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Background music matters: Why video games lead to increased aggressive behavior? ☆

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ABSTRACT

Previous research has shown that violent video game exposure increases aggressive thoughts, aggressive feelings, aggressive behavior and physiological arousal. However, most of the research in this field has only focused on the "video" aspect of these games, and little attention has been paid to the "audio". In this study, both background music within video games and the games themselves were used as two independent variables to test their influence on physical excitement and aggression. Physical excitement was measured using biofeedback equipment and aggression was measured using the hot sauce paradigm. Results showed that both music and video games can cause significant increases in physical excitement, while violent video games cause higher levels of physical excitement than non-violent games. The excitement level of the background music interacted with the game content to give a combined effect on aggression. Thus, the present study extended prior findings by showing that background music has an indispensable role in the level of aggression induced through video games. The results also demonstrated that it is both necessary and beneficial to design background music for video games in such a way that it matches the action taking place in the game.

1. Introduction

It seems that violent video games have a more powerful influence on people than television, newspapers or other traditional forms of media because we can actually take part in them, becoming active participants in the violence shown [42]. This feature of video games has attracted a great number of researchers to explore the various influences video games may have on players.

This research focuses on a burgeoning field within video games—background music. We all know that games are becoming more reliant on audio, since this has an important role to play in supporting the user's interaction with the gaming environment [31]. It is therefore reasonable to assume that different combinations of video games and background music will have different effects on players, including such aspects as physical excitement and aggression.

1.1. Video games

According to *The twenty-ninth statistical report on Internet development in China* issued by CNNIC, by the end of 2011 the number of online video game players in China had reached 324 billion (304 billion in 2010), with a growth rate of 6.6%. Playing video games has become the most popular form of entertainment for children and adolescents [26]. However, most video games on the market are extremely violent, containing significant amounts of injury and death [58]. The influence of video games on adolescents' physical and mental development has caused a heated debate both among researchers and the public at large [6,40,28,62].

Most recent studies on the influences of video games have concentrated on the various pros and cons of the games [52], how various effects on players are brought about [63], the duration of a video game's influence [10], and the roles of different components (violence, realism, amount of blood etc.) within the games [42,1]. As the name suggests, researchers have always treated video games as merely being "video" games.

1.2. Background music in video games

Video games are inherently multisensory, with first-person shooter and other action games often having both auditory and visual cues that are relevant to an appropriate behavioral response

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[24]. Video game audio encompasses every aspect of video game sound. This includes sound effects, background music, dialogue, ambience, and interface sound effects; of these, background music has been shown to be the most influential factor [31].

1.2.1. The development of background music in video games

Music really is an intriguing stimulus, and is widely used in movies to enhance the emotional experience for the viewer. This congruent visual and auditory experience can become so emotional that people will become even more immersed in the events on screen [11]. Just like with motion pictures, video games have experienced a similar progression from silent to sound. Video game music has changed from its original status of pure embellishment, into today's independent music system within the game [56]. With the rapid pace of technological development in the video game industry, there have been great improvements in terms of audio tools available for designers and composers, as well as space available for storage and playback [61].

In recent years, a new kind of audio-based game has burst onto the scene. Audio games (such as TagATune and TiM) are computer games that feature complete auditory interfaces, so they can be played even without the use of graphics, and are especially suited for visually impaired players [25]. Several such customized online games (such as Major Miner and Listen Game) have even been proposed for the collection of musical data, and proven to be more effective, interesting and cheaper than traditional methods such as hiring subjects to carry out the data collection work [43].

1.2.2. The role of background music in video games

Background music is an important part of the entire gaming experience. Without this audio component, a video game would not be so compelling or immersing. This is well-known in the games industry, and sound has been used for a long time to create complete immersion environments within gaming worlds. Until recently though, video game audio has not been regarded as being as important as the visual aspect. In order to grasp and hold the attention of the audience, more and more video game developers are now realizing that well-designed audio needs to be created and properly matched with the other components of the game. Nowadays, there are often entire teams of composers and developers behind the music and sounds of a video game [31].

