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Original Article

Playing Exergames and Sporting Activity

The Impact of Identification with One's Game Character

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Abstract. Three studies were performed to investigate how identification with an exergame character increases motivation to perform physical activity and, in turn, actual physical activity. Study 1 showed that the extent to which players identified with their game character positively correlated with motivation to perform physical activity. Study 2 indicated that participants who were asked to write down similarities (high identification) compared with differences (low identification) between themselves and their exergame character strengthened their motivation to perform physical activity. Study 3 suggested that playing with a game character that looked similar to one's own appearance (vs. controls) was accompanied by increased motivation to perform physical activity and a higher level of actual physical activity 1 week later. The level of physical activity required by an exergame had no significant influence on our results.

Keywords: [Please supply]

Exergames that allow players to physically perform different kinds of physical activities (e.g., bowling, jogging, boxing) are increasing in popularity. The most popular exergame device is the Nintendo Wii console (84 million sold worldwide), where movements are recognized by a controller and players see a cartoon-like game character on screen that mimics the same movements and gestures as the player (Fischer, Kastenmüller, & Greitemeyer, 2010). It has been speculated that exergames have a positive impact on physical activity in daily life. Physical activity "is defined as any bodily movement produced by skeletal muscles that results in energy expenditure" (e.g., walking, dancing, swimming; Caspersen, Powell, & Christenson, 1985, p. 126)[1]. However, this hypothesis remains unexplored by systematic research, and indeed we know very little about the circumstances under which exergames may foster actual physical activity. In the present investigation we predicted that the more players are able to identify with the game character during an exergame the more they are motivated to actually engage in physical activity in their daily life. Moreover, we tested whether this engagement in physical activity is influenced by the amount of physical activity an exergame requires.

Effects of Playing Video Games

Previous research on video games revealed that playing these games with a certain content increases related affect, cognitions, and behavior (for meta-analyses, Anderson et al., 2010**[not in refs]**; Fischer, Greitemeyer, Kastenmüller, Vogrincic, & Sauer, 2011). For instance, it has been demonstrated that playing a violent video game (e.g., first-person shooter) increases aggressive affect (e.g., Anderson & Ford, 1986), thoughts (e.g., Anderson & Dill, 2000), and behavior (e.g., Anderson & Dill, 2000; Greitemeyer &

[1] Note that physical activity has to be separated from physical exercise, physical fitness, and sports activity: The focus of physical exercise lies more on planned, repetitive, and structured activity that aims at improvement and/or maintenance of physical fitness. Physical fitness, in turn, "is a set of attributes that are either health- or skill-related" (Caspersen et al., 1985, p. 126). Sports activity is physical activity with the intention to compete with somebody else (National Heart, Lung, and Blood Institute, 2011).

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McLatchie, 2011) compared with playing a nonviolent game. For instance, Anderson and Dill (2000) found that participants who played a violent video game (compared with neutral games) administered longer blasts of white noise to other persons who provoked them. Likewise, Fischer et al. (2009) found that street-racing games foster reckless driving in actual road traffic. On the other hand, prosocial video games appear to increase prosocial affect (Greitemeyer, Osswald, & Brauer, 2010), behavior (Greitemeyer & Osswald, 2010) and to decrease aggressive cognition (Greitemeyer & Osswald, 2009).

The general learning model (GLM) suggested by Buckley and Anderson (2006) provides a theoretical framework to explain and predict these effects. The GLM assumes that personal and situational input variables influence internal states (arousal, affective, and cognitive) that affect behavior. For example, media containing violent content leads to aggressive behavior through an impact on internal psychological states (arousal, affective, and cognitive). These three components may interact and influence each other. However, previous research on sports-related video games does not reveal a clear pattern of results. Papastergiou (2009) suggested that exergames potentially increase sports activity, though there is no evidence available to support this hypothesis. When Ballard, Gray, Reilly, and Noggle (2009) measured the time participants played traditional sports games (i.e., where players take control such as playing football or basketball by pushing bottoms on a controller) and actual physical activity, they found a negative correlation. Thus, sports-related video games appear to be an exception to the GLM, in that the sports-related content of a game does not necessarily foster actual physical activity.

