photorealistic avatars were created by them, and not by the subjects. In this study (and in the study by Lucas, Szablowski, Gratch et al., 2016) avatars were generated by scanning players' faces and bodies, so they were highly realistic and therefore very similar to the players. Wauck, Lucas, Shapiro et al. (2018) also emphasize that the relationship between avatar similarity and in-game effects is often shown in the field of virtual reality, which is more immersive than computer games.

The similarity of players to their avatars is also associated with players' efficacy in team-played computer games. Van der Land, Schouten, Feldberg, Huysman and van den Hooff (2015) observed higher levels of efficacy in a team of players whose avatars were similar to themselves. In their study, eighty three-person teams were tasked with finding a killer by using information that was given to them. Everyone in the team was given unique clues that could guide them to the correct culprit. Additionally, every group received a common set of clues which led to erroneous conclusions if they were not considered in combination with each individual team member's information. It turned out that teams with higher similarity (of individual teammates and their avatars and of the group as a whole) performed better in the task, were more socially attractive, were more motivated to finish the task, and proceeded in a more strategic way.

GAME ENJOYMENT

It has not yet been clearly proved whether or not there is a relationship between game enjoyment and the similarity of avatars to their creators. Trepte and Reinecke (2010) established that creator-avatar similarity is strongly

associated with identification, the level of which is positively correlated with the enjoyment experienced through playing games. These researchers compared test subjects and their avatars by means of participants' self-completed personality assessments (assessment related to both participants and their avatars). These subjects did not play any computer games as part of the study; they only read descriptions of them. With this procedure plan, these researchers were able to exclude confounding variables associated with specific games. The relationship between game enjoyment and identification was also pointed out by Kao, Ratan, Mousas and Magan (2021), who established that using an avatar whose voice was similar to the player's was associated with a higher level of the player's identification with the avatar, which was further associated with a higher level of game enjoyment. Similarly, Birk, Atkins, Bowey and Mandryk (2016) show that player-avatar similarity leads to similarity identification and similarity identification is a significant predictor of game enjoyment. Group identification plays a comparable role. Peña, Ghaznavi, Brody and coworkers (2019) observed that game enjoyment in team computer games with avatars is associated with group identification. In a game created by these researchers, players played the role of a plane crash survivor who is trapped on an island with an active volcano. The task was to gather suitable resources with which to escape from the island before the volcano erupts. In order to accomplish the task, players could gather materials beneficial for the whole group (e.g., wood to build a raft) or only for them (e.g., gold). For half of the players, clues regarding the group's identity (e.g., participants' school colors) were visible; for the other half of the players, there were no clues. Game enjoyment was higher in the first team, in which players could experience group identity (due to similarity). In addition, avatar-player similarity strengthens a positive attitude towards the avatar (Su, Kim i Suh, 2011), which may contribute to positive emotions towards the game.

Wauck, Lucas, Shapiro et al. (2018) established no differences in levels of game enjoyment between players with avatars similar or dissimilar to them. As in the case of the relationship between avatar similarity and game efficacy, the researchers see the lack of confirmation of their hypothesis in too many stimuli distracting the participants from the similarity of avatars to them. Similarly Lucas, Szablowski, Gratch et al. (2016) did not find a simple correlation between player-avatar similarity and game enjoyment, however they found out that gender is an important moderator of it. In their study women who controlled a similar avatar enjoyed game less than those who controlled the dissimilar character. Conversely in men, those who played a similar avatar enjoyed game more than those who played dissimilar avatar.

