Exploring the Effects of VR Gameplay Videos on Performance and Experience

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ABSTRACT
Sharing gameplay videos online has become a common practice. In case of virtual reality (VR) games, these videos are typically in the traditional rectangular format, consisting of a real-world view showing the player's actions and a virtual-world view showing what the player sees in the VR game. Watching such videos can be considered a process of observational learning—when the viewers of these videos become players, they may perform better and have a better experience in the game. This study explores this potential chain of indirect effects of watching VR gameplay videos. The result of a laboratory experiment shows that watching VR gameplay videos indirectly enhances various aspects of players' experience including immersion, flow, competency, and positive affect, via its effect on observational learning and, thereafter, game performance. The theoretical and practical implications of these effects have also been discussed.

Keywords
gameplay video, game performance, gameplay experience, observational learning

INTRODUCTION
Watching videos of gameplay has become a common practice. For instance, before buying and playing a game, a game owner and player may have watched a gameplay video of the game from online sources. It is important to understand any influences of such pre-gameplay exposure to a digital game on the actual gameplay experience.

The current study investigated the influences of gameplay video with a specific focus on virtual reality (VR) games. VR offers an immersive experience with a panoramic and all-rounded perspective. However, gameplay video and live stream of VR games are in traditional video (i.e. rectangular videos) which offers a limited view of the VR gameplay. A typical gameplay video of a VR game includes a real-world view of the player's actions alongside a virtual view of the player's view. These gameplay videos consisting of two views show what happens in gameplay sessions.

Viewers can thus learn through observation. Information presented in walkthrough videos can be beneficial to actual gameplay. For example, a demonstration of how a player finds a power-up in a virtual environment can inform viewers about where to find the power-up in their actual gameplay.

Watching gameplay videos may thus trigger a chain of indirect influence on the viewers if they go on to become players of the game. Observational learning by watching VR gameplay videos may enhance viewers' performance in their own future gameplay (e.g. learn by watching how other players play a game). If their skill level matches the challenge presented by the VR game, they may perform better and

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have a better experience in the game, even in their first actual gameplay. The current study aims to explore this chain of indirect effects.

RELATED WORK

Video Game Spectatorship

Watching video games via live or archived streams has become a common phenomenon and has drawn the attention of the research community. Most studies in this area are interested what motivates players to watch gameplay videos (Cheung and Huang 2011; Gros et al. 2017; Sjöblom and J. Hamari 2017; Smith et al. 2013) —in other words, a key question for many researchers is why people like to watch other players play video games that are primarily designed to engage players and not an audience or spectators. Cheung and Huang (2011) studied the audience of game broadcasts (or "streaming" as they are known) of the popular games *StarCraft* (Blizzard Entertainment 1998) and *StarCraft 2* (Blizzard Entertainment 2010). They derived nine profiles, each with different motivations for being a spectator. For example, people belonging to a certain profile want to learn from the broadcasters, while those with another profile want to contribute by posting their own comments on the content.

Several studies have investigated game streaming as a form of user-generated content (Jia et al. 2016; Sjöblom et al. 2017; Hamilton et al. 2014) and examined the interactions between broadcasters and their audience (Kaytoue 2012). In an ethnographic study of live streaming on Twitch, Hamilton and his colleagues (2014) reported that streamers project their personalities in to the atmosphere of their streams. Such atmosphere attracts spectators who shared the attitude and values and thus communities emerge around steams. Streamers see the regular spectators of their streams as friends and interact with them. The interactions can be more than the text conservation supported by Twitch. For example, the streamers may choose gameplay options based on the suggestions from the viewers.

The effects of watching gameplay videos of VR games on actual gameplay, however, have so far received only limited attention from the research community.

Observational Learning

Observational learning is learning by directly observing or watching videos of another person performing tasks and viewing the outcomes of the tasks (Bandura 1986). Observational learning allows people to acquire knowledge and skills without making the effort in trial-and-error. However, they can observe the action and consequences of a demonstrator (or via a recorded video). Learning with this approach saves effort and reduces risks (especially in tasks that involved risks). Learning in this manner can be beneficial for different types of tasks, such as those related to the acquisition of motor skills (Larssen 2012), cognitive skills (Huff and Schwan 2012; Schwan and Riempp 2004), computer skills (Meij 2017; Yi and Davis 2003), and tasks involving tacit knowledge (Chen and Wu 2015). Research on observational learning is backed by research on neuroscience that investigates the activation of different areas of the human brain during observational learning (e.g., Calvo-Merino 2006).