If the sports-related context of a video game does not necessarily increase physical activity, the question arises under what conditions an exergame could potentially increase physical activity. In the present investigation we hypothesize that identification with one's game character could be a crucial influence on this relationship. The GLM assumes a number of different self-relevant processes that can be activated by video games, for example, self-activation, arousal, self-perception, and self-identification with the game character (e.g., Anderson et al., 2004**[not in refs]**; Fischer et al., 2010). Therefore, it is suggested that the impact of the sports-related content of exergames on physical behavior can be triggered by identification with the game character. In this context, Uhlmann and Swanson (2004) found that playing a video game with a certain content did activate associations between related behavior and self-concept. Moreover, Fischer et al. (2009) showed that participants who played street racing games perceived themselves to be more risky persons (see also Jin, 2010; Jin & Park, 2009; Klimmt, Hefner, & Vorderer, 2009). Initial support for this hypothesis stems from Fischer et al. (2010), who found that playing a video game with violent content with a game character looking similar (vs. dissimilar) to the player's own appearance increased aggressive behavior. Thus, we predict that motivation to perform physical activity will be enhanced when players can identify with their game character.

The Present Research

We tested the hypothesis that high identification with a game character is accompanied by increased sports activity in three studies. In Study 1 we investigated the link between an identification with players' game character and sports motivation on a correlational level. In Study 2 we predicted that writing down similarities (high identification) versus differences (low identification) between oneself and one's game character would strengthen sports motivation. In Study 3 we hypothesized that playing with a game character looking similar to one's own (vs. controls) increases sports motivation and the level of physical activity one week after playing.

To our knowledge, little is known about the long-term effects of playing video games. Fischer et al. (2010) showed that playing a racing game for about 15 to 20 min continued to increase risky driving 24 h after exposure to the game. In the present investigation, we explored whether playing an exergame with a personalized character for 15 min would influence subsequent behavior even over a week after game play.

We used different exergames requiring different levels of physical activity (i.e., bowling, boxing, jogging) to examine whether this variable influences our dependent variables (Studies 1 & 3). Because physical activity is a main component of sporting activity, a comparison between jogging/boxing (high physical activity) and bowling (low physical activity) seemed appropriate. Because the GLM does not make specific predictions whether the amount of physical activity necessary to play an exergame has any influence on subsequent physical activity, we had no specific hypotheses in terms of this factor (i.e., physical activity: high vs. low).

Study 1

In this study we wanted to test whether (1) the amount of physical activity an exergame requires and/or (2) the extent to which players identify with their game character is associated with their motivation to perform physical activity. The first test was carried out on an experimental basis: Participants played either the game boxing (high physical activity) or bowling (low physical activity). To the degree that the amount of physical activity an exergame requires is positively associated with the motivation to perform physical activity one would expect that participants in the boxing group (vs. bowling group) would hold a strengthened motivation to carry out physical activity. The second test was performed on a correlational basis: Given that identi-

fication with one's game character is positively linked with motivation to perform physical activity, one would expect a positive correlation between both variables.

Participants and Design

A group of 78 students from Liverpool John Moores University (UK) participated in this study (43 women, 35 men; age: $M = 22.32$, $SD = 3.25$). All participants were Malaysian exchange students who were staying for a summer in Liverpool. The study was based on a one-way (bowling vs. boxing) design.

Procedure and Materials

After participants had entered the lab for a course credit, they were told that the following study would investigate the impact of exergames, and that they would be asked to play an exergame at a later stage. Then, all participants were asked to look at their game character on the screen (still picture) with which they would later be playing (i.e., the character whose actions the participant would control in the game). All characters were cartoon-like and of the same sex as the participants. Then participants received two items to rate their identification with the game character, that is, "I can identify with the game character I will play with" and "The character I will play with has the same temperament as I have," on a scale from 0 (= *not at all*) to 7 (= *completely*), $\alpha = .61$. Then all participants were asked to play either the bowling (low physical activity) or boxing against a computer controlled opponent (high physical activity) exergames. In neither game did participants play against human opponents. These two games are provided on the Wii Sports CD (2006). We used these games because they largely differ in physical activity requirements, and because they are widely available as the Wii Sports CD is delivered together with the Wii console. After the game was completed, participants were asked to what extent (from 0 [= *not at all*] to 7 [= *completely*]) they are motivated to perform actual physical activity ("I am highly motivated to do sports."). Note that the present study was conducted in the context of an aggression-related study where different aggression-related variables were measured (e.g., emotions, cognitions, heart rate, blood pressure), which are not considered here.

Results

Motivation to Perform Sports

An ANOVA revealed no significant differences between participants in the boxing ($M = 2.29$, $SD = 1.25$) and bowling ($M = 2.42$, $SD = 1.24$) condition, $F(76) = 0.22$, $p > .64$.

