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Chapter 2

EMOTIONAL GAMING

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ABSTRACT

In recent years, research on the psychology of gaming has examined the negative and positive outcomes of playing video games. Thus far, a variety of affective phenomena have been investigated. In this chapter we will continue this exploration by examining the emotions elicited by the act of playing video games.

Because the study of emotions must rely on different type of methods, including subjective self-reports (e.g., description of feelings), neuropsychophysiological measurements (e.g. electromyography, skin conductance, heart rate, event-related potentials, functional magnetic resonance imaging), biological markers (e.g. cortisol, testosterone) and behaviours (e.g., facial expressions), we will cover all these distinct methods. We will explore how dimensional and categorical models of emotions have been used to identify the emotional responses of players, including their enjoyment experience. Expanding upon past research findings we will also discuss the social implications of gaming and suggest areas for future research.

INTRODUCTION

The long tradition of more than 40 years dedicated to research about media entertainment has produced a vast body of empirical studies on the positive and negative effects of exposure to different forms and contents of entertainment.

Video games, in particular, are nowadays one of the most popular forms of mass entertainment, and as such have become an object of study both from within the field of

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psychology and that of the affective computing sciences. Within psychology, research has focused on understanding the psychological processes that accompany the experience of playing, including emotions and motivations; and the positive and negative effects that these have on intra and interpersonal outcomes, including cognitive, emotional, and behavioural outcomes. The affective computer sciences meanwhile have targeted their focus on understanding how emotions can be captured, induced and integrated into the gaming experience.

Experiencing emotions tends to be one of the primary motivations for playing videogames [Ravaja, Salminen, Holopainen, Saari, and Laarni, 2004], and Freeman [2003] has stated that the evolution of computer games will be based more upon their capacity to provoke emotional experiences than on technological developments. It is therefore significantly important to understand the role of emotions in gaming.

In this chapter we intend to contribute to a systematization of how emotions have been studied in gaming, both by describing how different components of emotions have been studied and integrated, and by reviewing the emotional consequences of playing with special attention given to the role of game content on both intra and interpersonal levels.

WHAT IS EMOTION AND HOW CAN IT BE MEASURED?

Before considering any other aspect of the topic, it is first necessary to conduct a brief overview of what emotions are and how they have been evaluated. This enables us both to have a better understanding of how they can be measured and quantified.

Conceptualising emotion has always been a notoriously difficult task. In fact, when lay people are asked to define what it is, many reply saying they have an idea, but cannot give a precise definition of it [Fehr and Russell, 1984]. A variety of *possible suggestions* have been offered by theorists and researchers. Nevertheless, there is still a lack of consensus on the definition of emotion. Even recently, Frijda and Scherer [2009] stated that this term "may be one of the fuzziest concepts in all of the sciences" (p. 142). In spite of this, the need for a consensual definition has been emphasized by many authors. Kleinginna and Kleinginna [1981], for example, proposed the following definition based upon a review of 92 definitions taken from a variety of sources: "Emotion is a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can:

a) Give rise to affective experiences such as feelings of arousal, pleasure/displeasure;
b) Generate cognitive processes such as perceptually relevant effects, appraisal labeling processes;
c) Activate widespread physiological adjustments to the arousing conditions; and
d) Lead to behavior that is often, but not always, expressive, goal-oriented and adaptive" (p. 355).

This definition, like many others, asserts that emotions are goal-oriented and have a functional value, in the sense that they are useful at both intra- and interpersonal levels, by affecting the individual's perception, attention, thoughts, feelings, neurophysiological reactions, and motivating action (preparing the individual for actions) in an adaptive and effective way. Applying this functional view to video games, Tan [2008] has developed a theoretical framework which considers entertainment as an adaptive activity, involving both elementary functions such as fight or flight, social communication and other cognitive skills while experimenting with and experiencing the outcomes during gaming.

He has also outlined the role that pretense play may have in organizing these adaptive functions. An involvement in scenarios and activities of relevance to the individual allows players to experience, explore and plan several potential alternatives, encounter solutions and learn from outcomes while involved in virtual situations.

Another common thread amongst definitions of emotions is the assumption that several distinct components need to be considered when measuring the emotional response. In fact many contemporary researchers and theorists agree that emotion has a clear relation to bodily physiology, feelings and appraisals, behavioural expressions and action tendencies. Bradley and Lang [2007] have aggregated these components into a 3-system measurement, which includes:

1) Evaluative reports;
2) Physiological responses; and
3) Expressive displays and overt behaviour.

