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## Which Motives are Predictors for Long-term Use of Exergames?

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### Abstract

Computer games, which combine exercise and playing games, are called exertion games or exergames (EG). Various studies have dealt with the role of EG with respect to improving physical activity. Others have suggested design guidelines and player types and several have investigated motivational aspects. Very little, however, is still known about the sustainability of motives - even though a long-term use of EG would be essential to achieve goals such as health benefits or prevention of overweight. To get a better understanding of this aspect, our paper outlines and discusses the main motives for playing EG and tries to relate them to long-term motivation.

Data on long-term motivation has been collected in a retrospective analysis using an online questionnaire that has been returned by n=54 active or formerly active EG players. Motives for playing and stopping playing were queried. Motives investigated were fun, doing sports, health, losing weight, competition, and affiliation. Based on current literature discussion, these six motives were grouped into those presumed to provide long-term motivation and those which are commonly perceived to decrease it. The scoring on these different motives was then compared between two subject groups: The long-term motivated players, who have been playing for more than six months (and are still continuously doing it) and those who have stopped playing (not long-term motivated players).

There were no significant differences between the two player groups with respect to the scorings of the analyzed motives. Concerning the impact of unfulfilled perceptions that make players quit playing EG results were significant. Players strongly motivated by the motives doing sports, health and losing weight indicated that they quitted playing EG due to the fact that their expectations concerning physical activity, having health benefits and weight loss were not fulfilled.

This survey could not support the idea, that certain motives, generally associated with playing EG, are predictors for long-term use. This finding however might be due to the relatively small sample size as our data shows the tendency that motives fun and affiliation increase probability for long-term motivation, whereas motives such as doing sports, losing weight, health, and competition do not seem to be correlated with it.

As an experimental approach to investigate long-term effects using standardized protocols would certainly contradict the nature of playing games, it seems necessary to follow-on with our method to collect additional data for more statistical power.

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## 1. Background

EG are active videogames and their name is a compound of the words exercise and gaming. The aim of EG is to combine the fun of games with the benefits of exercise. Due to the fact, that EG is becoming more and more popular, the interest of researchers has been aroused. Up to now the amount of literature on this topic is limited. Most research is carried out on effectiveness and related health benefits of EG, investigating caloric expenditure, heart rate and  $VO_2$  [1,2]. In this respect, the possibility that EG may be an important tool to fight obesity and overweight especially in children is highlighted [3]. To reduce sedentary times and, in the long run, to decrease the number of overweight people this technology might be helpful. Different motives for playing EG are in the focus of research, but most studies focus on single motives or include only very few motives.

A selection of six main motives have been identified from existing literature (*fun*, *doing sports*, *health*, *losing weight*, *competition*, and *affiliation*) and they are included in this investigation. The most important motive for playing EG is fun. There is agreement in a variety of studies that for most players fun is the reason to play EG [4,5]. Due to the fact that fun is not a unitary experience, it is difficult to guarantee fun in games if the type of player is not identified [6]. Depending on the game and how it is played, playing EG can motivate people to become physically active and increase caloric expenditure, heart rate and improve coordination [1]. The motive that captures “liking the excitement and action of the activity” [7] and enjoying the movement while doing sports will be called *doing sports* in the following. The possibility of becoming physically active in the home setting could overcome many barriers to exercise [8]. Especially for women, health is an important motive for playing EG. The direct feedback about vital parameters given by many consoles motivates to keep playing. Positive effects on e.g. stress level, weight management or mental and physical fitness are described [4]. Particularly, in the United States EG are sometimes played only in order to lose weight. However, Whitehead [9] warns of weight loss being the main motive for playing EG in order to keep long-term motivation. Results can only be seen after a period of time and if users do not see first results quickly, it may lead to high dropout rates. Furthermore, competition has always been an essential aspect of traditional sports and research determined that competition is a key element and necessary for the players’ enjoyment of EG [10]. Lastly, the importance of not playing alone for motivation is emphasized in several investigations [11]. Competing parallel in separate physical spaces is the mode with the highest long-term motivation and the largest enjoyment in playing [12]. Due to the fact that the largest enjoyment in playing is while playing multiplayer mode, the motive to describe this motivation will be called *affiliation* in the following.

