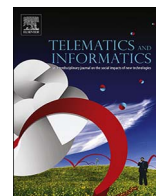




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How to create flow experience in exergames? Perspective of flow theory

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ABSTRACT

Exergames are popular computer applications. However, exergaming literature has insufficiently explained the formulation of user-experienced flow and what user needs may facilitate such a formulation, indicating a gap. To fill the gap, this study adopts the flow theory to construct a framework and examines how enjoyment and challenge impact the creation of flow, and how users' need for achievement and need for exercise may facilitate it. We recruited 583 participants who were asked to play exergames and complete a survey. The analytical results indicate that exercise enjoyment is positively linked to flow, while the need for exercise strengthens such a link. Moreover, challenge is positively linked to flow, and the need for achievement strengthens that link. This study is the first using the flow theory to explain the process by which exergamers experience flow.

1. Introduction

Exergames are computer applications that combine gaming with exercise to enable users to exercise in the comfort of their own home without the need for a dedicated sports venue or expensive sports equipment. Exergames are growing in popularity worldwide. For example, a popular game (Your Shape: Fitness Evolved 2012) has sold over 1.16 million units globally (VGChartz, 2017), suggesting the importance of research into exergames.

Recent research has emphasized the physical and psychological health-related effects of exergames. Physical effects include improved fitness (Huang et al., 2017c), attitudes to other forms of exercise (Nguyen et al., 2016) and dynamic balance (Cone et al., 2015), as well as cardiac rehabilitation (Ruivo, 2014). Psychological effects include elevated mood states (Huang et al., 2017d), positive mood (Jin, 2010b), increasing exercise intentions by using avatar-based exergames (Jin, 2010a), excitement (Song et al., 2013), the reduction of social physique anxiety (Song et al., 2014), and self-efficiency and enjoyment during virtual-reality exercise (Zeng et al., 2017). Such literature indicates a growing interest in how exergames can influence both the physical and psychological health of gamers. In addition to physical and psychological benefits, exergames likely attract users to concentrate on playing, thus

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creating flow experience. Flow experience could encourage further use (Liao and Teng, 2017), indicating the importance of flow experience. However, no study has yet explored how exergamer needs (e.g., the need for exercise and the need for achievement) can be moderators of flow and its antecedents (i.e., exercise enjoyment, gaming challenge), indicating a knowledge gap. Research filling this gap should offer novel insights to guide exergame providers' efforts to enhance gaming experiences.

Exergames are a combination of exercise and games. The gaming element typically provides users with challenge and enjoyment (Lyons, 2015). Gaming challenges motivate users to concentrate on overcoming them and such concentration and intrinsic enjoyment are central to the definition of flow and the key mechanism of the flow theory (Csíkszentmihályi, 1997; Liao and Teng, 2017), motivating us to adopt the flow theory.

Moreover, the exercise element in exergames can create effects that are similar to doing conventional exercise (i.e., improve physical fitness) (Nguyen et al., 2016). Hence, exergames can fulfill users' need for exercise, justifying the inclusion of need for exercise as a moderator. Moreover, overcoming gaming challenges provides positive feedback when playing exergames, which can also meet users' achievement needs, justifying the inclusion of need for achievement as the other moderator.

Therefore, the purpose of this study is to examine how challenge and exercise enjoyment are related to flow, and how user needs (i.e., for exercise and achievement) moderate such relationships. Overall, this study contributes to exergaming literature by clarifying how user needs strengthen the process of flow creation. Specifically, this study contributes to exergaming literature in several aspects. First, Lyons (2015) explored the impacts of feedback, challenge, and rewards on user enjoyment while playing exergames. Our study is in line with Lyons (2015) in examining challenge and enjoyment when playing exergames, but is novel in clarifying how the two moderators (i.e., the need for exercise and the need for achievement) can strengthen the impacts of challenge and enjoyment on the formation of flow. Such a clarification deepens our understanding of challenge and enjoyment during exergame play.

Second, Barnes and Pressey (2016) examined users' propensity to experience flow in virtual worlds. In line with theirs, our study also examined the flow experience in virtual worlds, but is new in examining flow in exergames, the virtual worlds that require users to use greater body movement. Our study may lead future scholars to examine whether enhanced need for achievement could explain the findings of Barnes and Pressey (2016).

Third, Limperos and Schmierbach (2016) investigated the links among the experience of playing exergames, enjoyment and intention to play. Specifically, they found that gamer achievement directly and indirectly influenced autonomy, competence, presence, enjoyment, and intention to play. Furthermore, enjoyment and presence mediated the relation between gamer performance and intention to play. In line with theirs, the present study also investigated in-game experience and its influence on enjoyment, but is new in clarifying how the need for exercise moderates the link between enjoyment and flow, as well as how the need for achievement moderates the link between challenge and flow. The clarification demonstrates the role of user needs in determining the relations between enjoyment and user responses.

2. Literature review and hypotheses

2.1. Flow and exercise enjoyment

Flow is defined as an enjoyable experience created through total concentration in conducting a task (Csíkszentmihályi, 1997). Flow can help create user loyalty (e.g., in game contexts) (Hsiao and Tang, 2016; Liao and Teng, 2017). Flow has antecedents including immersion and presence (Novak et al., 2000), particularly when individuals fully engage in a pleasurable and challenging activity (Csíkszentmihályi, 1997). Flow provides pleasure, a sense of playfulness, and novelty (Hoffman and Novak, 2009), suggesting that individuals experience happiness and tend to repeat the same task due to the positive feedback they receive (Csíkszentmihályi, 1997). For this reason, mental states may influence individuals' behavior and attitude to re-engaging in the same tasks, warranting research on the formation of flow in exergames.

Flow theory posits that flow experience occurs when individuals engage attentively and immerse themselves in specific activities (Csíkszentmihályi, 1997) and when individuals' skills are well matched to the challenge (Hoffman and Novak, 2009). If their skills do not match the challenge, they may experience boredom, frustration or apathy, rather than flow (Csíkszentmihályi, 1997). In gaming contexts, frustration may motivate gamers to seek help through task team participation to overcome challenges (Huang et al., 2017b), which is known as necessary for creating flow (Liao and Teng, 2017). Overall, research is still needed to understand how to create sustainable flow experiences (Barnes and Pressey, 2016).

Flow theory has been widely applied in the context of the real world and the virtual worlds, including in social commerce (Liu et al., 2016), online gaming (Liao and Teng, 2017; Teng, 2017a,b), and e-selling (Parvinen et al., 2015). Such literature indicates that flow theory is useful for exploring individuals' attitudes, behavior, and experience in various contexts.

In exergaming contexts, game play can create positive psychological outcomes. One potential reason is that playing exergames resembles doing conventional exercise. During and after exercise, pleasure and satisfaction provide individuals with enjoyment (Mott et al., 2001). Hence, such exercise enjoyment should instill a positive mood in users of exergames (Song et al., 2014), and enhances engagement and interest (Sun, 2013). Strong interest should motivate users to concentrate on playing exergames. Concentration is a core element of flow (Liao and Teng, 2017) and, thus, exercise enjoyment should be positively related to flow.

H1. Exercise enjoyment is positively related to flow experienced by exergame users.

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