





# The Impact of Game Peripherals on the Gamer Experience and Performance

Xiaobo Ke<sup>(✉)</sup>  and Christian Wagner 

School of Creative Media, City University of Hong Kong,  
Kowloon, Hong Kong, China

xiaobokeyc@my.cityu.edu.hk, c.wagner@cityu.edu.hk

**Abstract.** Game peripherals refer to the input-output devices assisting players to interact with video games. An interesting phenomenon related to game peripherals is bringing your own peripherals (BYOP) which means video game players, especially the advanced players, usually tend to use their own devices to play video games. An important reason for the popularity of BYOP is the players' belief that the best tools to play the game are their own devices, in terms of game experience and performance. Thus, the game peripherals used in the BYOP situation imply the excellent quality. However, the limited research on the game peripherals leads to the lacking understanding of what determines the good game peripherals and how the good game peripherals influence players' positive gaming experience and their performance. In order to call for more attention to the research on game peripherals and players' cognition, this paper focuses on two important dimensions of game peripherals (i.e., controller fit and vividness of interfaces) and their influences on players' positive in-game experience (i.e., sense of control, immersion and enjoyment). Furthermore, this research also discusses the relationship between positive gaming experience and in-game performance. A relational framework including seven propositions is proposed to guide and suggest future research on the game peripherals' influences and the positive gaming experience in the field of player-video game interaction.

**Keywords:** Game peripherals · Players' experience · Gaming performance · Player-video game interaction

## 1 Introduction

Game peripherals usually refer to the input-output devices facilitating players to interact with video games. The controllers and the user interfaces (e.g., the screen for displaying the virtual gaming environment and the audio devices for displaying the sound from the game) are two usual but important types of the game peripherals for playing the video games [47, 70]. In 2017, the game industry in America generated a record of 36 billion dollars in revenue [15]. Furthermore, one important observation found from this selling record is that the growth rate of hardware revenue (19%) is slightly higher than that of software revenue (18%) [15]. The active demand of the game peripherals is one of the important contributions to the high growth rate of the hardware revenue because of the popular phenomenon of bringing your own

peripherals (BYOP). The BYOP means the video game players usually would like to play video games by using their own devices, such as the keyboard, mouse and so on [79]. The BYOP is more common among the advanced players and this is also allowed in the professional tournaments of video games [82]. For example, rules and regulations of tournaments drafted by the International eSports Federation (IeSF) permit the professional players to set up their own game peripherals with some minimal restrictions [31].

The players believe their own peripherals are the best and critical tools to help them achieve the optimal gaming experience and high in-game performance. This belief is also an important reason for the popularity of the BYOP. Therefore, the game peripherals take an important role in the player-video game interaction regarding the game experience and performance of the players [6]. Furthermore, the game peripherals applied in the BYOP situation usually indicates the high quality. However, the research on the game peripherals is still insufficient yet [6, 42]. This leads to our limited understanding of what dimensions determine the good quality of game peripherals and how these factors influence players' positive gaming experience and hence impacting their performance.

To call for more attention to the studies on the influence of game peripherals on players' cognition in the player-video game interaction, this paper focuses on the influence of the controllers and user interfaces which are two common but essential game peripherals for video gaming. Specifically, based on the theories of technology-task fit [22] and media vividness [78], this paper develops the constructs of controller fit and the vividness of interfaces. Furthermore, three positive gaming experience, namely the sense of control, immersion, and enjoyment are identified from the theories of cognitive absorption [1], flow experience [10] and cognitive engagement [83, 84]. Drawn on the conceptual constructs, this paper raises seven propositions to illustrate the theoretical framework which consists of (1) how the controller fit and vividness of interfaces influence players' positive gaming experience; and (2) the relationship between the positive gaming experience and players' performance.

To sum up, this study provides a theoretical framework to help researchers understand the influence of the game peripherals on players' positive gaming experience and their performance. The propositions proposed by this study not only contribute to the knowledge of the mechanism of the player-video game interaction from the perspectives of game peripherals but as well highlight the potentials relationships of gaming experience with players' performance from the perspective of emotion-performance relation. We hope this study could help the scholars to guide their further research on the game peripherals and the players' gaming experience.