The first system relies predominantly on *judgments and subjective reports of emotions*, such as the use of adjective checklist, rating scales, questionnaires, or free description of affective experience.

The second common group of measurements involves *neurophysiological responses*. Of the physiological responses, research tends to examine heart rate, respiration, skin conductance (SC), muscle activity, and blood pressure. Neurological and biochemical responses are also commonly explored. Psychophysiology by definition investigates the relationship between psychological events and the resulting physiological activity and behaviour [Cacioppo, Tassinary and Berntson, 2007]. Many changes in physiological responses can be attributed to the human organism's attempt to identify and respond to new and relevant stimuli. These systems do not operate in isolation, but interact with higher regions of the brain [Lang, 1995], and in the last decades there has been a growing enthusiasm for the study of emotions through the use of neuroscience techniques. These techniques have been of a varied and extensive nature, but the most frequently utilized has been the continuous electroencephalogram (EEG) which extracts Event-Related Potentials (ERPs). ERPs enable researchers to assess the time course of brain's electrical activity within milliseconds. It has the advantage of a higher temporal resolution compared with many other neuroimaging techniques. The most studied ERP associated with emotions is the P3, which is a late positive potential (LPP) that peaks around 300 milliseconds after the onset of stimuli that are relevant for the individual. Many recent studies in affective picture processing have demonstrated that latency and amplitude of LPP (i.e., usually 300–1000 ms) are sensitive to affective relevant stimuli. This could be related to an allocation of attentional resources to stimuli with significant motivational value for the individual [Bradley and Lang., 2007; Cacioppo, 1994]. However, ERPs have poor spatial resolution and do not allow a robust identification of exactly which of the brain's neural generators are associated with the processing of stimuli. In contrast, functional Magnetic Resonance Imaging (fMRI) offers a higher spatial resolution, and as such it has been frequently used to identify those areas of the brain that become more or less activated according to variations in blood flow. However, the time resolution of fMRI is weaker, because the peak of blood flow response is slower (between 6-9 seconds after the onset of stimulus) [Harmon-Jones and Harmon-Jones, 2011]. Brain connectivity and source localization methods like sLoreta [Pascual-Marqui, 2002] may identify the cortical or sub-cortical source generators of the electric activity registered in the scalp, but to our knowledge no study of video games has so far utilized these methods, which in our view could add valuable information as to which cortical areas are triggered by relevant stimulus.

Bateman and Nacke [2010] have also reviewed existing neurobiological research literature and offered several perspectives on the neural responses associated with gaming activity. Their foremost suggestions refer to several key brain structures that might be related to both cognitive and emotional experience whilst playing games. These include the nucleus accumbens and the orbitofrontal cortex, due to their close associations with the neurotransmitter dopamine, which, in turn, is related to reward-seeking behaviours, pleasure and interest; the amygdala and the neurotransmitters epinephrine and norepinephrine, which usually relate to excitement and are active during the fight and flight response; and the release of the corticosteroid hormone cortisol, which is often considered an index of stress response. Since games can involve competitive elements, the release of testosterone can occur due to its relationship with dominance behaviours in competitive situations [Gonzalez-Bono, Salvador, Ricarte, Serrano and Arnedo, 2000; van der Meij, Buunk, Almela and Salvador, 2010]. In contrast, the hormone oxytocin has been consistently associated with prosocial behaviours and also with the facilitation of negative social emotions [Kemp and Guastella, 2011]. Arguably, therefore, it would also be pertinent to study their release during games that mimic social interaction, as a means of studying both social emotions and approach and withdrawal behaviours in competitive and cooperative games.

With regards to the third system – *overt actions* – the most common way to infer emotions is to measure different forms of what we can consider ‘overtly’ expressive behaviour. Such behavior includes facial expressions, gestures, vocalizations, and postures. Other less common actions can also be assessed, such as fighting, freezing, running and jumping. These behaviors are often surveyed through objective observational analysis. For example, Lazzaro [2004] evaluated emotions during gameplay amongst hard-core gamers, casual gamers, and non-players by video-recording their verbal and non-verbal emotional cues during play. Such cues included body language, facial expressions, verbal comments, and self-report responses on a questionnaire.

The multiplicity of components reflects the complexity of emotional responses. Nevertheless it is important to consider several indicators, as each system plays different adaptive roles that, in conjunction, may prepare the organism for action. Many researchers also expound upon the difficulties of relying on a study of any single component, in light of the inconsistent relationship usually found both between and within components.