Transferring Skills from Reality to VR

According to flow psychology (Csikszentmihalyi 1990), players can enjoy a game if their skill level matches the challenge presented by the game. Entering the virtual environment of a VR game is like transferring oneself to another environment. Every time a player starts playing a new VR game, the experience is similar to tackling challenges in a new place (Slater 2009) with a new body (Kilteni et al. 2012). If the players can be equipped with some basic skills or knowledge beforehand, they can start a game easily and have a more enjoyable experience.

Previous studies have shown evidence that players can acquire skills in the real world and transfer them to virtual environments (Ho 2016; Ho 2017). Ho (2017) conducted an experiment exploring the effect of real-world practice on VR games. In his study, he developed a VR game involving transferring balls by moving one's head. He also created real-world and VR versions of practice for the game. He compared the game performance and gameplay experience of participants who had no practice, a practice in a VR world, and a practice in the real world. The results show that real-world practice can help players feel more confident before playing a VR game.

GAMEPLAY VIDEOS: DIRECT AND INDIRECT EFFECTS

We argue that watching a gameplay video of a VR game before playing it has a series of direct and indirect effects on the actual gameplay experience and the player's impression of the game.

When players view a gameplay video of a VR game new to them, they can observe how another player tackles the challenges and can learn from this. This observational learning may involve motor skills acquisition (e.g., how to skillfully perform certain actions with the controllers of a VR headset) and/or knowledge acquisition (e.g., knowing where to find additional tools or power-ups that help with the gameplay). If the players transfer what they learn from watching a gameplay video in the real world to the virtual world of a new VR game, they may be able to easily tackle the early challenges in their first gameplay. They may also be able to perform better in the game overall and, in turn, have a better gameplay experience.

The following section describes a laboratory experiment that explored these direct and indirect effects. The observational learning involved in the indirect mechanisms may be related to motor skills or knowledge or both. Therefore, the experiment also focused on the potential mechanisms based on learning of cognitive skill and knowledge.

METHOD

We conducted a laboratory experiment involving two conditions: a treatment group that was given exposure to a gameplay video of a VR game before actual gameplay, and a control group without any such prior exposure.

Participants

We recruited 42 participants (Female: 27, Age: Mean (M) = 22.7 years, Standard Deviation (SD) = 2.9) from undergraduate and postgraduate students at a public university in Hong Kong. The mean years of experience with playing video games was 11.1 years (SD = 4.3). Each participant received a coffee coupon worth HK$25 (about US$3.2) as an incentive to participate. Twenty-one participants were randomly assigned to each group. All of them indicated that they were new to the game they played in the experiment.

The Game: Longbow

In our experiment, we used the game *Longbow* in Valve's VR game *The Lab* (Valve Corporation 2016) with the HTC Vive VR headset. In this game, the player stands at the top of a castle wall that has a gate. The goal is to protect the castle by killing waves of enemies approaching and attacking the gate in the wall. If the gate is broken and the enemies enter, the player loses. The enemies carry melee weapons, which means they can only attack the gate when they manage to get close to it. Enemies come in batches (or "waves" as they are known in the game) of 5–6.

The player's primary weapon is a bow and arrow. In the gameplay, the player needs to mimic the action of pulling and releasing an arrow on a bow using the two HTC Vive controllers. An enemy is killed if shot by an arrow. Some enemies wear protective helmets that are removed if shot. When an enemy dies, two red balloons (3 in case of death by headshot) appear. Shooting a red balloon can repair the gate if it has been damaged.

Some gadgets in the virtual environment also serve as secondary weapons—next to the player are two torches with which the player can light an arrow. An arrow with fire can burn off the shields of some of the enemies. There are also five bombs that the player can trigger by shooting. The bomb explosions kill all the nearby enemies at once. Finally, the player also has two oil tanks on the wall, which can be used to pour hot oil to kill enemies directly under the wall. These tanks can be triggered by shooting the archery targets next to them.

Two Types of Weapons, Two Types of Observational Learning

The two types of weapons corresponded to two types of observational learning we attempted to observe: the acquisition of motor skills and knowledge. The use of the bow and arrow to kill the enemies in the VR game requires the skillful use of the HTC Vive Controllers and careful aim. We attempted to see if the participants who had previously watched a gameplay video would kill more enemies with the bow and arrow (i.e., the primary weapon). In the current experiment, we used the number of enemy kills using the primary weapon as an indicator of the observational learning of motor skills.