IMMERSION

The avatar similarity is also important in relation to the level of immersion, but this area is understudied. The level of immersion reflects the degree of involvement in

the game (Brown and Cairns, 2004). Players immersed in the game poorly perceive time and the real world and they experience a sense of being in the task environment (Jennett, Cox, Cairns et al., 2008). According to Jennett, Cox, Cairns et al. (2008) immersion is the effect of a good gaming experience. Bartle (2003) describes the level of immersion as a specific type of relationship between the game character and the player. According to the researcher, the immersion process is based on the transition from the player, who is a separate identity from the character in the game, to the persona, where a player's real-life identity overlaps with the player's virtual self. The highest level of immersion may be related to the avatar-player similarity. Kao, Ratan, Mousas and Magana (2021) pointed out that stronger immersion occurred in players who controlled avatars whose voice was similar to theirs, in comparison to avatars whose voice was dissimilar to theirs. In a survey study Hooi and Cho (2012) established that physical player-avatar similarity induces the feeling of homophily, which increases an individual's self-awareness. Furthermore, self-awareness affects the level of perceived immersion. Birk, Atkins, Bowey and Mandryk (2016) show that player-avatar similarity leads to similarity identification and similarity identification is a significant predictor of immersion level.

The basis of the relationship between player-avatar similarity and immersion level may be identification with the avatar. The similarity between the player and the avatar increases the player-avatar identification (Trepte and Reinecke, 2010) and its degree is an important predictor of the level of immersion (Poncin and Garnier, 2012). Engagement can be another important factor. In studies of the pedagogical agents, researchers established that students choose pedagogical agents who are similar to them (Baylor, Warren, Park, Shen and Perez, 2005; Baylor and Plant, 2005) and they are more influenced by an agent of the same sex and ethnic origin (Baylor, 2009). Moreover, students rate agents of similar ethnicity as more engaging and affable than agents of different origins (Baylor and Kim, 2003) and engagement is the first stage of immersion (Brown and Cairns, 2004). However, it should be noted that avatars are not identical to agents: the former are controlled by humans, whereas the latter are controlled by computer algorithms (Fox, Ahn, Janssen, Yeykelis et al., 2015).

Most studies have established that there is a positive correlation between the player-avatar similarity and game experience: game efficacy, game enjoyment and immersion. Those researchers who did not confirm these hypotheses (Lucas, Szablowski, Gratch et al., 2016; Wauck, Lucas, Shapiro et al., 2018) drew attention to possible causes such as lack of an immersive environment in the computer game and distracting players from the avatar's resemblance (although they also take into account the lack of such relationships). The relationship between the player-avatar similarity and the effectiveness of the actions taken is also observed in the area of research on pedagogical agents. However, according to Trepte and Reinecke (2010), it is necessary to use real avatar creators in research, but in most

of the studies, study participants did not create their avatars in a manner similar to that used in computer games. Therefore, the next task is to check the existence of these dependencies in a context similar to computer games.

Additionally, player-avatar similarity and game experience may be related to the gender of the players. Lucas, Szablowski, Gratch et al. (2016) established that gender is a significant moderator of the relationship between player-avatar similarity and game enjoyment. According to the researchers, these results may be due to the fact that women are more ashamed of their bodies than men and therefore they do not enjoy playing a similar avatar. In addition, women experience more pressure than men to present their true gender, even though male avatars offer more in-game benefits (Ratan, Fordham, Leith and Williams, 2019). This can affect their gaming experience. Moreover man and women differ in terms of the amount of time they spend playing. Several studies have shown that men play more often than women (Lucas and Sherry, 2004; Chou and Tsai, 2007) and Chou and Tsai (2007) found that this activity is in general more enjoyable for male players than for female players. Nonetheless the research on gender in the player-avatar similarity, game enjoyment, game efficacy and immersion context is limited. In this study, we check whether gender plays a role as a moderator of the discussed interrelations.

CURRENT STUDY

In our research project, we assume that avatars are a virtual representation of study participants. In Bartle's (2003) approach, they would be called at least Characters, but due to terminological simplification they will be called avatars.

Based on the available literature, four research hypotheses were formulated:

H1 *The higher the level of similarity between the subject and the avatar, the higher the subject's in-game efficacy.*

H2 *The greater the similarity between a participant and their avatar, the better a game is enjoyed.*

H3 *The higher the similarity between the subject and its avatar, the higher the immersion level.*

In addition, we posed three more research questions:

RQ1 *Does gender moderate the effect of player-avatar similarity on game efficacy?*

RQ2 *Does gender moderate the effect of player-avatar similarity on game enjoyment?*

RQ3 *Does gender moderate the effect of player-avatar similarity on immersion level?*

METHOD

The *Characterium* computer game was developed for the purpose of the presented research project. This idea arose as a result of the conclusion of the Trepte and Reinecke (2010) who postulate that in research with avatars, real avatar creators should be used and the research procedure should actually use the game phase.

