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Modeling outcomes of violent video game play: Applying mental models and model matching to explain the relationship between user differences, game characteristics, enjoyment, and aggressive intentions



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ABSTRACT

While much research on video games has focused on aggressive outcomes, the extant research has not come to consensus on the role of other factors, notably enjoyment, frustration and individual differences amongst players, in mediating the link between violent game play and aggression. This experimental design uses a mental models approach to examine game features (e.g., controller naturalness), player characteristics (e.g., first person shooter experience, sex, degree of competitiveness) and the game play experience (e.g., perceived game realism, immersion, game failure, frustration and enjoyment) to explain aggressive outcomes. Results from a revised path model suggest perceived realism, immersion, and experience with other first person shooters all positively predicted enjoyment while frustration negatively predicted game enjoyment. Frustration and enjoyment both predicted state aggression. The findings of this study support the application of mental models as a theoretical approach to unify thinking about violent games, contextual features of violent games, individual difference variables and differences in player perceptions and game experiences with regards to outcome aggression. Results are discussed in terms of the model matching hypothesis and implications for the comprehensive study of violent game play, including the importance of enjoyment and frustration, are also discussed.

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1. The role of enjoyment, frustration, player experience and immersion in mediating the link between violent game play and aggression

Previous research has examined the link between violent game play, characteristics of the game, the gamer, and aggressive outcomes using a variety of approaches (see Anderson, 2004; Anderson et al., 2010; Greitemeyer & Mugge, 2014; Sherry, Lucas, Greenberg, & Lachlan, 2006, for meta-analyses). In terms of game characteristics, researchers have focused on point of view (e.g. Farrar, Krcmar, & Nowak, 2006), the presence of blood and gore (e.g. Farrar et al., 2006), realism (Barlett & Rodeheffer, 2009; Krcmar, Farrar, & McGloin, 2011), controller naturalness (McGloin, Farrar,

& Krcmar, 2013), and the presence or absence of realistic weapons (McGloin, Farrar, & Fishlock, 2015; Whitaker & Bushman, 2012), to examine how these game features influence users' game play experience and aggressive outcomes. Beyond these game related features, researchers have also looked at the role of individual difference factors including player competitiveness (Sherry & Lucas, 2003), experienced immersion (Nowak, Krcmar, & Farrar, 2006; Persky & Blascovich, 2008), and previous experience with games (Gentile, Lynch, Linder, & Walsh, 2004).

Despite the contributions many of these investigations have made, few have examined each of these important variables in a more comprehensive way. For example, studies focused on key outcomes such as enjoyment and aggression have often only examined one or the other (see Bonus, Peebles, & Riddle, 2015 for an exception), perhaps assuming them to be contradictory. However, aggressive outcomes and enjoyment may indeed go hand-in-hand and although Bonus et al. (2015) explored hostile attributions, and not aggression, per se, they did find a positive link between

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enjoyment and hostile attributions. Thus, enjoyment and aggression are clearly two variables that should be explored simultaneously to a greater extent. Given the prevalence of violent video games and the controversy surrounding this topic in the literature, along with the relative lack of attention paid to enjoyment and aggression as potentially linked variables, it would appear that there is a need for researchers to take a more comprehensive approach in their examination of the video game/violence relationship, and the specific variables that may or may not be contributing factors. Violent video games are defined in this study as any game that relies primarily on aggressive in-game behaviors (e.g. shooting, stabbing, fighting, etc.) to fulfill the game's principal missions and/or objectives.

In order to examine these relationships, this study uses a mental models theoretical approach and tests a hypothesized path model using an experimental design. In it, the controller's naturalness was manipulated, and game play processing factors (i.e., perceived realism, immersion, in-game failure, frustration, and enjoyment), as well as individual difference factors (i.e., sex, player competitiveness, and experience with first person shooters) were measured. Also, given the relative lack of research in some areas, special attention is paid to the roles of experienced enjoyment, in-game success, and frustration in predicting aggressive outcomes.

2. Mental models, video game play and model matching

In order to explain the process by which media exemplars may influence attitudinal and behavioral outcomes, numerous theoretical models have been proposed. These include theories of modeling and imitation, such as early Social Learning conceptualizations (Bandura, 1977), to later theories that incorporate aspects of cognition and emotion (e.g., Generalized Aggression Model (GAM), Anderson & Carnagey, 2004; script theory, Huesmann, 1986; cognitive-neoassociation theory, Berkowitz, 1989), as well as physiological processing (e.g. Limited Capacity Model of Motivated Media Message Processing, Lang, 2000). While these and other previous models have been supported by evidence, the application of mental models is appropriate here given, first, its reliance on networked approaches to memory and learning that are supported in the literature (see Roskos-Ewoldsen, Roskos-Ewoldsen, & Carpenter, 2002 for a review), and second, its ability to explain on-going, interactive behavior such as that which occurs during video game play.