Although the gadgets (i.e., the secondary weapons) appear in the virtual environment, the game does not provide instructions on what they do with them or how to use them. Therefore, if a player does not already know how to use them, he/she may not pay attention to them at all. The player's use of the gadgets to kill the enemies in their first round of gameplay would thus be a strong indication that they have learned what the gadgets do and how to use them. Therefore, we attempted to see if the participants who had previously watched a gameplay video killed more enemies using the gadgets. For this, we used the number of enemy kills with the gadgets as an indicator of the observational learning of knowledge.

The presence of these two different types of weapons in *Longbow* in *The Lab* (Valve Corporation 2016) was a major reason it was selected for the experiment.

The Gameplay Video

A gameplay video was created by screen-recording the first-person view (that is, the view seen on the monitor) of a short gameplay session along with a recording of the player's actions in the real world. Figure 1 shows a screenshot of the video. The gameplay video lasted for 3 minutes and showed a player killing enemies using the primary weapon (a bow and arrow) as well as the gadgets in the environment (Figure 2).

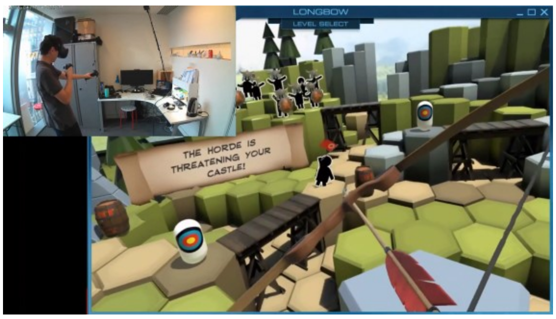

Figure 1: Screenshot of the gameplay video.

Figure 2: Screenshot of the gameplay video showing the use of a bomb (one of the gadgets) to kill an enemy.

Measurements

The participants' demographic profiles and previous experience with playing video games were captured through a background questionnaire. The participants were also asked to fill in a post-gameplay questionnaire that included a gameplay experience questionnaire (GEQ) (IJsselsteijn et al. 2013). The GEQ consists of question items (measured on a 5-point Likert scale from 0 to 4) covering 7 aspects of the gameplay experience: immersion, competency, flow, tension, challenge, negative affect, and positive affect.

All the gameplay sessions were recorded using a video camera so as to capture the participants' behavior in the real-world along with a screen recording capturing the participants' view of the virtual world of the VR game. We kept track of the following statistics: number of enemies killed (Kills), number of enemies killed with arrows (Primary Weapon Kills), number of enemies killed with gadgets in the environment (Gadget Kills), and number of waves of enemies the participants survived (Waves).

Procedure

At the beginning of each session, a researcher briefed the participant on the procedure and asked him/her to give their written consent. Next, the participant filled in a background questionnaire intended to capture their demographic profile and previous experience with playing video games. Then, the researcher introduced the VR game that the participant was going to play. The introduction mentioned the player's goal (i.e., to defend a castle) and a description of what the enemies would try to do. After the introduction, the participants in the treatment condition watched a gameplay video on a desktop monitor, while participants in the control condition did not watch any such video.

Next, the researcher helped the participant to put on an HTC Vive VR headset and told him/her how to use the primary weapon (i.e., the bow and arrow). The participant was told to practice using the bow and arrow by shooting the practice targets in the VR game. After the participant had successfully shot a practice target 3 times, the researcher told him/her to shoot an enemy waving a flag to start the game whenever he/she was ready. The purpose of this step was to ensure that the participants had acquired the basic skill of shooting a target with the primary weapon. The gameplay ended when the participant lost or when he/she managed to complete 8 waves of the game. After the VR gameplay, the participant filled in the post-gameplay questionnaire and was debriefed.

Results

A series of t-tests were conducted to compare the means of the measures in the control and treatment conditions. There was a significant difference in the means of the number of kills with the gadgets ($t(40) = -2.72$, $p < .01$). Participants who had watched a gameplay video before the VR gameplay ($M = 2.00$, $SD = 2.49$) killed more enemies using the secondary weapons (Gadget Kills) than those who did not ($M = .38$; $SD = 1.12$) with a statistical significance (Table 1).

Measures	**Mean (Standard Deviation)**		**t**
	Control	Treatment	
Kills	10.57 (7.17)	14.00 (8.15)	-1.45
Primary Weapon Kills	10.19 (6.47)	12.00 (7.09)	-0.86
Gadget Kills	0.38 (1.12)	2.00 (2.49)	-2.72*
Wave	3.76 (2.12)	4.71 (2.26)	-1.41

* $p < .01$

Table 1: Statistics of Measures Collected in the Game.