Referring to the conclusions presented by Lucas, Szablowski, Gratch et al. (2016) and Wauck, Lucas, Shapiro et al. (2018), we designed an in-game avatar representation that his face and his body are visible all the time.

The *Characterium* computer game is not a commercial game, therefore none of the participants had played it before. The game consists of two parts: the first part is a character creator in which players create their avatars; the second part is the actual game, in which the participant controls the avatar they created. The game was developed in several stages, which are described below.

Based on free online avatar creators, a list of features that occurred in at least four of the studied avatar creators was created: gender, face shape, skin color, hair color and length, lips, eyes, ears, nose, eyebrows and glasses. Most of the creators allowed only the avatar's face to be created, but the whole character's silhouette also plays an important role. Thus, besides the selected characteristics, a silhouette option (slim, average, fat, muscular) was also added to the game, as well as a choice of the avatar's clothes. Four participants (two boys and two girls) aged 16 were tasked with describing hair and clothes that are characteristic of their peer groups. Thus, a diverse database reflecting current youth trends was made.

The last development stage of the avatar creator was making a character competence pool. For this purpose, we gathered various traits from randomly chosen computer games: *Spell Force*, *Dungeons & Dragons*, *Guild Wars 2* and *Fallout 2*. Subsequently, taking into consideration the available definitions and new ideas, sixteen competencies were chosen: bravery, creativity, intelligence, agility, responsibility, honesty, openness, courage, strength, perceptiveness, cleverness, accuracy, agreeableness, conscientiousness, sensibility, resilience. Next, six of these traits (responsibility, agreeableness, conscientiousness, honesty, strength, cleverness) were rejected by the principal investigator of the project due to parallel meaning with other traits. In this way, the final list of ten competencies was created: bravery, creativity, intelligence, agility, accuracy, sensibility, openness, courage, resilience, perceptiveness.

Characterium is an arcade game in which the player has to jump higher on bars that appear whilst trying not to fall down (Fig.1). The space button causes the avatar to jump; the arrow keys control the avatar right and left. In the first pilot study, the game was tested by five adolescents, who afterwards said that the game was attractive enough but was too easy. So, we increased the difficulty: faster movement of the bars, and new distractive obstructions (e.g. flies) which from time to time flew across the screen. After these modifications, the game was tested by three adolescents, who evaluated it as hard enough.

PARTICIPANTS

130 adolescent Polish high school students aged 15–17 ($M = 16.53$; $SD = 0.60$) took part in the study. Participation was voluntary and no remuneration was offered. The experimental procedures took place in schools

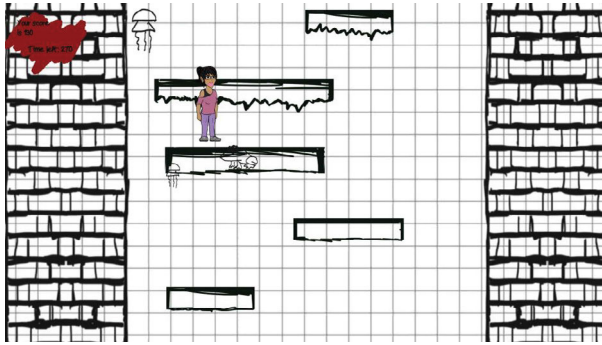


Figure 1 Computer arcade game used in the study

and dormitories. Due to the fact that underage adolescents participated in the study, their parents/caregivers had to agree to their participation.