Classification of Emotions: Dimensional and Categorical Approaches

Many theoretical models have been put forward in an attempt to classify emotions. Of these, we will briefly consider the value of dimensional and categorical models.

The identification of the emotional structure is the main goal of the *dimensional model*. Of all the dimensional models, we will pay special attention to the circumplex model, on the basis it has made the most significant contribution towards empirical research in the area of emotions and entertainment [e.g., Ravaja, Saari, Salminen, Laarni, and Kallinen, 2006]. Originally proposed by Russell [1980], this model asserts that the structure of emotions is based on two linear independent dimensions: valence and arousal. Valence corresponds to the hedonic dimension of emotion (from negative to positive pleasantness) and several authors have argued it bears a clear relation to the motivational parameter of direction, such as approach or avoidance. The arousal dimension is linked with degrees of emotional intensity [Bradley and Lang, 2007]. Although the arousal dimension has been extensively used to assess the entertainment appeal of games, it is also valuable when considering the hedonic component of emotion. In our opinion, in order to incite people to play video games, motivation and emotions must be key factors.

Several physiological and neural systems are associated with these two motivational parameters of emotion. For example, skin conductance (SC), i.e., an increase in sweat gland activity, which results from activity in the peripheral nervous system, is considered a good index of augmented sympathetic arousal. Several studies in affective processing of visual images have also found that pupil dilation and the amplitude of the LPP correlate both with self-reports of arousal and electrodermal response amplitude. Facial EMG activity is related to the hedonic valence dimension. More specifically, the zygomaticus major and orbicularis oculi muscle regions are together often indexes of positive valence, and the corrugator supercilii muscle is frequently used as an index of negative valence [Bradley and Lang, 2007].

We also believe that this biphasic organization of emotions is especially useful for understanding several aspects of game playing. For example, it can be relevant to capture the continuous changes in emotional responses that may occur during the gameplay experience, and also to analyse the effects of play on emotional responsiveness to stimuli in the real world and their linkage to interpersonal responses.

Aside from the biphasic organization of emotions, we should also consider *categorical models,* which can help us understand and capture the specific emotions that manifest during game activity. Used in conjunction, dimensional and categorical approaches are complementary and should be viewed as different hierarchical levels of emotional systems [Hamm, Shupp and Weike, 2003]. With regards to categorical models, several researchers have emphasize the existence of a limited number of specific discrete emotions, including sadness, fear, disgust, anger, and surprise [e.g., Ekman, 1992], while others have proposed more candidates, such as pride, shame, guilt, envy, embarrassment, interest, hope, or frustration [e.g., Keltner and Buswell, 1997; Silvia, 2008]. Some authors have made a conceptual distinction between basic and other secondary emotions. Frijda [1986], for example, has theorized that basic emotions should be distinguishable from one another both as a result of their social-communicative and their behavioral functions. Secondary emotions may be comprised of blends or composites of basic emotions or other tendencies. Although it is beyond the scope of this chapter to address this controversial distinction [for a review of this topic see Ortony and Turner, 1990; Panksepp, 1992] a consideration of discrete emotions offers us a valuable insight into the subject of emotional reactions during game play.

EMOTION-RELATED RESPONSES TO VIDEO GAME EVENTS

Many studies have combined an analysis of self-report, neurophysiological activity and behavioural expressions while studying emotions during game activity. Some studies have considered only the physiological tonic measures, or rather, the mean of physiological response during a certain period of time, to compute the overall emotional response. However, examining the different emotional components and the phasic physiological responses to specific video game events can be especially useful, as there is typically a dynamic flow of events and actions during games that resemble the real world. In this vein, many neurophysiological devices and methods, as well as the examination of expressive behaviors could represent valuable tools for recording responses to phasic, rapid and instantaneous events during gaming [Ravaja, Turpeinen, Saari, Puttonen and Keltikangas-Jarvinen, 2008].

We will review the literature that has looked into these different emotional components by considering the dimensional and/or the categorical models of emotions. Poels, van den Hoogen, Ijsselsteijn and de Kort [2012], for example, have differentiated the role of emotional arousal and valence dimensions during initial game-play in predicting game preferences and player behaviour at later stages, both in the short and long-term. The authors also considered both subjective reports and physiological responses of these dimensions. SC was used as an indicator of arousal, whilst zygomaticus and corrugator EMG were used as indexes of displeasure and pleasure. They found that the hedonic dimension of pleasure was a predictor of short-term game preference and playing time, whereas arousal was most predictive of long-term game preferences.