## 2 Theoretical Background

In this section, we introduce the several fundamental theories and the necessary literature to develop the focal constructs for this study. Specifically, the controller fit, the vividness of interfaces and the three types of positive gaming experience, namely sense of control, immersion and enjoyment, are introduced in the following sub-sections, respectively.

## 2.1 Controller Fit

The “fit” focus has been most significant in information systems research on the performance of individual decision-making and technology adoption (e.g., [40, 93]). As one of the influential information systems theories, the model of task-technology fit (TTF) concerns in the correspondence and matching between the task requirements and the abilities of information technologies [22]. The TTF model suggests that users will adopt a new technology if it is good enough for them to execute a certain task effectively and efficiently [67]. In addition, the TTF model has confirmed the influence of characteristics of tasks, technologies and individuals on the individuals’ perception of TTF and hence influencing individuals’ performance [13, 21]. This indicates that the TTF model actually considers the fit among the task, the technology and the user. Furthermore, the studies with “individual-technology fit” focus also have been conducted in another research stream which is based on the innovation-values fit (IVF) theory [69]. The IVF argues that individuals’ use of an innovative technology depends on the fit between the innovation and the values of individuals [43]. The value concerned by the individual could be regarded as “generalized, enduring beliefs about the personal and social desirability of modes of conduct or ‘end-states’ of existence” [39]. In other words, when the technology can match individuals’ values, they would be more likely to adopt and use this technology, and vice versa [43, 68]. Thus, the IVF theory can also be employed to explore the interaction relationship between persons and technologies [69].

In the context of gaming, the controllers are the essential information input techniques in player-video game interaction. The common types of the controllers are the gamepad, the joystick, and the combination of the keyboard and the mouse [6]. Based on the theories of task-technology fit [22] and innovation-value fit [43], we propose a construct named controller fit which means the controllers’ fit to the players and the game contexts. Two dimensions determine the controller fit: (1) the correspondence between the game requirements and the abilities of the controllers, namely game-controller fit; (2) the matching between the players’ preference (determined by the beliefs, social desirability, habits and etc.) and functionalities of the controllers, that is, the player-controller fit. Furthermore, three factors will influence players’ perception on controller fit: the characteristics of the games, the controllers and the players.

In the existing research regarding the controller fit, we can find that the construct of controller naturalness [61, 62] is well researched in the reality simulated game context. Controller naturalness refers to the overall intuitiveness which a controller is perceived when players are interacting with a virtual environment [75]. The literature on controller naturalness usually concerns in the matching between the controllers and the mental model [4] of the players (e.g., [59, 63, 74]). Therefore, to some extent, controller naturalness is a subset of the controller fit. However, the players’ other characteristics (e.g., beliefs and habits) are also important factors which may influence the players’ gaming experience and game adoption [18]. Moreover, player-controller fit also covers the matching between players’ mental model and controllers. In addition, the correspondence between abilities of the controllers and the game requirements (i.e., game-controller fit) is also influential according to the theory of task-technology fit. Therefore, as the theoretical sublimation of controller naturalness, controller fit

proposed by this study emphasizes a more comprehensive role in the players' positive gaming experience from both perspectives of the game-controller fit and the player-controller fit.

## 2.2 Vividness of Interfaces

In general, vividness refers to “the representational richness of a mediated environment as defined by its formal features; that is, the way in which an environment presents information to the senses” [78]. Vividness is one of the important properties of media technologies for the high quality of presentation. Two dimensions of the sensors usually determine the extent of media vividness [19, 78]: (1) sensory breadth which means the number of sensory channels simultaneously presented (e.g., audio, visual, haptic, and etc.); (2) sensory depth which indicates the quality of the presentation by the sensory channels (e.g., the quality of the image/video). Therefore, higher vividness implies more sensory channels [25, 92] and more information cues [17, 20] provided by these channels (say, the quality). Furthermore, vividness is also likely to attract and hold individuals' attention, which makes people feel emotionally interesting and provokes their concrete and imagery thinking [37].