The t-tests of the seven aspects covered in the GEQ did not reveal any direct effects of the treatment with statistical significance (Table 2).

Although the exposure to a gameplay video did not reveal significant direct effects on the seven aspects of game experience we measured, our aim was to examine the indirect effects of watching a gameplay video on the gaming experience via its effects on observational learning and game performance.

Measures	**Mean (SD)**		**t**
	Control	Treatment	
Immersion	2.57 (0.75)	2.46 (0.48)	0.57
Competency	1.98 (0.88)	1.88 (0.78)	0.41
Flow	2.73 (0.66)	2.72 (0.53)	0.05
Tension	1.06 (0.76)	0.84 (0.80)	0.92
Challenge	2.24 (0.59)	1.98 (0.60)	1.40
Negative Affect	0.70 (0.53)	0.62 (0.64)	0.44
Positive Affect	3.18 (0.72)	2.97 (0.71)	0.95

Table 2: Statistics of Seven Aspects of the Game Experience Measured with the GEQ.

To examine the series of indirect effects of watching a gameplay video on gameplay experience via its effect on observational learning (acquisition of motor skills or knowledge) and game performance, mediation models were tested using Hayes' (2013) PROCESS macro on SPSS (Model 6). Hayes' approach of testing mediation effects is based on regression. Model 6 in Hayes's PROCESS macro is aimed at testing the indirect effects of variables in a serial relationship.

We tested mediation models to examine the indirect effects of exposure to a demonstration video on the 7 aspects of the gaming experience in the GEQ via its effect on the observational learning of motor skills (as indicated by the number of Primary Weapon Kills) and game performance (as indicated by the number of Waves). The results did not show any significance.

We also tested mediation models to examine the indirect effects of exposure to a demonstration video on the 7 aspects of the gaming experience in the GEQ via its effect on the observational learning of knowledge (as indicated by the number of Gadget Kills) and game performance (as indicated by the number of Waves). The results indicated significant indirect effects of exposure to a gameplay video on immersion through knowledge acquisition and thereafter on game performance—B = .11, SE = .06, Lower Limit of Confidence Interval (LLCI) = .04, Upper Limit of Confidence Interval (ULCI) = .30. The results also indicated that the indirect effects of exposure to a gameplay video on competency through knowledge acquisition and then on game performance were significant—B = .25, SE = .12, LLCI = .09, ULCI = .57. Further, it was found that the indirect effects from exposure to a gameplay video on flow through knowledge acquisition and then game performance were also significant—B = .10, SE = .06, LLCI = .02, ULCI = .30. The indirect effects from exposure to a gameplay video on the positive affect through knowledge acquisition and then on game performance were found to be significant—B = .19, SE = .08, LLCI = .08, ULCI = .41. Tests of similar mediation models on tension, challenge, and negative affect did not reveal any significance. Figure 3 graphically illustrates the significant indirect effects.

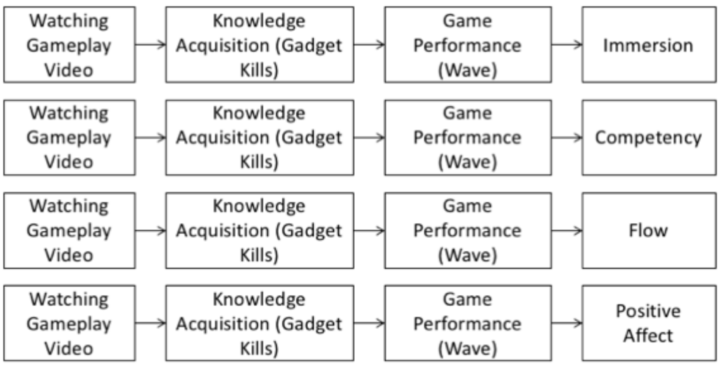

Figure 3: Illustration of significant indirect effects.

DISCUSSION AND CONCLUSION

The significant difference between the use of gadgets to kill enemies, by participants who did and did not watch a gameplay video, demonstrates the direct effect of watching gameplay videos on the observational learning of knowledge. This suggests that exposure to a gameplay video before actually playing the game affects players' knowledge and behavior during their interaction with a game.

The mediation model testing in the analysis further shows that exposure to a gameplay video can indirectly affect four aspects of the gameplay experience—immersion, flow, competency, and positive affect—via its effect on the observational learning of knowledge and game performance. This suggests that watching a gameplay video of a VR game before actually playing it can provide a player with some tips (in this case regarding the use of gadgets), which can in turn help him or her to perform better in the game, and eventually have a better gameplay experience. This is consistent with our expectations.