In particular, music in video games can serve to enhance a sense of immersion (or presence), cue narrative or plot changes, act as an emotional signifier, enhance the sense of aesthetic continuity, and cultivate the thematic unity of a video game [44]. Additional audio cues can give the player an idea of what exactly is happening on the screen [50]. Furthermore, being able to listen to music that the player has chosen him- or herself could result in lower levels of physiological arousal [44]. Other research has shown that exposure to 'violent' music was more strongly linked to indirect forms of aggression, whereas violent visual media exposure was more strongly linked to physical aggression [57].

A number of empirical studies have demonstrated the key role that background music plays in video games. North and Hargreaves [45] investigated the combined effects of the nature of music and a concurrent task within a driving game on measures of task performance and musical preference. Results showed that music and the concurrent task both competed for limited processing resources, and that music had a positive effect on task performance. Hébert et al. [29] examined the effect of built-in music on cortisol secretion as a consequence of video game playing, and results showed that the 'music' group showed significantly higher stress levels than the 'silent' group. Lennings and Warburton [37] directly compared the effects of exposure to violent visual media versus violent auditory media, and found that violent visual and auditory media seemed to have similar basic elements that can potentially influence behavior. Wolfson and Case [60] manipulated background color (red/blue) and sound (loud/quiet) in a series of computer games. The results suggested that sound alone had little impact, but that a red/loud combination was associated with perceptions of excitement and playing well.

1.2.3. Current situation of background music in video game

Anecdotal evidence suggests that video game designers have long acknowledged the importance of music in video games as a crucial part of gaming: enhancing excitement and drawing players further into the game, in much the same way as music does in films [29]. But it is a pity that the importance of audio in video games has long been ignored. In terms of sensory modality, there is very little research that has directly compared the effects of violent visual and auditory signals in video games, and this has been mostly restricted to theoretical explorations. Furthermore, summaries of informed researches in this field are also very rare. There have been particularly few empirical studies focusing on the role of background music in video games. In this study, the background music and the video game itself were used as two different independent variables to test their respective influences on physical excitement and aggression, with an aim to providing reliable empirical evidence for further discussion.

1.3. The General Aggression Model (GAM)

For the first time, the GAM provides an integrated model that can explain aggression arising as a result of multiple motives, as well as offering empirically validated insights into ways of reducing aggression [22]. GAM emphasizes three critical stages in understanding aggression: (1) person and situation inputs, (2) present internal states (i.e., cognition, physical excitement, effect), and (3) outcomes of appraisal and decision-making processes [4,22].

Although GAM is not primarily aimed at explaining the relationship between violent video games and aggressive behavior, it can still be easily applied [7]. In the short-term, the function of a violent video game is the same as that of a situation variable, which may directly influence one, two, or all three aspects of a person's internal state, and then lead to aggressive behavior [6].

Because violent video games contain much more violence than nonviolent video games, according to the model we hypothesize the following:

> **H1.** Violent video games, as a situation input, will cause higher levels of physical excitement and more aggressive behavior than nonviolent video games.

1.4. The limited-capacity model of attention

This model assumes that a person's total attention capacity at any one point in time is limited [33]. Just as Norman and Bobrow [46] said, "all processes draw from a common pool of resources". The total capacity allocated to process all activities can be divided into two parts: capacity devoted to the primary task, and spare capacity [33]. Spare capacity is devoted to secondary tasks and other surroundings. It is believed that capacity being used to perform the primary task cannot be used to perform the secondary task. Thus, the more capacity being used for the primary task, the less a person has available to accomplish any secondary task [36]. This deficit is believed to result from competition between the two targets for limited attentional resources.

In fact, different forms of perception will also compete for limited attentional resources – they are not just confined to one channel [8]. This means that auditory and visual tasks will both compete for common perceptual resources [8,59]. Sensory cortices