In the context of gaming, vividness refers to the quality of the user interfaces related to the presentations of the game's virtual environments, such as the audio-visual system displaying the game's scenes and sounds. Based on the previous literature on the quality of user interfaces, we are able to find that most of these studies usually center on the quality of visual display systems (e.g., [5, 68]) and the quality of audio systems (e.g., [65, 76]), respectively. Typically, the information from the visual device is essential and indispensable for the most of game contexts as the visual device displays the main game scene containing objects with which players need to interact (e.g. avatars, enemies and targets) as well as a complicate cum moving background (e.g. interiors and landscapes) [6]. In most circumstances, the game controlling decisions (i.e., how to play the game in next second) are made mainly drawn on the information gained from the visual display systems. Besides, the information from audio devices is also often used to reinforce or facilitate the players' experience in the player-video game interaction [6]. Most of the extant game related studies on display systems and audio systems are actually concerning about the sensory depth of the vividness of user interface, such as screen size [28], resolution [72], screen position [7], surround quality of the sound [76] and so forth.

## 2.3 The Positive Experience in Gaming

The user experience is one of the main topics of the information systems studies. In the previous literature, the research on games or other hedonic information systems usually focuses on the positive mental state of the users (e.g., [54, 80]).

The flow experience [10], cognitive absorption [1] and the cognitive engagement [83, 84] are the three main theoretical foundations of the relevant research on users' positive experience in the interaction of human-hedonic information systems (e.g., the

game). The flow experience refers to the optimal overall experience, “the state in which individuals are so involved in an activity that nothing else seems to matter” [10]. Cognitive absorption denotes a state of deep engagement and involvement that a user can experience in the interaction with hedonic information systems [1, 12, 24]. Cognitive engagement relates to the state of playfulness, and that the state of playfulness is identical to the flow experience [84]. Specifically, cognitive engagement is the flow experience without the notion of control [83, 84]. These three constructs are all the multi-dimensional constructs and dimensions of each construct are listed in Table 1.

**Table 1.** Dimensions of flow experience, cognitive absorption and cognitive engagement.

	Positive gaming experience used in this study	Flow experience	Cognitive absorption	Cognitive engagement
Dimensions	Enjoyment	Pleasure and enjoyment	Heighten enjoyment	Intrinsic interest
	Immersion	Concentration	Focused immersion	Attention focus
	Sense of control	Control	Control	–
	–	–	Temporal disassociation	–
	–	–	Curiosity	–

Based on Table 1, we can find that the enjoyment and the immersion are the two dimensions included in these three positive mental states (i.e., pleasure and enjoyment and concentration in flow experience; heighten enjoyment and focused immersion in cognitive absorption; intrinsic interest and attention focus in cognitive engagement). In addition, the sense of control is the dimension which only appears in the flow experience (i.e., control) and the cognitive absorption (i.e., control) as the cognitive engagement is the flow experience without the sense of control. Therefore, the enjoyment, immersion and sense of control are the three positive gaming experience usually concerned by these foundational theories. In this case, this study mainly focuses on these three dimensions for the development of the proposition on the relationship of game peripherals with players’ positive game experience and their performance.

Firstly, the sense of control captures the user’s perception of being in charge of the interaction [1]. The sense of control is one of the important triggers for players’ dominance feeling in the gameful experience [16]. Secondly, the immersion is defined as “the experience of total engagement where other attentional demands are, in essence, ignore” [1]. In other words, the immersion relates to the experience of total involvement and emotional engagement in the virtual world [73]. Thirdly, enjoyment refers to the extent to which interaction with the system is perceived by players as pleasurable and enjoyable [23, 80]. The enjoyment as a desirable affective response is important for users’ satisfaction during the system interaction [2, 14], especially in the context of hedonic information systems [54].

### 3 Proposition Development

According to the research framework as shown in Fig. 1, seven propositions are developed to illustrate the theoretical relationship among game peripherals (say, controllers and user interfaces), players' positive gaming experience and their in-game performance. The in-details proposition development is presented in the following subsections.