Although motivation in EG is relatively well understood, there is a lack of research on long-term motivation. Most games seem to be fun when they are played for the first time, but health benefits only occur after some time. Therefore, it is necessary to find out which motives are relevant for long-term motivation, in order to keep people playing in the long run. A retrospective analysis allows one to get information about long-term effects. Additionally, it is possible to draw conclusions on motives that increase the possibility of being motivated long-term and also on motives that inhibit the possibility of becoming motivated long-term in the use of EG. Results might give an insight into the impact of unfulfilled perceptions that make players quit playing EG.

## 2. Hypotheses

In order to design and promote EG in a way that increases the probability of keeping people playing EG in the long run it is essential to have a closer look at the different motives for playing EG. The aim of this study is to find out which motives are more likely to keep the motivation for playing over a long period of time. Motives commonly related to high motivation in playing EG are *fun*, *doing sports* and *affiliation*. Thus, these motives are expected to support long-term motivation. On the other hand, motives such as *health*, *losing weight* and *competition* are perceived to inhibit long-term motivation because of a great number of dropouts due to high expectations concerning results. In this context, the authors investigate, if playing EG in order to have fun increases the probability of playing EG in the long run, and thereby allows health and weight benefits, in contrast to the direct motivation of health benefits or losing weight. This leads to the following hypotheses, each comparing two main motives:

H1. People with high scores in the *fun* motive are long-term motivated for playing EG in contrast to people with high scores in the *health* motive.

H2. People with high scores in the *fun* motive are long-term motivated for playing EG in contrast to people with high scores in the *losing weight* motive.

The same idea refers to *doing sports* as motivation in contrast to *losing weight*, as well as to the *affiliation* motive versus the *competition* motive:

H3. People with high scores in the *doing sports* motive are long-term motivated for playing EG in contrast to people with high scores in the *losing weight* motive.

H4. People with high scores in the *affiliation* motive are long-term motivated for playing EG in contrast to people with high scores in the *competition* motive.

Additionally, it is examined whether unsatisfied expectations concerning motives such as *health*, *losing weight* and *competition* are potential reasons for previously very motivated players to stop playing. Unfulfilled expectations in the *fun*, *doing sports* and *affiliation* motives are not perceived to be a common reason to quit playing EG. A causal relationship is expected, because the query asks, whether the reason to stop is a direct consequence related to the respective motive.

Participants of the study are divided into two groups of long-term motivated and not long-term motivated players, based on the period of time they have been playing EG. The authors defined long-term motivation as “playing actively for more than six

months” (group 1). Those who quit playing EG are not long-term motivated (group 0). Players, who are currently playing actively but have been doing it for less than six months, are eliminated from the survey because this time is not long enough to make predictions on their long-term motivation.

### 3. Methods

#### 3.1. Participants and Study Design

The main research concerning EG focusses on children, adolescents, and young adults [4,5,13] and this is why the target group in this study is young people. The method chosen to study the proposed relationship of variables was an online questionnaire, which was uploaded in different online communities like Twitter, computer and EG internet forums, and Facebook in order to reach the young target group. Participation was voluntary and it was guaranteed that all information will be treated anonymously and confidentially. During the four weeks of data collection in August 2014, 124 participants started the questionnaire and 55 people finished the whole survey. This results in an online response rate of 44.4%, which is comparably high in contrast to other studies [14]. Data show n=27 dropouts in the path of active as wells as inactive players. One questionnaire was excluded and finally a total of n=54 participants, n=27 women and n=27 men with a modal age of 23y (range 15-48y) were included into the analysis.

#### 3.2. Questionnaire

There was one questionnaire with two paths for active and currently inactive players. The first question is whether the participant plays actively or has stopped playing. Afterwards, types of consoles and games, and habits to playing needed to be indicated. The question about active or inactive player distinguished between one of two paths. For both groups motives for playing, and depending on the group reasons to stop playing, were queried. Finally, questions about socio demographic facts were asked. An overview of the questionnaire’s structure can be seen in figure 1.