PROCEDURE

Firstly, participants signed participation consent and a GDPR form. Next, they played the computer game: they created their avatar (without any time limitations) and played the arcade game for five minutes. Avatar creation consisted of choosing of its gender, age, skin color, face shape, eyes, ears, eyebrows, nose, lips and/or earrings, glasses and hair, silhouette and clothes. The last element of avatar creation was selection of competencies. Subjects had to distribute five hundred points between ten competencies. The number of points assigned to a given competence had to be a multiple of ten (e.g., 10, 50, 130). Participants could not move on until all points had been distributed. There was no obligation to assign points to every competence, thus the player could, for instance, assign five hundred points between only three competencies. After this part, the actual game was launched: for five minutes participants played the game by controlling their self-created avatars. Subsequently, players had to complete several surveys and questionnaires.

MEASURES

Player/participant- avatar similarity: The sum of the points in the Similarity Scale. This scale was created by researchers, as in most previous studies, the similarity between avatars and players was assessed by researchers (e.g. Trepte and Reinecke, 2010, Rahill and Sebrechts, 2021). Subjects responded on scale of 1 (*strongly disagree*) to 5 (*strongly agree*) to eight items: *my avatar is very similar to me*, *my avatar's face is very similar to mine*, *my avatar's eyes are very similar to mine*, *my avatar's ears are very similar to mine*, *my avatar's lips are very similar to mine*, *my avatar's nose is very similar to mine*, *my avatar's personality is very similar to mine*, *my avatar's clothes match my dress style*. Participants could get from 8 to 40 points. The higher the result on the scale, the higher the subjective participant-avatar similarity. The scale is characterized by high reliability: Cronbach's alpha coefficient for this measure was .903. Examples of avatars created by the subjects are shown in Figure 2.



Figure 2 Examples of avatars created by the study participants

Game efficacy: The sum of points achieved in the game. The game had no end, thus there was no minimum or maximum number of points that could be achieved. The goal of the game was to attain as many points as possible in five minutes. It was also possible to get a negative score (e.g., in the case of a player constantly falling from the lowest bar to the ground or not being able to proceed to higher bars).

Game enjoyment: The sum of the points obtained in Game Enjoyment Scale. Using a scale of 1 (*strongly disagree*) to 5 (*strongly agree*), participants responded to two items: "the game was a positive experience for me" and "the game brought about positive emotions in me". The range of results in this scale varied from 2 to 10. The higher the result, the higher the participant's game-related enjoyment. Cronbach's alpha coefficient for this scale was .313. This low value is due to the fact that the scale consists of two items.

Immersion level: The sum of the points achieved in the Polish adaptation (Strojny and Strojny, 2014) of the Immersion Questionnaire (Jennett, Cox, Cairns, Dhoparee, Epps, 2008). The range of results in this scale varies from 27 to 135. The higher the result, the higher level of participants' immersion. Players responded to 27 questions about their feelings at the end of the game. This measure allows the level of participants' immersion to be determined. Answers were given on a scale of 1 (*very little/very poor/definitely not/not at all*) to 5 (*a lot/very well/definitely yes/very much so*). Example items include "To what extent did the game hold your attention?" and "Did you feel that you were trying your best?". As a result of the research of Strojny and Strojny (2014), Cronbach's alpha coefficient of the Polish adaptation of the questionnaire is .94. Cronbach's alpha coefficient of this scale is .877, which is slightly lower than the Polish adaptation of this questionnaire.

Gender- The gender declared by study participants. It could take one of two values: woman or man.

RESULTS

Statistical analysis was done with IBM SPSS Statistics 25 package. In order to test the research hypotheses, a series of Pearson’s *r* correlations was performed. The relationship between game efficacy ($M = -229.86$, $SD = 1600.89$) and participant-avatar similarity (was tested $M = 19.35$, $SD = 8.01$). It was established that there is no significant correlation between game efficacy and participant-avatar similarity ($r = -0.08$, $p = 0.384$). Next, the relationship between game enjoyment ($M = 6.72$, $SD = 2.03$) and participant-avatar similarity was tested. There was no statistically significant correlation between how much participants enjoyed the game and participant-avatar similarity ($r = 0.03$, $p = 0.706$). Lastly, we tested the relationship between immersion level ($M = 72.70$, $SD = 15.97$) and participant-avatar similarity. A statistically significant positive correlation was found between immersion level and participant-avatar similarity ($r = 0.25$, $p = 0.005$).