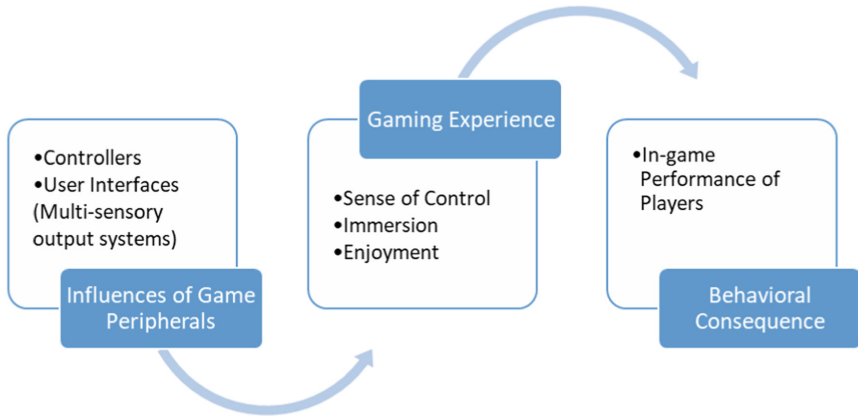


Fig. 1. The theoretical framework.

#### 3.1 Controller Fit and Players' Positive Experience in Gaming

In this paper, we propose a construct of controller fit indicating the influence of controllers. Two dimensions consist of this construct: (1) game-controller fit which means the correspondence between the game's requirements and abilities of the controllers; (2) player-controller fit which refers to the matching between the players' mental model, belief, and habits as well as the functionalities of controllers. Therefore, three factors, namely the game characteristics, the controller characteristics and the player characteristics, influence players' perception of the controller fit.

As shown in Table 2, three focuses of controller fit can be summarized from the existing literature on the relationship between controller fit and their influence on users' experience. Table 2 indicates that the current research mostly centers on the controller naturalness (e.g., [59–61, 74]) which is a specific type of player-controller fit. That is, the matching between the players' mental model of the real world and the mapping methods of the controllers. This kind of controllers fit (i.e., controller naturalness) has already been confirmed that it effectively influence players' experience in gaming, such as the aggressive intention (e.g., [63]), the immersion (e.g., [62]). However, the controller naturalness is not always true and effective because this kind of controller fit is highly depended on the game context (say, the reality simulated games) [81]. Therefore, this is why other specific types of controller fit are still important and worthy to be researched. For instance, in a game context where the games have no real-world

analog, like casting a healing spell or flying a fictional vehicle, players' mental models of controlling behaviors are more a function of their video game experiences rather than their experiences in the real world [71]. In this case, the matching between players' habits of previous game experience and the controller is more meaningful and useful [71]. This is another types of controller fit shown in Table 2 (i.e., controller fit to players' game experience).

**Table 2.** The summary of three focusing types of controller fit in the literature.

Focuses of controller fit	Description of controller fit	Importance for players' game experience	Supporting references
Controller naturalness	The matching between players' mental models of the real world and mapping methods of the controllers	In the reality simulated games, the controller naturalness plays an important role in shaping players' experience	[59–63, 74]
Controller fit with players' game experience	The matching between the players' previous gaming experience and the controllers	In virtual oriented games, controller fit to players' previous game experience is more significant	[71, 81]
Comparison of different controllers	The overall fit assessment of the controllers	The different types of controllers have different influences on players' game experience	[86, 87]

Thus, in order to give out a consistent theoretical lens for the research on controllers in the player-video game interaction, this paper proposes the construct of controller fit which is the theoretical sublimation of the controller naturalness and other studies of the controller. Furthermore, we also hope to call for more attention to conduct more studies of the controller fit in the various gaming context. To this end, we develop two propositions on the controller fit and its influence on players' positive experience to guide the further research.

According to the theory of TTF, users will only use an information technology when it fits their tasks at hand [22, 38, 88]. Following this logic, in the gaming context, we argue that the players prefer to use the controller which fits the game which is being played, namely the controller fit resulting in the phenomenon of BYOP. This is because the controller fit leads to the high game experience of players. According to the findings of the existing studies, we can find that a closer match between the user's existing knowledge and the channel of input allows the gamers to react more efficiently to the game's information [4, 60], which enhances the sense of the control. Moreover, a study reveals that the fit between the games and the controllers leads to more presence experience which is an important element of the overall immersive experience [87]. In addition, the controllers fit also provides the player with more opportunities to focus on the game contents, which also enhances the possibility of experiencing focused immersion [62, 63]. Thus, the propositions on controllers fit and positive players' experience in gaming are listed as follows:

*Proposition 1 (P1): Controller fit has the significant effect on the players' sense of control in gaming.*