Although the indirect effect may seem small, the current study makes a key contribution by providing evidence to support the link between watching a gameplay video before playing a game and the actual VR gameplay experience. The results of the current study suggest that there is a connection between watching gameplay and the actual VR gameplay experience, albeit through a connection that is indirect and in the form of a serial mechanism through observational learning and game performance. The results suggest that the mechanism of the indirect effects on four aspects of the VR gameplay experience, namely, immersion, competency, flow, and positive affect, all of which are positive and enjoyable aspects of the VR gameplay experience.

The result of the current study has several interesting implications for the literature on game spectatorship, observational learning, and skill transfer between realities. The result reveals that watching video gameplay of a VR game has indirect effects on the actual experience of playing it. The implication is that before new players actually enter the world of a VR game, they may already have a "sneak peek" of the VR world. Furthermore, new players may learn from such "sneak peeks," which can indirectly influence their game performance and thus their gameplay experience. This is an interesting finding for the literature on game spectatorship. It has been suggested that the experience of game spectators may influence their experience as players (Coavoux 2018). The current findings shed light on the mechanism of how this influence occurs. Furthermore, the findings suggest that VR gameplay experience can be influenced by pre-gameplay spectatorship, even if such experience is non-VR and noninteractive. This can also inform the research into the VR gameplay experience (Murphy 2017). The result guarantees further research in this area.

The result of the current study can also enrich the literature on observational learning. In the context of gameplay, the current findings show that players can acquire knowledge about a VR game by watching a recorded demonstration. This is consistent with the notion of observational learning. The interesting implication is that such learning can indirectly influence game performance and as a result, players' gameplay experience. As suggested by flow theory (Csikszentmihalyi 1990), players most enjoy gameplay if their skill level matches with the challenges in a game. The current result suggests that approaches taken in observational learning (e.g., watching live demonstrations or demonstration videos) can be adopted to prepare players for a new game. This can be particularly relevant to games with innovative game mechanics of which players have no similar previous experience.

The indirect effects of observational learning on motor skills were not found to be significant. This may be because the gameplay video consisted of two views—a real-world view showing the player's actions and a virtual view showing the consequences of those actions. Divided presentation, such as this, may have prevented the participants from learning the required motor skills through observation.

The results of the current study can enrich the research into skill transfer between realities. As discussed previously, research into knowledge and skill transfer from VR to realities has received very limited attention from the research community. In contrast to a focus on real-world practice (Ho 2016; Ho 2017), the current study focuses on observational learning through watching a demonstration video in the real world. The result suggests that knowledge acquired by watching a demonstration video of a VR game in the real world can be transferred to VR and subsequently influence the gameplay experience. It is debatable whether learning by watching a demonstration video of a VR game is learning in the real world. One perspective is that the demonstration video is learning material in the real world. Therefore, the learning happens in the real world. On the other hand, the demonstration video can be seen as providing a limited snapshot of a VR gaming world. Watching such a video initiates observational learning in VR but through a limited point of view (i.e., the rectangular boundary video format). From this perspective, it is about transferring skills acquired through a limited point of view in VR to a normal view in VR. Further studies may be needed to answer this question. For example, future studies can investigate the interaction involved in learning in different realities and VR, by comparing the learning effects of live demonstrations, demonstration videos, and practice tutorials.

One limitation of the current study is that it only presents evidence based on one VR game involving a particular set of game mechanics. The video walkthrough in the current study included a first-person view of the VR game player. The first-person view is dependent on the player (the demonstrator) and the VR game design. If the demonstrator turns frequently, the effect of the video walkthrough may be reduced. If the VR game requires a lot of scanning of the surroundings, the view may swing often and not be easily comprehensible for the viewer. Thus, the effects may be reduced. Future studies can investigate these aspects. The findings are therefore not very generalizable. However, they certainly provide enough evidence to warrant future studies in this area. Future researchers should consider examining every step of the indirect effects of watching gameplay videos.

The current study also presents some practical implications, and for instance, game designers can consider an option that allows new players to watch a gameplay video before playing a VR game. This opens up a new area of design for game designers. For example, the pre-gameplay videos can prepare new players with basic knowledge about the game and basic skills they will require. Furthermore, game designers can even consider embedding pre-gameplay videos into the narrative of a game. For example, a player character can be a detective who discovers some videos (pre-gameplay videos) before entering a VR world to investigate a crime.

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