Subsequently, we checked whether gender is a significant moderator of the tested interrelations. For this purpose, moderation analysis was performed using the PROCESS 3.5 macro. None of the constructed models were statistically significant, which means that gender does not modify the relationship between avatar-player similarity and game efficacy, game enjoyment and immersion level. The results of the analyses are presented in Table 1.

Table 1 The hierarchic regression analysis results, in which the moderating effect of gender in game efficacy, game enjoyment, immersion and player-avatar similarity is tested

	<i>B</i>	<i>SE</i>	<i>T</i>	<i>p</i>	95% <i>CI</i>	
					<i>LL</i>	<i>UL</i>
(Constant)	25.41	2.27	11.21	<0.001	20.92	29.90
Game efficacy	0.00	0.00	0.40	0.687	0.00	0.00
Gender	-4.18	1.47	-2.84	0.005	-7.09	-1.27
Game efficacy * Gender	0.00	0.00	-0.41	0.685	0.00	0.00
(Constant)	17.54	7.30	2.40	0.018	3.09	31.98
Game enjoyment	1.20	1.05	1.15	0.254	-0.87	3.28
Gender	-0.16	5.39	-0.03	0.976	-10.83	10.50
Game enjoyment * Gender	-0.61	0.75	-0.82	0.411	-2.09	0.86
(Constant)	16.25	9.33	1.74	0.084	-2.21	34.71
Immersion	0.13	0.13	1.00	0.318	-0.12	0.37
Gender	-4.37	6.41	-0.68	0.496	-17.06	8.31
Immersion* - Gender	0.00	0.09	0.02	0.984	-0.17	0.17

DISCUSSION

The aim of this study was to confirm the existence of relationships between player-avatar similarity and game experience in the natural context of computer games. The subjects created their avatars and then controlled them in the game. Three basic hypotheses are put forward in the present study: the greater the player-avatar similarity, the greater the player’s in-game efficacy (H1), game enjoyment (H2) and immersion level (H3). In the current project, the relationship between player-avatar similarity, game-related enjoyment and immersion level was explored and analyzed in a different way than in previous methods. Firstly, the participants had an opportunity to actually create their own avatars; secondly, they played the game by controlling their actual avatars. This kind of procedure is much closer to the actual experience of creating a virtual representation of oneself and using it to play a computer game, as suggested by Trepte and Reinecke (2010). It turned out that only the relationship between player-avatar similarity and immersion level was statistically significant.

Game efficacy

In the current study there was no proven relationship between the similarity of avatars and players and the in-game efficacy of the players. The research conducted so far in this area does not make it possible to unambiguously determine the existence of this association. Jang, Kim and Ryu (2010) and Rahill and Sebrechts (2021) are of the opinion that this relationship exists, but Lucas, Szablowski, Gratch et al. (2016) and Wauck, Lucas, Shapiro et al. (2018) are of the opposite opinion.

In previous research, the similarity between the avatar and the player was assessed using different methodologies. In one study participants were instructed to create similar or dissimilar avatars (Rahill and Sebrechts, 2021); in other studies, they did not create avatars but described avatars they had previously created in MMORPGs (Jang, Kim and Ryu, 2010) or similar avatars were created by the researchers (Lucas, Szablowski, Gratch et al., 2016; Wauck, Lucas, Shapiro et al., 2018). The procedure used in the current project was different than in the previous studies, but it has certain advantages. The participants actually created their representations and did not receive any instructions or advice concerning how their avatar should look, therefore the procedure was more similar to those found in real computer games.