*Proposition 2 (P2): Controller fit has the significant effect on players' immersion in gaming.*

### 3.2 Vividness of Interfaces and Players' Positive Experience in Gaming

Vividness refers to “the ability of a technology to produce a sensorially rich mediated environment” [78]. Furthermore, vividness of the media is believed to affect involvement with the mediated environment [19, 25]. Vividness can be achieved through the manipulation of dimensions of depth and breadth [78]. The breadth implies the number of different sensory channels utilized (e.g., visual, audio and etc.) [26]. In contrast, the depth indicates the resolution or quality of a particular sensory channel [25].

In the context of player-video game interaction, vividness also often takes an important role in the game experience because of the integrated systems of user interfaces. When reviewing literature (as shown in Table 3), we are able to find that the vividness of interfaces has a significant influence on the players' positive experience in the player-video game interaction. For example, Liu et al. [52] examined the positive relationship between visual vividness and immersion while Williams [87] confirmed the vividness leads to the sense of presence and hence improving player's enjoyment. Besides, we further found that the vividness also significantly influences users' experience and decision-making in contexts of business and social network (see Table 3).

**Table 3.** The summary of vividness research in different fields.

Research areas	Importance of the vividness	Stimulated positive experience	Supporting references
Game experience	Visual vividness helps players to create a sense of presence, enjoyment and immersion in the player-video game interaction	Presence, enjoyment, immersion	[35, 52, 76]
Online shopping	More vivid product visualizations are linked to a more positive affective emotional experience and purchasing intention of website visitors	Immersion, enjoyment	[9, 41, 90]
E-tourism	The vividness of the technologies quality is important for visitors' overall satisfaction of the travel attractions and visitor's attitude change	Presence, mental imagery	[45, 85]
Recommendation systems	Vividness represents multiple symbol sets to convey information and is positively associated with better information processing of individuals	–	[25, 37]
Social media	The vivid information can not only increase the perceived quality and credibility of the presented information but also enhance the hedonic feelings of users	Social presence	[17, 19, 48, 91]



Table 3 indicates that the vividness of interfaces is a widely researched construct in various contexts, which means the influence of the user interface is an important factor for the user experience and the cognition change. Based on the previous literature, this paper develops two propositions on the vividness of interfaces in the context of games. These two propositions highlight the role of user interfaces as the important game peripherals in the player-video game interaction.

Vividness is “likely to attract and hold our attention and to excite the imagination to the extent that it is emotionally interesting” [66]. Furthermore, higher vividness is often associated with more salient information cues/sensory channels, and therefore it generally is more attractive [37, 66] and drawing attention [37, 46]. In addition, the display of vivid information also triggers more positive affective responses, such as enjoyment in shopping [37, 64]. The literature listed in Table 3 also supports these arguments. Therefore, in the context of gaming, the vivid interface also makes players more absorbed and enjoyed in the game landscape because of the attractiveness of the vividness information and its emotionally interesting characteristics. Therefore, two propositions on the vividness of interfaces and positive players’ experience in gaming are listed as follows:

*Proposition 3 (P3): Vividness of interfaces has the significant effect on players’ immersion in gaming.*

*Proposition 4 (P4): Vividness of interfaces has the significant effect on the players’ enjoyment in gaming.*

### 3.3 Players’ Positive Gaming Experience and Their Performance

Drawn on the dimensions of the flow experience, cognitive absorption and cognitive engagement, we extract three types of positive experience which the players usually experience in gaming. These three types of positive experience are sense of control, immersion and enjoyment. In this sub-section, we illustrate the relationships between these three types of positive experience and the players’ game performance.