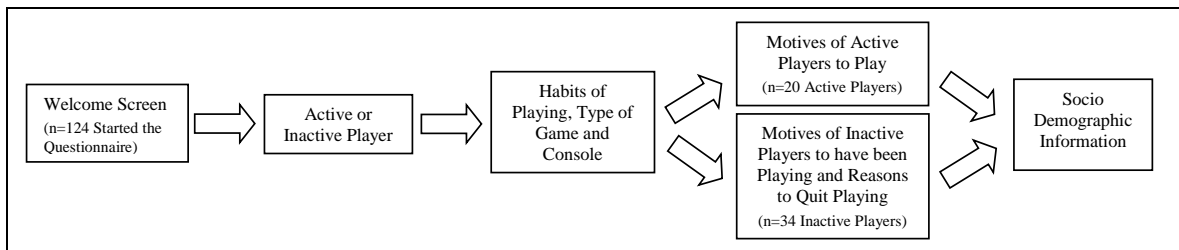


Fig. 1. Schematic structure of the questionnaire with numbers of started and completely fulfilled questionnaires.

The active players had to answer 19 questions concerning their motivation. There are three questions for each motive. Motives are measured on a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree). To ensure that the specific motive is captured, two of the three questions are asked in a positive direction and one question is asked negatively. For the two positive questions different wording is used to describe the same motive. The value of the negatively formulated question is turned around and for each motive one score is summarized.

For the inactive players the same three questions about each motive were asked but formulated in past tense. A total of 25 questions had to be answered by the inactive players. For each motive, there was one question, asking whether the player quitted playing EG due to unfulfilled perceptions in this specific motive.

#### 3.3. Statistical Analysis

From the individual ratings provided the mean over all subjects within each of the two groups was calculated. To find a regression model that predicts the probability of a person belonging to group 0 or group 1 a Binary Logistic Regression (BLR) approach has been used. This method allows (like a linear regression analysis) one to model the relationship between “group belonging” the dependent variable and our independent variables, being the six motives, *fun*, *doing sports*, *health*, *losing weight*, *competition* and *affiliation*. In the context of the BLR the motives are our “predictors”. Compared to linear regression analysis, BLR is based on quite different assumptions (i.e. dependent variable is binary and therefore not Gaussian but rather Bernoulli distributed). In order to calculate the BLR the dichotomous variable *long-term motivation* is coded 1 if the person is long-term motivated and coded 0 if the person is not long-term motivated.

The chosen BLR-function is given as follows:

$$p = \frac{e^{k+\sum \beta_i \cdot X_i}}{1 + e^{k+\sum \beta_i \cdot X_i}} \quad \begin{array}{l} i = 1 \dots 7 \text{ (index for motive, i.e. "fun" index =1)} \\ X_i = \text{Value of a motive } i \\ \beta_i = \text{regression coefficient for motive } i \\ k = \text{regression constant} \end{array} \quad (1)$$

In the first step of the analysis equation (1) is applied to achieve the best prediction for the given data points ("Complete Regression Model"). In the second step -in order to test the four hypotheses (each with a reduced set of two motives only) the above equation is simplified to:

$$p(j) = \frac{e^{kj + \beta_A \cdot X_A + \beta_B \cdot X_B}}{1 + e^{kj + \beta_A \cdot X_A + \beta_B \cdot X_B}} \quad \begin{array}{l} j = 1 \dots 4 \text{ (index for hypothesis)} \\ \beta_A = \text{regression coefficient for motive A} \\ \beta_B = \text{regression coefficient for motive B} \\ X_{A,B} = \text{value of motive A,B} \\ kj = \text{regression constant for hypothesis } j \end{array} \quad (2)$$

The regression coefficients  $\beta_i$  are then used to calculate the odds ratio  $OR_i = \text{Exp}(\beta_i)$ , which is a measure of the effect size: An increase of the respective predictor for one unit increases the probability of belonging to group 1 by the amount of  $OR_i$ .

The idea behind the testing of the hypotheses is simple: If motive A (first statement in the formulation of the working hypothesis) increases the probability of belonging to group 1 and at the same time motive B (second statement) decreases the probability of belonging to this group, it is more likely that this working hypothesis can be verified.

The Omnibus Test of Model Coefficients (O) is calculated to see if the explained variance is significantly higher than the unexplained variance. If this test is significant, the motives do significantly increase the ability to predict motivation.

To determine the goodness of fit given by the amount of variance in the dependent variable that is explained by the predictors the Nagelkerke ( $R^2_N$ ) [15] has been used. High explanatory power of a regression model is generally given if  $R^2_N$  exceeds the value 0.5.

In order to test unfulfilled expectations, Spearman's Rank Correlation Coefficient is used.