In-game efficacy was measured in the current study as the number of points scored in the game. However, this kind of measure has a flaw: it does not take into account the participants’ skills. Although the subjects had no previous experience with the *Characterium* game, the method of avatar control was comparable to commercial computer games. Thus, it gives some benefits for gamers compared to non-gamers, as well as for gamers who play arcade-type games as compared to gamers who play other types of games. Some researchers (Jang, Kim and Ryu, 2010; Rahill and Sebrechts, 2021) used a subjective measure of participants’ in-game efficiency, i.e., subjects

assessed their efficacy themselves. This kind of measure mostly reflects players' base level of skills and experience. The end results of the participants in the game varied from -6,550 to 5,730 points. It is possible that the players had very different previously acquired skills, especially considering the fact that some of the players declared that they did not play computer games at all, while others reported playing daily. Very low results could also indicate that the player stopped playing and waited until the time ran out. Giving up or continuing to play despite losing evokes different emotions. The emotional condition of the participant (e.g. anger or frustration) could impact the relationship between player-avatar similarity and the game's final result.

Game enjoyment

In the current study, there was no proven relationship between player-avatar similarity and game enjoyment. Thus far, results in this area have been inconclusive. Some researchers have demonstrated that such a relationship exists (e.g. Trepte and Reinecke, 2010), while others have stated the opposite (e.g. Wauck, Lucas, Shapiro et al., 2018). In the research conducted so far, players were supposed to either imagine the avatars that they would create for a specific game (Trepte and Reinecke, 2010) or use very realistic and very similar avatars (Lucas, Szablowski, Gratch et al., 2016). In another study, player-avatar similarity was only based on the similarity of their voices (Kao, Ratan, Mousas and Magana, 2021). Avatar creation based on imagination, voice similarity, or a very high level of similarity is a different phenomena than the avatar creation procedures that are often found in conventional computer games. Moreover, in the research of Trepte and Reinecke (2010), the participants did not play any game at all; they only described the probable expected feelings. The procedure used in the current project was most similar to the actual process of playing a computer game.

Possibly, avatar-player similarity is not sufficient per se to evoke pleasurable feelings in participants. In various pieces of research, the importance of other factors has been pointed out, such as identification (Trepte and Reinecke, 2010; Kao, Ratan, Mousas and Magana, 2021) and sense of control (Kim, Schmierbach, Chung et al., 2015). A factor that should be considered in upcoming studies is playing duration. In research where game enjoyment was measured, the playtime was ten minutes (Bowman, Oliver, Rogers et al., 2016) or thirty minutes (Trepte and Reinecke, 2011). In the current study, this time was only five minutes. However, it is uncertain how much time players need to experience game enjoyment. Moreover, it is difficult to compare laboratory conditions to the actual gaming experience, which lasts much longer, e.g., several hours. Another question concerns whether experienced enjoyment arises at the stage of avatar creation or only during gameplay. The result achieved by participants is also important as perhaps game enjoyment decreases when players are losing even if they are playing with avatars similar to themselves. In the current study, game results varied between -6,550 and 5,730 points.

Immersion

In the current study, a relationship between immersion level and participant-avatar similarity was found. Along with increased similarity between subjects and their avatars, the immersion level also rose. These results are coherent with the studies of Hooi and Cho (2012) and Kao, Ratan, Mousas and Magana (2021). The current study had a correlational nature, thus it is impossible to determine the direction of this relationship. On the other hand, the current results could suggest further hypotheses. The first possibility is that the level of immersion affects how an avatar is perceived as similar to the player; the second possibility is that perceiving an avatar as similar to the player affects the level of immersion. In both cases, the impact of another factor is possible, e.g. involvement level. Another possibility is the presence of additional elements, which leads to increased perceived similarity level and immersion level, e.g., identification with the avatar. Referring to the concept of Bartle (2003), it can be hypothesized that a Character level of immersion has emerged between the players and the game characters. Perhaps the more the avatars resemble the players, the more the players perceive them as an extension of their own self and therefore experience greater immersion. Another explanation is based on the results of Baylor and Kim (2003). Perhaps the player-avatar similarity affects the involvement of players, and the involvement is related to the level of immersion.