The sense of control represents the players’ perception of being in charge of the interaction with video games [1]. Control is the abilities to manage one’s interaction, including the capabilities of interrupting the interaction, adapting the interaction to one’s desires, selections making, and being generally in charge of interaction [53, 55]. The perception of the control abilities is also a partial means by which a person can feel he or she is competent, mastery, and capable to make decisions [54] with the use of controllers in gaming, which makes the players have high confidence in the effectiveness of their game operations. Therefore, the players with a high sense of control could be more prone to aggressively concentrate on the challenges occurring in the game environment because of their confidence of game controlling driven by the sense of control. Furthermore, the sense of control as a positive players’ experience also stimulates players’ positive mental state which facilitates players’ performance [57]. Together, the cognitive concentration on the game challenges and the positive mental state of players jointly help the players gain their higher game performance. Thus, the proposition is listed as follows:

*Proposition 5 (P5): Sense of control has the significant effect on the players' gaming performance.*

Immersion refers to “the experience of total engagement where other attentional demands are, in essence, ignore” [1]. The experience of immersion is the typical and important experience for the user’s engagement with hedonic information systems. In the game context, the immersion experience has also been proved the positive influence on the intention to play [89] and on the game repurchase behaviors [44]. Furthermore, a higher level of immersion potentially has a greater impact on performance [36]. For example, Liu et al. [52] found the immersion experience leads to higher performance while Lin et al. [51] find that immersion impacts players’ recall ability in gaming. Moreover, Slater et al. [77] suggests a positive relationship between immersion and the ability of spatial judgments. The high immersion means the high cognitive resource concentrate on the context of the game, which is the important factor for players facilitate their cognitive skills in gaming [3]. Therefore, the proposition on immersion and players’ gaming performance is listed as follows:

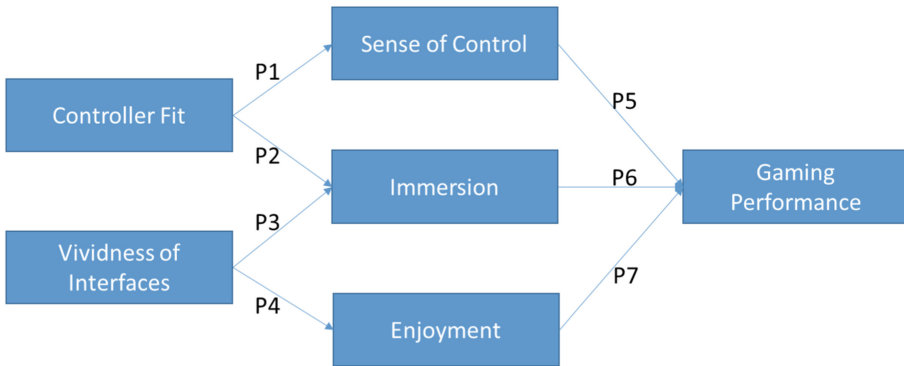
*Proposition 6 (P6): Immersion has the significant effect on the players' gaming performance.*

Enjoyment is defined as the extent to which the interaction with the systems is perceived as pleasurable and enjoyable [23, 80]. Clearly, enjoyment is a typical positive emotion. The effect of positive emotion on the individuals’ performance in games is positively significant from two perspectives. On the one hand, the positive emotion and affect (e.g., enjoyment or happiness) stimulates players’ more creative problem-solving abilities [30, 33, 34] and facilitates their decision-making under pressure [32]. The abilities of problem-solving and making decisions in the stressful situation are both the important factors for the better performance in the competition [57]. On the other hand, if the game is performed in the group formation, the enjoyable experience of the players also increases their team cooperation which ultimately improves their team performance [50, 56]. Therefore, the proposition of enjoyment and players’ gaming performance is listed as follows:

*Proposition 7 (P7): Enjoyment has the significant effect on the players' gaming performance.*

## **4 The Research Opportunities Based on Propositions**

In this paper, we focus on the influence of game peripherals on the players’ positive experience and performance in the player-video game interaction. According to the propositions raised in the last section, the overall relationships among the game peripherals, players’ positive gaming experience and their performance are shown in Fig. 2.



**Fig. 2.** The theoretical relationship model

#### 4.1 The Influence of Game Peripherals for Further Research

In this paper, two propositions center on the controller fit and vividness of interfaces, respectively. Actually, we found that existing literature, to some extent, has examined some propositions related to the game peripherals (proposed in this paper). Therefore, this paper also summarizes the relevant literature which has verified the propositions raised in the paper (as shown in Table 4). Based on Table 4, we can see that the P1–P3 have been empirically supported. However, these supports are partial. For example, Liu et al. [52] confirmed the vividness of interfaces positively influence the immersion experience of the player and hence improving their enjoyment of gaming. This research mainly focuses on the influence of visual vividness (screen size is manipulated in the study of Liu et al.) on players' immersion experience. However, the vividness of interfaces is not only determined by the visual channel, especially in the current gaming mode. The audio channel and the tactile channel are also important interfaces for the optimal game experience [6]. The design of the multisensory interface is also one of the mainstream strategies in the current game development (e.g., games of F1 series). However, the research on the vividness of interface enabled by the multisensory channels is still yet limited. Therefore, the impacts of the multisensory interface on the players' immersion and enjoyment could be the future research orientation related to the propositions on the vividness of interfaces.