Motivation to Perform Sports and Identification

As expected, we found a significant correlation between motivation to perform sports and identification with the game character, $r(78) = .27$, $p < .02$.

Discussion

Study 1 showed that identification with one's own exergame character was positively associated with sports motivation on a correlational basis. The amount of physical activity the exergame required had no impact on sports motivation. However, identification was not experimentally varied, and the motivation to perform physical exercise was not measured before *and* after playing. Thus, it was impossible to test to what extent motivation changed through playing; additionally, cause and effect interpretations cannot be made. Thus, one could argue that participants who are highly motivated to participate in sports identify more with a game character that engages in sport. In order to address this problem, we experimentally varied the identification with one's game character (see Study 2).

Study 2

In this study participants were asked to write down similarities (high identification) versus differences (low identification) between themselves and their game characters. We expected that high (vs. low) identification would lead to increased sports motivation.

Participants and Design

A group of 27 British students (13 male, 14 female; age: $M = 21.37$, $SD = 1.82$) of Liverpool John Moores University participated in this study. A one-way factorial design was used (similarities vs. differences).

Materials and Procedure

As is Study 1 participants entered the lab and watched their game character on the screen. We ensured that the game characters' sex matched with the participants' sex. In the high identification ($N = 14$) condition they were asked to write down similarities between themselves and the game character (low identification: differences, $N = 13$). Then, as a manipulation check, identification was measured with the single item "I can identify with the game character I played with." Then all participants played the game "Boxing" (against the console) for 15 min with the game character they just had seen. Afterwards, they received a short sports-motivation questionnaire with the following items:

"I consider myself as a sporty person," "I am highly motivated to do sports," and "I cannot wait to do a sporting activity," $\alpha = .82$. All items were measured on a scale from 1 (= *not at all*) to 5 (= *completely*).

Results

Identification

Participants identified with their game character to a higher extent when they were asked to write down similarities ($M = 3.57$, $SD = 0.76$) compared with when they were asked to write down differences ($M = 2.08$, $SD = 1.19$), $F(1, 25) = 15.46$, $p < .01$, $d = 1.49$.

Sports Motivation

Participants were more motivated to perform sporting behavior when they were asked to write down similarities ($M = 3.60$, $SD = 0.83$) compared with when they were asked to write down differences ($M = 2.79$, $SD = 1.08$), $F(1, 25) = 4.73$, $p < .05$, $d = 0.84$. However, no significant correlation was found between sports motivation and identification, $r(27) = .19$, $p > .34$.

Discussion

The second study showed that partner similarity is causally linked with both partner identification and with sports motivation. Thus, playing an exergame as a game character with which people can highly identify strengthened the motivation to perform sports. However, the study was accompanied by different problems. First, we did not use the same items as in Study 1 because the studies were part of student projects and the different students used different items. Second, identification did not significantly correlate with sports motivation, whereas we did observe significant association in Study 1 (although the effect was in the same direction). This inconsistency may have occurred because we used different items and the sample size was smaller in Study 2 than in Study 1. Finally, we do not know whether the impact of identification on sports motivation had any long-term effects on future physical activity. In order to address these problems, we conducted Study 3.

Study 3

Studies 1 and 2 provided evidence that the motivation to perform sporting activity is positively linked with identification with one's game character. Study 1 provided no evidence that this motivation is associated with the amount of physical activity an exergame requires. In Study 3 we tested whether these patterns emerge with an alternative design, and whether this has an impact on long-term physical activity (i.e., 1 week after playing).

Participants were asked to personalize the game character in order to resemble their own personal appearance. The Nintendo Wii console allows players to create their own "Mii," a customizable game character whose physical appearance (i.e., shape and color of, e.g., mouth, eyebrows, hair, nose, face, physical stature) can be adjusted to mimic the player's own physical features (Fischer et al., 2010; Nintendo, n.d.). Then participants were asked to play a jogging game with either their personalized game character or a generic one. In a further control group, individuals played the game bowling with a generic character. We introduced this bowling group in order to provide an additional test of whether the level of physical activity associated with game play (jogging: high activity; bowling: low activity) had any impact. As mentioned previously, we expected no significant effects due to the level of physical activity necessary to play the game. After 1 week all participants were asked to what extent they had performed physical activity in the previous week. We hypothesized that physical activity would be increased in the jogging/personalized game character condition compared with the jogging/generic game character and the bowling/generic game character conditions.