Lazzaro [2004] has also contributed by identifying several specific emotional responses based on self-reported experiences and on the video recordings of verbal and non-verbal emotional cues exhibited during play. Some emotions were specific to the individual experience, such as frustration, fear, surprise, curiosity, disgust, relaxation, absorption and feelings of achievement. Other emotions meanwhile were associated with membership of a social group and related to bonding, social recognition and pride, along with a sense of delight at others' misfortune during competitive interactions.

van Reekum et al. [2004] have also evaluated eight discrete emotions (surprise, anger, shame, pride, interest, joy, tenseness, and helplessness) and their intensity using self-report methods. They also analyzed physiological responses, such as SCL, cardiovascular activity, finger temperature, and muscle activity during game play experiences, in which goal conduciveness and intrinsic pleasantness were manipulated. The two conditions of goal conduciveness were passing to the next level after successfully completing the previous one (conducive events) and hitting an obstacle or being shot by the enemy (obstructive events). To manipulate intrinsic pleasantness, the authors used a pleasant or an unpleasant sound that was displayed in both conduciveness conditions. For the intrinsic pleasantness manipulation, only skin conductance was affected; however, they did find that higher joy and pride were affected by conducive events. In contrast, high anger, surprise and tenseness were reported in obstructive situations. With regards to physiological responses, the magnitude of SCR was higher after obstructive conditions, while finger temperature was more sensitive to conducive events. In the conducive events, there was also a faster HR immediately before players passed to the next level and a slower HR after the event; results that were interpreted as an anticipatory response.

Mandryk and Atkins'study [2007] is also noteworthy. They have developed a novel method for continuously modeling emotion using physiological data. Their analysis takes into account both the dimensional and the discrete categorical models. Firstly, they computed arousal and valence values from the normalized physiological signals of SC, HR, and zygomatic and corrugator muscle regions. SC and HR were used to measure arousal, and zygomatic, corrugator and HR were used to generate valence. Then, arousal and valence values were used to calculate specific emotions of boredom, challenge, excitement, frustration, and fun. Subjective measures of emotions were also analyzed. The authors view this method as able to provide valuable physiological indexes of players' emotions, which could also be worthwhile when assessing user experiences of other entertainment technologies.

Weber, Behr, Tamborini, Ritterfeld and Mathiak [2009] have also analyzed event-related content of playing sessions, as well some physiological indicators of arousal (HR and SC) during play. They found that changes in physiological responses throughout the game took place at specific times, particularly in situations of imminent danger to the game character. According to the authors, the level of arousal during gameplay is a function of uncertainty and perceived levels of control over a situation. In situations where the location of the enemy is unknown, the level of perceived control diminishes and arousal increases; however, when the location of the opponents is known but the potential threat from them is not, perceived control increases and arousal decreases. To some extent these findings suggest that physiological arousal increases in order to deal more effectively with threats, and therefore it could be associated with activation of the defense system [Lang and Bradley, 2010]. With regards to neural responses, Ivanitsky, Kurnitskaya, and Sobotka [1986] have found differences in the topographic distribution of four ERPs (P300, N600, P800, and N1000) in two different circumstances, those of winning and losing during a video tennis game. In the author's opinion winning the ball is causative of positive emotional reactions and losing of negative ones. According to their findings an increase of N600 in the left posterior associative cortex occurred when the participant won and a decrease of P800 in the right frontal area occurred when the ball was lost, suggesting that positive and negative emotions are associated with *specific spatiotemporal* patterns of *cortical* activity. However, as already mentioned, the ERP have low spatial resolution. In order to gain a better understanding of neuronal activity, some authors have used fMRI. Cole, Yoo, and Knutson's study [2012] is one such recent example. These authors analysed the brain activity inferred indirectly from blood flow during the onset, the offset and the interactive gameplay of a serious video game. The overall results revealed an activation of the reward-related mesolimbic neural circuits, which, in turn, again suggests the involvement of motivational processes during gameplay. These results are also consistent with other studies that have found dopamine release whilst gaming [Koepp et al., 1998]. Through the recording of phasic psychophysiological responses of emotional valence (zygomatic and orbicularis oculi muscle activities for positive emotions and corrugator muscle activity for negative emotion) and arousal (SCL and cardiac interbeat interval), Ravaja and colleagues [2006] were also able to identify which specific events during the game elicited positive emotions. As expected, positive emotions occurred in rewarding events, such as when the game character reached the goals, or earned points for example. Being very sucessful in specific ocasions also triggered high arousal. However, a especially interesting finding was that some negative game events caused both positive emotions and arousal, which may suggest that players have the capacity to experience positive feelings despite being confronted with negative but challenging situations. Nevertheless, replaying a negative event on subsequent occasions was related to negative affect. Overall, these results indicate that being confronted with both negative and positive events during games can be perceived emotionally as positive. This raises several questions, that we will address in greater detail later. One of these relates to the player's overall experience of enjoyment and the paradoxical view that negative experiences in media entertainement are often regarded as a significantly positive experience. Another question considers the effects that engaging in violent games may have at both individual and interpersonal levels.