Furthermore, the propositions of the controller fit are also partially studied mainly by the research on controller naturalness (e.g., [59, 62]). The research efforts on the controller naturalness are mainly spent in the players' immersion experience in the reality simulated games, such as the exercise games [59] and shooting games [60]. However, the research also confirmed that the controller naturalness is not suitable in the virtual oriented game context [71]. In the games which are not the reflection of the real-world, the controller fit to the gamer's previous gaming experience is more important with respect to the players' gaming experience. Therefore, the controller fit in the context of a virtual game could be the one of the future research orientation for the propositions of controller fit and players' gaming experience.

**Table 4.** The summary of the verification of P1–P4.

Propositions	Verification notes	Supporting references
P1: Controller fit → Sense of control	Having not yet been verified	–
P2: Controller fit → Immersion	Partially verified, the controller naturalness (a type of controller fit) leads to players' immersion	[59–61]
P3: Vividness of interfaces → Immersion	Partially verified, the current research focuses on the visual vividness	[52]
P4: Vividness of interfaces → Enjoyment	Partially verified, vividness of interfaces influence enjoyment via the mediators	[52, 76]

## 4.2 The Emotion-Performance Relation in Gaming

This paper develops three propositions (i.e., P5–P7) on the relationship between players' in-game positive experience and their gaming performance. The extant studies also pay attention to the relationship of players' experience with their gaming performance. However, most of these studies focus on the influence of players' gaming performance on their experience after playing the game. For example, Hopp and Fisher [27] find that the female players' enjoyment is influenced by their gaming performance; Limperos and Schmierbach [49] find the mediating effect of enjoyment on the relationship between players' performance and future intentions to play the game. On the contrary, how the in-game experience influence players' gaming performance is still not well under researching. As shown in Table 5, we can only find a few research that confirmed the in-game immersion experience positively influences players' gaming performance (e.g., [8, 29]), which indicates research opportunities for the influence of in-game experience on players' performance. Furthermore, the argument of emotion-performance from the field of sports science theoretically supports the proposition 7.

**Table 5.** The summary of the verification of P5–P7.

Propositions	Verification notes	Supporting references
P5: Sense of control → Performance	Having not yet been verified	–
P6: Immersion → Performance	Verified, but needs more research in different context to check the generalizability of the results	[8, 29]
P7: Enjoyment → Performance	Having not yet been verified, in the gaming context, but is supported by the arguments of emotion-performance relation in the filed sports science	[11, 58]

Actually, players' positive gaming experience is a promising field of research because of their influence on specific components of performance excellence (e.g., cognition) [11]. However, the benefits of these emotional experiences have hitherto not been fully realized in a game context, especially in the context of professional

competitive gaming (say, eSports). Therefore, the three propositions on the in-game players' experience and the gaming performance are promising research orientations for the human-computer interaction research to understand the emotion-performance relation in the context of gaming.

## 5 Conclusions

This paper focuses on the two characteristics of game peripherals (i.e., controller fit and vividness of interfaces) and their influence on the players' positive in-game experience (sense of control, immersion and enjoyment) and their gaming performance. Seven propositions are raised to illustrate the theoretical relationships among game peripherals, players' positive gaming experience and their performance. Based on the propositions, the further research orientations are also discussed and suggested. This paper hopes to help the researchers further explore the research on game peripherals from the perspective of fit and vividness as well as the research on the emotion-performance relation in the field of player-video game interaction.

**Acknowledgement.** The research presented in this article was supported in part by the UGC Teaching and Learning Project entitled "Developing Multidisciplinary and Multicultural Competences through Gamification and Challenge-Based Collaborative Learning".

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