For all statistical tests, significance level was chosen to be  $p=0.05$ .

**4. Results**

*Descriptive Results*

According to our definition  $n=20$  of the participants turned out to be long-term motivated and  $n=34$  participants were not long-term motivated. Figure 2 differentiates the mean scores of the motives between these two groups and shows the standard deviation (SD).

*Results Complete Regression Model (CRM)*

Without including the predictors into the calculation, the model predicts 63.0% correctly. In the CRM, when all predictors, are included 70.4% are predicted correctly. O is not significant ( $p=0.288$ ). The statistical goodness of fit is  $R^2_N=0.174$  only, which indicates low explanatory power. Table 1 shows the significance and OR for each motive of the CRM.

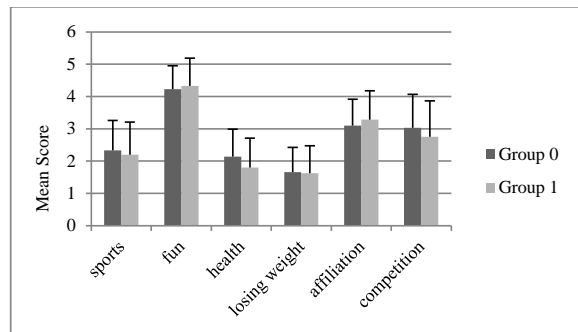


Fig. 2 Mean scores and SD of motives for Group 0 (not long-term motivated) and Group 1 (long-term motivated).

Table 1. CRM: Variables in equation.

	Motives	Regression Coefficient $\beta_i$ (Regression constant=-1.120)	Standard Error	Wald	Sig.	OR
CRM	Fun	.317	.471	.452	.501	1.373
	Doing Sports	-.045	.491	.008	.927	.956
	Health	-1.037	.606	2.932	.087	.354
	Losing Weight	.819	.673	1.482	.223	2.268
	Competition	-.595	.343	3.012	.083	.552
	Affiliation	.546	.465	1.380	.240	1.727

### Results Hypotheses Tests

Testing hypothesis H1, the O is not significant with a value of  $\text{sig.}=0.326$  and  $R^2_N$  is close to 0 ( $R^2_N=0.055$ ). Therefore, the regression model is not significant and does not have a high explanatory power. The percentage of correctly predicted values is 59.0%.

Regarding the second hypothesis H2, including motives *fun* and *losing weight*, the O is not significant ( $\text{sig.}=0.872$ ). Furthermore, the value of  $R^2_N$  is small ( $R^2_N=0.007$ ) and the number of correctly perceived values reaches 63.0%.

In H3 motives *doing sports* and *losing weight* are investigated and in the O there is no significance as the value is  $\text{sig.}=0.871$ .  $R^2_N$  has a value of  $R^2_N=0.077$  and 63.0% are predicted correctly.

The last hypothesis H4 does not show a significant result in O ( $\text{sig.}=0.235$ ). Besides,  $R^2_N$  shows a value of  $R^2_N=0.071$  and the model perceived 68.5% correctly.

In Table 2 values of significance and the OR for the hypotheses can be seen.

Table 2. Hypotheses: Variables in equation.

	Motives	Regression Coefficient $\beta_1$	Standard Error.	Wald	Sig. (1-tailed)	OR
H1	Fun	-.193	.383	.253	.308	1.213
	$k_1=-.415$ Health	-.480	.355	1.827	.088	.619
H2	Fun	.186	.384	.234	.314	1.204
	$k_2=-1.253$ Losing Weight	-.045	.364	.015	.451	.956
H3	Doing Sports	-.186	.380	.240	.312	.830
	$k_3=-.219$ Losing Weight	.067	.457	.022	.442	1.070
H4	Affiliation	.554	.400	1.923	.083	1.741
	$k_4=-.937$ Competition	-.470	.321	2.150	.072	.625

### Spearman's Rank Correlation Coefficient

In addition to the BLR, the Spearman's Rank Correlation Coefficient is considered in case of players who are not long-term motivated. Each composed score of the six motives is compared to the respective value of stop playing because of unfulfilled expectations. Exact values and significant combinations are shown in table 3.

Table 3. Spearman's Rank Correlation Coefficient in terms of unfulfilled expectations.