ENJOYMENT IN GAMING

One important line of research for the understanding of emotions in gaming is that of personal evaluations made by players after experiencing specific emotions over the course of the game play time. Several authors have developed the concept of meta-emotion in order to explain how experiencing intense, negative emotions (anger, fear, or sadness) can sometimes be felt as a rewarding experience, thereby contributing to an overall experience of enjoyment [e.g., Bartsch, Vorderer, Mangold and Viehoff, 2008; Jäger and Bartsch, 2006; Olivier, 1993].

Meta-emotion has been explained both in terms of affective reactions toward one's own emotions [e.g., Gottman, Katz and Hooven, 1997; Jäger and Bartsch, 2006] and of meta-level mental processes, including emotional self-awareness, normative evaluation of emotions and emotion regulation [e.g., Mayer and Stevens, 1994]. However, the complexities of meta-emotion and their consequences have not yet been integrated into an overarching conceptual framework within the field of videogame research.

According to some authors, enjoyment, considered as a positive meta-emotion, is at the heart of the entertainment experience [Tan, 2008; Vorderer et al. 2004]. The concept of enjoyment has been used to describe and explain positive emotional reactions toward videogames and its contents [Klimmt, Schmid and Orthmann, 2009; Vorderer, Hartmann and Klimmt, 2003], and it is considered a complex construct that also involves physiological, affective and cognitive dimensions [Vorderer et al., 2004].

Several factors are associated with the experience of enjoyment; some relate to individual differences, while others relate to specific game features. Research in this area is vast and by consequence, limitations of space prevent us from reviewing this topic in full. Instead we will focus on some emotional experiences and game features that are specifically associated with enjoyment and motivations for playing.

Ryan, Rygby and Przybylski [2006; 2009; 2010] have applied self-determination theory to a study of intrinsic motivational factors that are relevant to game enjoyment. They evaluated the motivational role of autonomy, competence and relatedness and found that all three made an independent contribution to game enjoyment, but also to immersion and estimations of future engagement [Ryan, Rigby, and Przybylski, 2006]. Relatedness and satisfaction were also correlated with positive well-being outcomes, but only autonomy and competence contributed to an increase in player's positive affect following play. Playing games to address a need for competence is consistent with theories of flow which considers challenge as an important element of game enjoyment [Ravaja et al., 2006; Vorderer et al., 2003].

In fact, people may seek games that stimulate optimal emotional responses or response patterns such as flow experiences [Sherry, 2004]. A flow state occurs when an individual is deeply involved in something that is perceived as intrinsically motivating and depends on a successful balance between the perceived level of the challenge and the skills of the person. Empirical research regarding flow states in videogames has shown that reports of flow experiences predicted such factors as engagement in the game [Wood, Griffiths, Chappell and Davies, 2004], an interest in continued playing [Choi and Kim, 2004], and the perceived skills that are challenged by a given task [Keller and Bless, 2008]. Flow experience is therefore a valuable component of videogame entertainment.

Many studies have used self-report scales to measure the experience of flow, but there are also some recent studies that have used neurophysiological indexes to capture this experience. In a recent study, Klasen, Weber, Kircher, Mathiak, and Mathiak [2012] analysed fMRI data during game play and related them to several components of game activity that might correspond to the experience of flow, such as engaging in activity which balanced using existing skills and facing some challenges, concentration/ focus; clear goals; control over the activity; and immediate feedback about the progress that the individual makes. They found specific brain activation patterns for these components, and highlighted the activation of the reward-related dopaminergic *midbrain* structures as well as other cognitive and sensorimotor networks. These results also make a strong case for the view that playing games involves a flow experience which is associated with appetitive motivational states.

