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No priming in video games

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ABSTRACT

Video games depict a variety of different concepts. Models of learning in games like the GLM (General Learning Model) and GAM (General Aggression Model) predict that exposing players to these in-game concepts can lead to important changes in player behaviour.

Priming effects are thought to be key to determining these changes in behaviour. However, recent research has suggested problems with the priming effects that have previously been observed in the video game literature. Indeed, widespread methodological issues with this body of research make it unclear whether priming effects occur at all in video games.

Two experiments (total N = 532) investigated whether priming effects still occurred in video games when known confounds in the literature were accounted for. Priming was observed in neither study. However, in both studies a novel negative priming effect was observed instead, in which exposure to a specific concept inhibited players' reactions to things that were related to that concept.

These studies support previous research which indicates there may be serious confounding in the video game literature. They also suggest that the priming-related effects of video games may be overestimated. Finally, they highlight the potential existence of negative priming as an effect of video game play.

1. Introduction

Video games are an extraordinarily popular form of entertainment. At the time of writing this, *Minecraft* has sold over 100 million copies (Rad, 2016); *Grand Theft Auto V* over 65 million (Makuch, 2016), and *Tetris* has enjoyed over 400 million paid downloads (Reilly, 2016). These games depict a diversity of different concepts and experiences. *Call of Duty 3* features the sounds and sights of World War II Normandy. In *Papers, Please,* players are shown the necessary evils of being a border guard in a fictional dystopian society. *That Dragon, Cancer* depicts what it is like to care for a terminally ill child. *Desert Strike* presents the player with Apache helicopters that are raining death on ground forces.

Given their ubiquitous nature and varied content, it is unsurprising that there has been considerable interest in what the effects of video games might be on their players. In recent years, explanations of these potential effects have emerged which centre around the idea that playing games which feature specific concepts leads to the priming of these same concepts, and hence important changes in player behaviour.

One prominent model of how playing games can lead players to express a variety of new behaviours through mechanisms of priming is the GLM, or General Learning Model. Under the GLM, when players observe the depiction of a concept in a game, reactions to that same concept becomes temporarily facilitated, or primed (Sternberg, 2005). This effect is theorised to lead to short-term changes in player behaviour in a variety of ways. For instance, the priming of a concept is predicted to make scripts associated with the primed concept easier to activate, and hence more likely to be used. Furthermore, priming is posited by the GLM as an important step in determining longer-term changes in behaviour. As exposure to specific in-game concepts is repeated over longer periods of play, priming effects are reinforced, and temporary effects on player behaviour are made chronic (Buckley & Anderson, 2006).

The path to behavioural change outlined above relies on the idea that the concepts which are depicted in games are primed by these games. However, crucially, it is no longer clear why, or if, priming actually *happens* in video games. Numerous studies over the past two decades have seemingly provided conclusive evidence that playing games leads to the priming of the concepts that are

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depicted in these games (e.g (Anderson et al., 2004; Greitemeyer & Osswald, 2011).). However, recent research has challenged both the validity of these experiments and the generalizability of the priming effects which they demonstrate.

The key reason why these effects have been called into question is to do with experimental control. As Adachi and Willoughby (2011) note, many experimental studies in the literature use an approach in which different games are used as different experimental conditions. Whilst these games may differ greatly in terms of the content which they contain, they also differ in other ways. As a consequence, it is unclear whether any observed difference in priming is due to the content of the games under test, or whether it may instead be due to the influence of some third factor.

The experiments reported here therefore investigate whether priming effects occur in video games when potential sources of variation between experimental conditions are removed from experimental designs.

In Experiment 1, two versions of a bespoke maze game were made. This game was reskinned so that it formed two different conditions. In one condition, the game was vehicle-themed. Players took on the role of a car looking for a garage whilst avoiding trucks. In the other condition, the game was instead animal-themed. Players took on the role of a mouse looking for their mouse hole whilst avoiding cats. After play, participants engaged in an image categorisation task featuring in-game concepts. The aim of this study was to determine whether a game featuring specific concepts lead to those concepts being primed by play. If this was the case, then the concept of the vehicle-themed game would have the concept of 'vehicles' primed, whilst the players of the animal-themed game would have the concept of 'animals' primed.

Following this study, a second experiment was conducted. The aim of this study was to replicate the effects observed in Experiment 1, and also to discover if priming occurs if people only play a game for a short period of time. In Experiment 2, a bespoke game was again custom made. In this case, the game was a vehicle-themed infinite runner game. However, due to the small effect sizes observed in previous experiments this experiment was run online in order to obtain a large sample size ($n = 460$). Participants again engaged in an image categorisation task after play.

