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Rapid Communication

Effectance and Control as Determinants of Video Game Enjoyment

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ABSTRACT

This article explores video game enjoyment originated by games' key characteristic, interactivity. An online experiment ($N = 500$) tested experiences of effectance (perceived influence on the game world) and of being in control as mechanisms that link interactivity to enjoyment. A video game was manipulated to either allow normal play, reduce perceived effectance, or reduce perceived control. Enjoyment ratings suggest that effectance is an important factor in video game enjoyment but that the relationship between control of the game situation and enjoyment is more complex.

INTRODUCTION

Research on the enjoyment of playing video games has repeatedly addressed the role of interactivity. One proposition is that interactivity facilitates the experience of causal agency, that is, the perception of receiving immediate, direct feedback on one's action and of influencing the game world ("effectance"[1,2]). White[3] argued that the perception of one's causal effects on the environment is enjoyable because it motivates the organism to interact with the environment and thus to increase the likelihood of survival. Video games respond to player inputs immediately and constantly, so they can evoke strong and continuous experiences of effectance, which establishes an enduring sense of enjoyment.[2] Thus effectance is hypothesized as one important mechanism that links video game interactivity to enjoyment:

Hypothesis 1: The degree of effectance a video game offers has a positive effect on player's perceived enjoyment.

Video game interactivity has also been linked to the perception of *control*.[4] Being in control means to know about the attributes of a situation, to anticipate its dynamics, and to be able to influence it according to one's goals. People generally prefer situations that they can control and try to avoid situations that other forces dominate. Being in control is regarded as enjoyable.[4] Because the interactivity of video games allows players to formulate goals about how they want the game world to be (e.g., to destroy all opponents) and to take action to achieve these goals, being in control is hypothesized as a second important state that facilitates game enjoyment:

Hypothesis 2: The degree of control a video game offers has a positive effect on player's perceived enjoyment.

The concepts of effectance and control are considered as interlinked. Effectance should facilitate the perception of being in control, because the observation of one's own causal influence on the situation

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(effectance) is a precondition of control. But control is bound to additional preconditions, such as the ability to influence a situation according to specific goals. So effectance and control are additive rather than competing factors of video game enjoyment.

METHOD

Five hundred volunteers aged between 14 and 72 years ($M = 29.66$, $SD = 9.16$) participated in a Web-based experiment; 63.4% of participants were female. Most of them (37.2%) were full-time employees; 33.2% were university students. Regarding frequency of play, 34.2% reported they play video games "frequently" and 35.8% said they play games "up to once a month." Participants were recruited from registered members of two portals for online research (www.online-diagnostik.de and www.psytests.de).

The stimulus was a java applet video game programmed by Remi Faitout (www.boussolefr.com/jeux/javanoid/). Players steer a racket at the bottom of the screen. Bricks are situated at the top of the screen, and a ball moves between the bottom and the top. Whenever the ball hits a brick, the brick disappears; when it approaches the bottom of the screen, players must hit it and strike it back toward the bricks. Otherwise, the ball disappears and the round is lost. The goal of the game is to make all bricks disappear while losing as few balls as possible.

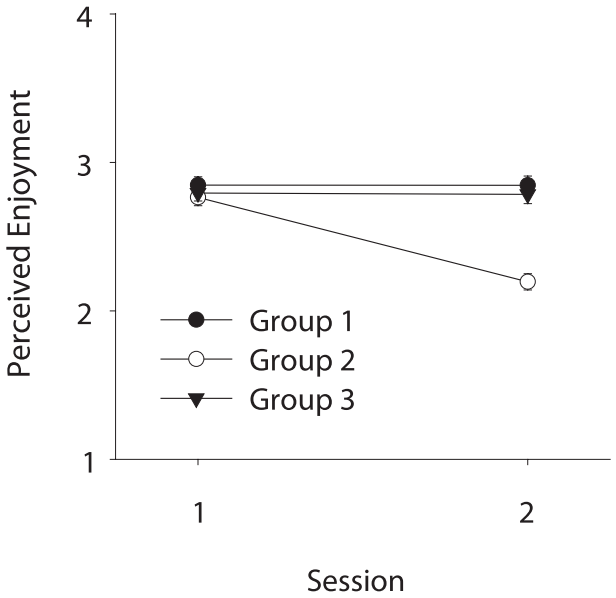

FIG. 1. Mean perceived enjoyment (+*SE*) while playing different versions of a computer game for three experimental groups. At session 1, all groups played the standard condition; at session 2, group 1 ($n = 171$) used the standard condition, group 2 ($n = 170$) played the version with reduced effectance, and group 3 ($n = 159$) played the version with reduced control.