Method

Participants and Design

A group of 42 students of the Liverpool John Moores University (Liverpool, United Kingdom) participated in this study; one participant was excluded from the analysis (> 3 standard deviations over the mean in the dependent variable). Thus, data of 41 participants (17 women, 24 men, age: $M = 20.88$, $SD = 2.05$) were available. The design was based on a one-way ANOVA (jogging with personalized character vs. jogging with generic character vs. bowling with generic character).

Procedure and Materials

After participants had entered the lab for a course credit, they were asked to play an exergame. Before the game, all participants created their own personalized game characters using the Nintendo Wii's Mii feature (see above). Once this phase had been completed, participants played the game. In the condition "Jogging with personalized character" participants played the game "Jogging" (Nintendo Wii Fit) with their personalized character, where they physically jogged in front of a TV with a controller in their trouser pocket. The movement of the controller was recognized by the console and the players watched themselves jogging in a cartoon-like environment. The condition "Jogging with generic character" was identical to the personalized condition except that partici-

Table 1. Means and standard deviations in Study 3

	Jogging with personalized character (N = 14)		Jogging with generic character (N = 13)		Bowling with generic character (N = 14)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Identification with character	8.00	2.50	4.04	1.91	5.64	2.52
Sports motivation	3.59	0.79	3.17	0.72	3.02	0.68
Sports activity the week after	1.27	0.16	1.17	0.17	1.14	0.13

pants jogged with a generic game character representing their movements on the screen. In the condition "Bowling with generic character" participants played the game "Bowling" (Nintendo Wii Sports) with a generic character, a virtual bowling simulator. All participants played their games for approximately 15 min. All game characters had the same sex as their players. Afterwards, all participants received a questionnaire, which measured perceived similarity, exhaustion, and motivation for physical activity. In terms of identification, participants were asked to what extent they thought that their game character was associated with them, and to what extent they thought the character had nothing in common with them (reverse coded) (α = .96). Exhaustion was measured with the item "The game I played was exhausting." In terms of motivation for physical activity, we asked all participants to what extent they thought that jogging is a drudgery (reverse coded), that life is much richer as a result of running, that running is the high point of their day, and to what extent they felt distressed by jogging (reverse coded) (α = .73). All items were measured on a scale from 0 (= *not at all*) to 10 (= *totally*). Then participants were told that the experiment was over, and that they should return to the lab in 1 week for a second testing. All participants came back to the lab and filled in a questionnaire. Here we used a part of the Physical Activity Questionnaire (PAQ, Kowalski, Crocker, & Kowalski, 1997), which contains a list of different kinds of physical activities. Participants were asked to report to what extent they performed each physical activity type (from 1 [= *never*] to 4 [= *very often*]). We dropped the item "jogging" from the list in order to make it less obvious that this second testing was related to the first testing. The variable "physical activity the week after" was computed by the mean number of physical activities participants actually performed at least once (i.e., skating, walking, cycling, aerobics, swimming, dancing, football, badminton, street hockey, floor hockey, boxing, other).

Results

For means and standard deviations see Table 1.

Perceived Similarity

A planned contrast analysis indicated that participants who jogged with their own character (+2) considered themselves more similar to their game character compared with participants who jogged (–1) or bowled (–1) with a randomized character, $t(38) = 4.10$, $p < .05$, $d = 1.29$. In terms of the conditions jogging and bowling with a generic character, no significant difference was found, $t(38) = 1.78$, $p > .08$, $d = 0.69$.

Exhaustion

A planned contrast analysis indicated that participants who bowled with a generic character (+2) were less exhausted compared with participants who jogged with a personalized (–1) or a generic (–1) character, $t(38) = 3.12$, $p < .01$, $d = 0.60$. In terms of the conditions jogging with a generic and personalized character, no significant difference was found, $t(38) < 1$, $p > .70$, $d = 0.15$.

Motivation to Perform Physical Activity

A contrast analysis showed that participants who jogged with their own character (+2) reported having a higher motivation to perform physical activity compared with participants who jogged (–1) or bowled (–1) with a randomized character, $t(38) = 2.05$, $p < .05$, $d = 0.67$. In terms of the conditions jogging and bowling with a generic character, no significant difference was found, $t(38) < 1$, $p > .36$, $d = 0.21$.

Physical Activity the Week After

A contrast analysis showed that participants who jogged with their own character (+2) performed more physical activity the week after participating in the study compared with participants who jogged (–1) or bowled (–1) with a randomized character, $t(38) = 2.24$, $p < .05$, $d = .75$. In terms of the conditions jogging and bowling with a generic character, no significant difference was found, $t(38) < 1$, $p > .54$, $d = 0.22$.