Results of both experiments not only indicated an absence of priming, but instead showed a negative priming effect in which participants were slower at categorising the content of the games that they played.

2. Background

2.1. The importance of priming effects in video games

The GLM, or General Learning Model (Buckley & Anderson, 2006) describes how exposure to games may lead to changes in player behaviour. Under the GLM, when players are exposed to depictions of specific concepts in a game, these concepts become temporarily easier for those players to access again. This priming then spreads to related knowledge structures such as scripts, schema, and beliefs. This leads to players being temporarily more likely to express behaviours which are related to the concepts present in the games that they have been playing. For instance, playing a prosocial game is thought to prime prosocial concepts, and lead temporarily to players expressing prosocial behaviours (Greitemeyer & Osswald, 2011). Similarly, playing a game which contains a depiction of sexual behaviour might prime sexual concepts (Yao, Mahood, & Linz, 2009), and playing a game which contains a depiction of aggression might prime aggressive concepts (Anderson et al., 2004).

As well as these short term effects, the GLM argues that playing games can lead to long-term changes in personality through processes of reinforcement. Reinforcement refers to the idea that repeatedly priming a concept or knowledge structure will lead to that same concept or knowledge structure becoming easier to activate again, not over short periods of time, but over long periods of time. Knowledge structures which may become reinforced under the GLM include beliefs and attitudes related to in-game content, perceptual and expectation schemata, and behavioural scripts (Buckley & Anderson, 2006).

It is important to note that the GLM is itself an extension of an earlier, extremely influential, theory of how the aggression-related content of video games leads to aggressive behaviour. This narrower model is known as the GAM, or General Aggression Model (Anderson & Bushman, 2002). Just as priming is key to the GLM, the idea of "priming effects" (Bushman & Anderson, 2001) are similarly integral to this model. Under the GAM, when players are exposed to depictions of aggression in video games, concepts which are related to aggression are primed. These concepts include both objects which may be depicted in a game (such as a gun), and more abstract things (such as the idea of 'harm' or 'kill') (Anderson & Carnagey, 2004). And just as in the GLM, this priming may then spread to related knowledge structures and lead to both short term changes in behaviour, as well as long term changes in behaviour through processes of reinforcement (Anderson & Carnagey, 2004).

Priming is therefore a theoretical important effect when it comes to learning and behaviour change in games. Furthermore, there are diverse examples of priming's seeming existence in video games. For instance, in the studies outlined above, Yao et al. (2009) tested whether playing games which feature sexual content leads to the priming of sex-related concepts. In this study, participants played either a game with sexual content (*Leisure Suit Larry: Magna cum Laude*), or a game which did not feature sexual content (*The Sims II* or *PacMan II*). Researchers found that playing the game with sexual content caused the priming of sexual concepts. The researchers theorised that this effect may help explain the existence of sexually objectifying behaviours amongst some groups of gamers. Similarly, Greitemeyer and Osswald (2011) investigated whether playing games which depict prosocial behaviour leads to the priming of prosocial concepts, and hence prosocial behaviour. Players were assigned to play either a game with prosocial content (*Lemmings*, in which the player must attempt to stop the titular characters from plummeting to their doom), or a game which did not have prosocial content (*Tetris*, in which players stack blocks). Researchers found playing the prosocial game led to greater "accessibility of prosocial thoughts". This priming effect was linked to greater amounts of prosocial behaviours being expressed by players immediately following play. For instance, players of prosocial games were more likely to pick up pencils spilled by a confederate in the laboratory, and likely to agree to take part in future research with no compensation, and more likely to help a harassed experimenter.

Finally, a variety of studies have tested whether playing games which feature depictions of aggression leads to the priming of aggression-related concepts. For example, in (Anderson et al., 2004) participants were exposed to either a game which featured a depiction of violence (*Marathon 2*) or a game which did not (*Glider Pro*). Results indicated that playing *Marathon 2* rather than *Glider Pro* resulted in the priming of aggression-related concepts. This kind of effect is commonly used to support the arguments of academics who suggest that playing video games may lead to players behaving more aggressively. These predicted aggressive behaviours range from attempting to inflict more discomfort on individuals in lab based tasks such as the Competitive Reaction Time Task (e.g (Anderson & Carnagey, 2009).), to increases in committing real-world acts of violence (e.g (Anderson et al., 2008).).