Three versions of the video game were used. The first *(standard condition)* served as the control condition with no changes to the original game. The second version was used to affect players' perceived effectance *(reduced effectance condition)*. While the speed of the ball was the same as in the standard condition, this version ignored each input of a player with a probability of 33.3%. For example, if players pressed the cursor-left key, the racket would move with a probability of 66.6% but would display no reaction with a probability of 33.3%. To avoid players detecting the manipulation, the probability calculation was performed anew after each input. The third game version was designed to affect participants' sense of control *(reduced control condition)*. It responded to all inputs in the normal way, but the ball moved much faster compared to the standard condition. Therefore, it was harder for players to keep the ball within the screen and thus to maintain control over the game situation.

An online questionnaire with three scales measured perceived effectance (11 items, $\alpha = 0.92$), perceived control (9 items, $\alpha = 0.93$), and game enjoyment (8 items, $\alpha = 0.92$).

Participants played two rounds. In the first round, all participants received the standard condition with the instruction that this was a "training session" (t_1). After playing for 2 minutes, they completed the questionnaire and were then invited to play a second round (t_2). For this round, participants were randomly assigned to play the standard, the reduced effectance, or the reduced control condition. Afterwards, they completed the same questionnaire again and answered some general questions. Finally, participants were thanked and offered individualized feedback via e-mail. All data were collected in spring 2004.

Overall, the study comprised the between-subjects factor *game version* with the levels standard, reduced effectance, and reduced control and the within-subject factor *session* with the levels t_1 (standard condition for all participants) and t_2 (standard condition, reduced effectance condition, or reduced control condition). The dependent variable was game enjoyment.

RESULTS

After manipulation checks indicated that the game versions at t_2 had successfully reduced ef-

fectance and control, a repeated-measures ANOVA was computed with *session* as within-subject factor, *game version* as between-subjects factor, and game enjoyment as dependent measure (see Fig. 1).

A significant interaction effect between session and game version on enjoyment was observed: $F(2, 497) = 50.47$, $p < 0.01$, $\eta^2 = 0.17$). Game enjoyment in participants who played the standard game at both t_1 and t_2 was very similar at both points of measurement. In participants of the reduced effectance condition, the second session produced substantially lower levels of enjoyment ($M = 2.20$, $SD = 0.72$) than in the standard condition ($M = 2.85$, $SD = 0.81$). A post hoc test revealed that this difference was significant ($t[339] = 7.85$, $p < 0.001$, one-tailed, $d = 0.78$) and that enjoyment within the reduced effectance condition was also significantly lower at t_2 than at t_1: $t(169) = 10.65$, $p < 0.001$, one-tailed, $d = 0.81$. Overall, these findings support hypothesis 1.

Participants in the reduced control condition ($M = 2.78$, $SD = 0.78$) did not differ notably in game enjoyment at t_2 from the standard condition ($t[328] = 0.71$, $p = 0.240$, one-tailed, $d = 0.08$) and reported virtually equal enjoyment values at t_1 ($M = 2.79$, $SD = 0.67$) and at t_2 ($t[158] = 0.17$, $p = 0.433$, one-tailed, $d = 0.01$). Therefore, findings did not support hypothesis 2.

DISCUSSION

The results indicate the fundamental role of interactivity in video game enjoyment: players enjoy watching the results of the actions they perform, and their fun declines if these efficacy experiences are limited. Since effectance is a very basic determinant of enjoyment, it becomes salient in "natural settings" only when it is lowered (e.g., the computer is too slow to run the game). During normal game play, then, the continuous, unreduced effectance experiences will "silently" contribute to overall enjoyment.[2]

In contrast, control is probably very salient to players. However, a reduction of control over the game does not automatically lower enjoyment. Our explanation is that the fun of control in video games (1) can arise from being in control, as explicated previously, but that it (2) can also occur in episodes when players have to *struggle* for control (challenge[5]). Challenges go along with suspense, while established control should evoke emotional relief, which are both states of enjoyment.[1] Therefore, our findings do not discard control as explanation but rather indicate that the control-based formation of video game enjoyment seems to be more complex, with different states related to control holding the capacity to evoke game enjoyment.

Overall, the findings suggest that a variety of mechanisms underlie the interactivity–enjoyment connection. One of them is effectance: video games are enjoyable because they evoke perceptions of causal influence on the game world. Additional mechanisms—some of them linked to control—will have to be investigated in the future. Follow-up studies should address them using more advanced video game technology.[6] Nevertheless, the current study represents one milestone in explaining the implications of interactivity for video game enjoyment.

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