Mediation Analyses

To test whether the motivation to perform physical activity mediates the effect of playing jogging with a personalized

character (vs. playing jogging/bowling with a generic character) on physical activity during the week after participating in the study, a bootstrapping analysis based on 2,000 bootstraps was executed (Preacher & Hayes, 2004). The results showed a significant direct effect of jogging with one's own character on physical activity, $\beta = .34$, $t = 2.27$, $p < .05$, which was reduced to nonsignificance, $\beta = .23$, $t = 1.55$, $p > .12$, when controlling for the mediator (motivation). In addition, the true indirect effect was estimated to lie between 0.019 and 0.0874 with 90% confidence. Because zero is in the 90% confidence interval, one can conclude that the real indirect effect became marginally significant at $p < .10$ (two-tailed). Thus, there is some evidence that motivation mediates the effect of jogging with the personalized character on physical activity.

Discussion

In the third study we showed that playing the game "Jogging" for just 15 min had a large effect on physical activity the week after playing ($d = 0.75$) compared with controls, where this effect was at least partially mediated by players' motivation to perform physical activity. Interestingly, as in Study 1, we found no significant effect between different levels of physical activity required to play the game. This finding also supported the findings of Melzer (2009), who showed that the level of violence in an exergame where players have to fight with a sword requiring high (vs. low) physical activity had no impact on different cognitive, emotional, and behavioral variables. It also should be mentioned that our design was not fully crossed. The reason for this lies in the fact that this study was the work of a dissertation student; as the study was longitudinal and, as a consequence, relatively laborious, the supervisor asked the student to abandon one group.

General Discussion

The present investigation began with the idea that exergames can have a positive effect on physical activity when players identify with their game avatars. In two studies we found evidence for our assumption. Study 1 showed at a correlational level that identification with one's game character predicted strengthened motivation to perform physical activity. Study 2 indicated that the motivation to perform physical activity increased when identification with one's game character was experimentally increased. Study 3 replicated this finding with an alternative manipulation. In addition, the results indicated that increased motivation to perform physical activity in the high identification condition strengthened physical activity 1 week after playing. No evidence was found that the amount of physical activity required by an exergame had any impact on motivation and performance.

Our data demonstrated that playing exergames with a character that players can identify with had a positive effect even after playing for only a period of minutes. This effect may be even larger and sustained with long-term, repeated exposure to the game. Future research should investigate the effect of playing with a personalized avatar on subsequent behavior among people with different age levels using a longitudinal design (several months or years). If this long-term impact on physical activity can be demonstrated, it would lend support to an initiative to introduce exergames at schools in order to increase the physical activity of children. Note that, for example, 35% of Americans and over 25% of people in Great Britain suffer from obesity, which is accompanied by severe heath-related problems (e.g., heart disease, Kraus, Winston, Fletcher, & Grundy, 1998). Given that more people would play exergames with a personalized character and can thus be expected to perform more physical activity, this may have a beneficial effect on health in the long term.

From a practical perspective, our data suggest that game producers and users should focus more on the possibility of creating one's own character. Producers should provide more options and possibilities for creating characters that mimic the player's own (e.g., the shape of one's face and body, clothing, etc.). Alternatively, an option could be created whereby players have the option of scanning their own face and/or body and using this material for game characters. In addition, users should be encouraged to take time to create their own characters before they start playing.

Note that the motivation items in all three studies may have been perceived by our participants differently than intended. That is, in all studies we wanted to measure the motivation to perform *physical activity*. In the Studies 1 and 2, however, we measured the motivation to perform *sports*. Thus, it remains unclear whether participants related these items to "pure physical activity" or to physical activity with the intention to compete with somebody else (i.e., sports). Additionally, the items for the motivation measure in Study 3 could be considered more as motivation to have fun or to show commitment (in terms of running) instead of motivation to perform physical activity. Future research should be more precise and should use items like "I am highly motivated to perform jogging/bowling/boxing."

Limitations

The present investigation measured behavior indirectly (i.e., self-reports one week after playing in Study 3). Future research should employ physical activity measurement devices such as pedometers or accelerometers. Moreover, motivation to perform physical activity was measured only after playing but not before playing. Thus, we cannot provide data as to how this motivation changed through the act of playing.

Conclusion

The vast majority of previous research on video games has focused on the negative side of this media type (e.g., aggression, risk taking). Our research, however, showed that playing these games can also be accompanied by positive effects. Researchers and video game developers should concentrate more on these positive aspects of video games and identify their opportunities for the society.

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