Moreover, we tested (separately) whether the association between player-avatar similarity and three variables (game enjoyment, game efficacy and immersion) is moderated by the gender, as there are differences in male and female players. This hypothesis has not been confirmed. Perhaps this is due to the fact that in *Characterium* game, neither gender of the avatar provided additional benefits. Therefore, choosing a male or female avatar did not reduce the chances of winning the game and, as a result, did not affect the players' feelings. In addition, in this study, the study participants created their avatars themselves, so the similarity or its lack was their choice.

STUDY LIMITATIONS

This experiment has several limitations. The participants did not receive direct instructions to create an avatar similar to themselves. Therefore, they could create characters that reflect their ideal version, movie character or random appearance. However, when after the game they indicated their motives for creating their avatar, resemblance was not only much more important than creating an ideal self but also one of the most important motive in general.

The number of respondents is not large. This is due to the fact that the study was conducted during the Covid-19 pandemic, and its participants were adolescents. At that time, education in high schools was mainly online and schools and dormitories were closed most of the time. The research was conducted on a one-to-one basis and could not be conducted online. It was conducted when students

returned to school for a short time. More studies are needed, with more study participants, to increase statistical power.

The game enjoyment scale had a low reliability coefficient (Cronbach's $\alpha = .313$). This may be the result of the fact that the scale consisted of only two items. However, the scale used by Trepte and Reinecke (2010) also consisted of just two items, yet the internal consistency of the items was high (Cronbach's $\alpha = .89$).

The assessment of the similarity of avatars to adolescents was subjective as the respondents did it themselves. However, young people sometimes perceive themselves incorrectly: for example, in a study by Lim and Wang (2013), more than 50% of adolescents reduced or inflated their reported weight; this rate was even higher in the Bergström, Stenlund and Svedjehäll (2000) study, in which 95% of young men and 96% of young women inflated their reported body size. Maximova, McGrath, Barnett et al. (2008) established that among non-overweight participants, 30% of them reduced their reported BMI value, and 71.4% of overweight young people, as well as 59.4% of obese adolescents, reduced their reported weight. It is of no importance whether inaccurate perception of oneself is intended or not.

Moreover, the amount of time the subjects spent on creating their avatar was not measured. Ducheneaut, Wen, Yee, and Wadley (2009) showed that players spend up to 76% of all game time customizing their avatars. Thus it could be assumed that creating sb's own character is an important process for them. On the basis of these data, it could be assessed how important the avatar is for the study participants, and, as a result, whether the player-avatar similarity is important to them.

SUMMARY

The issue of the relationship between player-avatar similarity and various aspects of playing games remains open-ended. In the current study, no associations between avatar-player similarity and gaming enjoyment or in-game efficacy have been proven. However, a positive correlation between avatar-player similarity and immersion level was discovered. It should be noted that in this study, compared with previous studies, the players actually created their avatars and played as them in a computer game. This procedure is the closest to casual computer gaming, where the player creates his own virtual representation and thereafter plays as it in the game. Moreover, participants assessed their experiences (enjoyment, immersion level) immediately after the game was played, in contrast to previous studies, in which they referred to past or hypothetical games. Another advantage of this project was the use of a computer game that the participants had no previous experience with.

In further research, the issue of identifying the direction of the relationship between the similarity of an avatar to its creator and immersion level should be addressed. Immersion is an important phenomenon that affects the gaming experience and thus its attractiveness.

Computer game developers should therefore aim to provide players with as broad a spectrum of choices as possible in avatar creators. The immersion phenomenon is also important, especially considering its application in other contexts, e.g. psychotherapeutic interventions (Walshe, Lewis, Kim, O'Sullivan and Wiederhold, 2003) or pain management (Magora, Cohen, Shochina and Dayan, 2006). Moreover, researchers should further investigate the game enjoyment and game efficacy concepts in relation to player-avatar similarity. Both game enjoyment and succeeding in games (as well as immersion) are crucial elements of the whole game-playing experience.

COMPLIANCE WITH ETHICAL STANDARDS:

This project received a positive opinion of the Ethics Committee at the Institute of Psychology of the Jagiellonian University. The study was performed in accordance with the ethical standards as set forth in the 1964 Declaration of Helsinki and its later amendments.

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