Correlation	Sig (2-tailed)	Correlation Coefficient
Fun and Fun_stop	sig. = .046	r = -.344
Doing Sports and Spots_stop	sig. = .039*	r = .356
Health and Health_stop	sig. = .047*	r = .344
Losing weight and Losing Weight_stop	sig. = .002*	r = .521.
Competition and Competition_stop	sig. = .949	r = .011
Affiliation and Affiliation_stop	sig. = .570	r = .101

## 5. Discussion

The aim of this study was to examine long-term use of EG and factors influencing long-term motivation. In this context, the paper provides a comparison of motives perceived to support or inhibit the probability of playing EG in the long run. The first hypothesis (H1) investigating the *fun* and *health* motives is rejected; the motives do not significantly increase the ability of the model to predict long-term motivation.  $OR_i$  indicates that the *fun* motive increases the probability of belonging to group 1, whereas the *health* motive increases the probability of a person belonging to group 0. Therefore, it is not advisable to promote and design EG primarily for health benefits, instead the focus should be on fun. If games are fun, long-term motivation is more probable and *health* benefits may follow later. This finding supports other results that point out the problem of keeping long-term motivation and the fact that both, fun and health, need to be addressed because otherwise motivation and energy expenditure decrease over time [16].

There are similar results for H2. According to  $OR_i$  the *losing weight* motive decreases the probability of belonging to group 1 whereas the *fun* motive increases this probability. Therefore, there is a tendency which supports the theory of H2 and this is why there is some evidence that games should not be implemented with the primary focus on *losing weight* because this motive does not result in a higher probability of playing EG in the long run.

Considering the  $OR_i$  in H3, it can be seen that the *losing weight* motive increases the probability to be long-term motivated whereas the *doing sports* motive seems to decrease the probability, when compared directly. This is contrary to the perceived. *Doing sports* does not seem to be a better motivation for long-term playing EG than the *losing weight* motive. This result

contradicts the findings in existing literature observing sports being a motivator for playing EG [17]. However, this study did not investigate long-term effects.

The model of H4 perceived 68.5 % correctly, in contrast to 63.0 % without including the motives. OR supports the idea that the *affiliation* motive increases the probability of long-term motivation in contrast to the *competition* motive.

Due to the fact that the regression models do not show high explanatory power, results are of limited informative value and interpretation has to be done with caution. However, this fact might be due to the relatively small sample size or because the data collection was only once and on hindsight.

When including all predictors in one model 70.4 % are predicted correctly. Matching with results of H3, the *doing sports* motive has a decreasing influence on long-term motivation next to *competition* and *health*. The assumption of *doing sports* not being a sustainable main motive for playing EG is confirmed by the results of the descriptive statistics as it has only a low mean score. Moreover, the regression coefficient shows that high scores in the *doing sports* motive significantly correlate with high scores in quitting because of unfulfilled expectations concerning physical activity.

Regarding the mean scores of the *health* and *losing weight* motives, these motives are not assessed to be important for playing EG either. Additionally, unfulfilled expectations concerning both motives significantly are a reason to stop playing EG.

In the *competition* and *affiliation* motives there is no correlation between the motive and stopping playing because of the expectations. Nevertheless, mean scores show that they are important reasons for playing EG. The high mean score of *affiliation* and the results of the BLR underpin the high relevance of *affiliation* as motivation for EG.

The high mean score confirmed *fun* as the most important reason for playing EG and this is also indicated by the OR. Regarding the negative correlation concerning *fun*, players had fun but a lack of fun was not the reason to stop playing. Players apparently quit for different reasons.

## 6. Conclusion

The *fun* motive is determined to be the most important motive for long-term motivation in EG. In designing EG the focus should be on increasing fun. However, motives for playing EG could change over time and therefore it should be investigated whether there are differences in e.g. long-term and short-term fun. Although EG can be physical exertion and therefore may have a positive influence on health and weight, results indicate that the focus should not be on these motives because unfulfilled expectations sometimes result in stopping playing. Furthermore, *affiliation* is confirmed to be very important for long-term motivation in playing EG. Due to the fact that this is one of the first investigations concerning motives in long-term motivation of EG further investigation is needed. This study gives a first insight into the topic and a suggestion for an approach. Nevertheless, results need to be reviewed and secured. Long-term data collection is needed to get information about reasons and specific moment in time for change in motivation.

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