In brief, mental models are cognitive structures that enable individuals to construct malleable representations of knowledge. These structures, or models, can incorporate both objective aspects of an experience, object, situation, and/or person and can incorporate subjective aspects of that object as well (Mastro, 2009). A resulting model, therefore, can reflect the object itself and the individual's experience of that object. Because mental models are malleable and change over time, a mental model can be called on to interpret and make sense of a media message (Roskos-Ewoldsen et al., 2002), and can also be influenced by one as well (Farrar et al., 2006; Krcmar & Lachlan, 2009; McGloin, Farrar, & Krcmar, 2011, 2013). In their conception and theoretical explication (see Van Dijk & Kintsch, 1983) mental models are understood to be dynamic, malleable, and importantly, adaptable by new and incoming information (Magliano, Dijkstra, & Zwann, 1996). Furthermore, a key notion of the mental models approach is that there is correspondence between an external entity and the mental representation of that thing (Johnson-Laird, 1983). Because video game play itself provides a constant stream of incoming information that changes through user input, the match between dynamic, ongoing, adaptable game play and a dynamic representation of it is well suited for this study and its aims.

In fact, one facet of the mental models theory that bears particular importance in the experience of game play outcomes is that of model matching. Model matching argues that in order to make sense of an experience, the user must evaluate and compare incoming information from the game to their existing mental models, which may include models of both previous gameplay experiences as well as models of real-world situations, events, people, and behaviors (Boyan & Sherry, 2011). Specifically, it is argued that a closer match between a game's content with the user's model of the action being depicted in the game makes it easier for the gamer to have an uninterrupted, immersive experience. This immersive experience may also make it easier to transfer events and actions featured in the game to real life mental models and ultimately to outside game experiences. The judgments and decisions associated with a closer model match between real and virtual experiences may facilitate successful game play (Boyan & Sherry, 2011) amongst other potentially linked outcomes. Therefore, in the following sections, we explore the ways in which model matching may influence a series of outcomes that may ultimately result in enjoyment as well as aggression.

3. Model matching and the influence of controller naturalness

Controller naturalness has been shown to play an important role in the model matching process, such that a motion capturing or a more natural mapping controller may allow a user to integrate real world behavioral models into the game play (McGloin et al., 2013). Controller naturalness has been defined as the intuitiveness with which a controller allows a user to interact with the virtual world (Skalski, Tamborini, Shelton, Buncher, & Lindmart, 2011). An increase in controller naturalness often allows a user to utilize relevant and existing mental models that aid in the processing of a game's challenges (McGloin et al., 2015). Thus, given these findings, and the mental models framework, it seems likely that participants who play a first person shooter game with a natural mapping gun controller will perceive greater controller naturalness than those who play with a traditional button and joystick controller (H1).

The influence of controller naturalness has recently been linked to the user's perception of the game's realism (e.g., McGloin et al., 2011, 2013). Although the construct of game realism has varied across studies from graphical realism (e.g., Barlett, Rodeheffer, Baldassarro, Hinkin, & Harris, 2008; Ivory & Kalyanaraman, 2007) to inferential or imaginative realism (i.e., the extent to which the actions or narrative could occur in real life, e.g., Barlett & Rodeheffer, 2009), enactive realism has emerged as an important predictor of several outcomes, notably enjoyment (Lin & Peng, 2015). Enactive realism is understood to be the player's interaction with the game via the interface and, importantly, game controllers, as well as their interaction with game characters that make the player feel as if s/he is actually participating in the virtual environment. From a mental models perspective, it seems likely that a natural controller (i.e. gun) would more closely match a player's mental abstraction for that activity (i.e. shooting). Regardless of players' experience with real guns, it is very likely that participants would have a mental model for one from previous media exposure given the amount of gun violence that is featured in contemporary media (Smith et al., 2004; Smith, Lachlan, & Tamborini, 2003). Thus, compared to a traditional button and joystick controller, a natural mapping motion capturing controller would allow for easier model matching, thus resulting in greater perceptions of game realism (H2).

Players are also likely to experience greater immersion as a result of increased controller naturalness. Immersion is a subscale of presence, conceptualized as a psychological feeling of

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