Another relevant game feature associated with enjoyment experience is that of competition. According to Vorderer and colleagues [2003], playing video games is expected to be enjoyable only if there are sufficient numbers of competitive situations in which the player can potentially arrive at success. In the author´s view, the experience of success may lead to an intensive positive affect, which in turn may increase motivation to continue playing. In contrast, a dissatisfactory outcome may elicit adverse emotions (e.g., anger, frustration) and yet potentially motivate players to continue playing, on the basis that it encourages them to try and solve the problems at hand.

Social competition also seems to be a key factor in enjoyment and can play a valuable social adaptive role. Social comparisons can be associated with specific emotional states, such as stress and frustration, but also joy that varies according to a player's perceived status during the game. During this process self-esteem can also be affected. The concept of social value orientation might be relevant in terms of explaining these emotional reactions, such as competitive orientation (i.e., the general tendency to maximize the individuals' own benefits in comparison with the benefits obtained by others), individualistic orientation (i.e., general tendency to maximize one's own benefits) or cooperative orientation (i.e., to care both for one's own as well as that of others).

Identification with a game character has been also suggested as a determinant of video game enjoyment [Hefner, Klimmt and Vorderer, 2007; Klimmt, Hefner and Vorderer, 2009].

Identification has been described as the illusion of becoming the character within the game's universe, and the notion of wishful identification (a desire to emulate the character) has been suggested as one reason why violent, strong, and hyper-masculine characters are particularly attractive to adolescent males [e.g., Konijn, Bijvank and Bushman, 2007]. Alongside this, it is important that the character is able to accomplish the missions attached to their role [Przybylski, Rigby and Ryan, 2010].

Another factor that has contributed to the far-reaching theoretical frameworks on enjoyment and game preferences is the role of fantasy, curiosity and personality traits [e.g., Johnson and Gardner, 2010; Seger and Potts, 2012; Witt, Massman and Jackson, 2011]. Witt and colleagues [2011], for example, have analyzed whether the descriptive model of *big five* factors of personality could be useful to *predict* videogame playing. They found that only openness to experience predicted high gaming time. Bartsch, Appel and Storch [2010] studied the role of the need for affect as an important predictor of the experience of emotions and meta-emotions in response to drama or horror films. High need for affect, defined as an individual's tendency to be motivated to approach emotionally events, was related both with a strong intensity of negative and ambivalent emotions, and a higher positive evaluation of their experiences in terms of meta-emotion enjoyment. In our view, it would be interesting to further test the role that this emotional trait may play on emotional playing motivations and enjoyment. In addition, other components of emotions, such as physiological and behavioral measures should be included, so as to offer stronger conclusions about the emotions that were experienced and the relevance of this affective trait on specific emotions and meta-emotion experiences.

As has already been mentioned, many emotions are evoked during the process of playing video games. Some of these are intense and positive, while others are negative. At the end of the game, many players may look back and judge the experience as an enjoyable and rewarding activity.

So far we have explored how distinct components of emotions can be used to measure their occurrence during game activity. We have also surveyed some of the game features and differences unique to the player that can increase enjoyment. We should not end this chapter however without also considering the content element of games, and examining the way exposure to this can affect a player both on an inter- and intrapersonal level.

Video Game Content: Emotional Effects and Interpersonal Outcomes

Heavily drawn on social-cognitive and social-learning theories, the General Learning Model (GLM) has recently been used to explain both the short and long term effects of playing videogames on cognition, affect, arousal, empathy, emotional desensitization, and interpersonal behaviour. In this way, it provides a conceptual framework for understanding the learning and the developmental processes involved in shaping behaviour [Buckley and Anderson, 2006; Gentile et al., 2009]. Several experimental studies, conducted in both Eastern and Western contexts, have consistently demonstrated the short term effects of playing violent games. These have been found to prime aggressive cognitions, trigger hostile/angry feelings, increase physiological arousal, promote highly aggressive behaviour, and reduce prosocial behaviour [for meta-analyses, see Anderson, 2004; Anderson and Bushman, 2001; Anderson et al., 2010]. Many nonviolent games also increase arousal and negative affect, such as anger and hostility, frustration, and anxiety [e.g., Arriaga, Esteves, Carneiro and Monteiro, 2006; Anderson and Ford, 1986]. However, in violent games these negative emotions can contribute indirectly to increase the likelihood of aggression. In addition, violent games also prime aggressive thought and other negative social consequences have been found such as a reduction on prosocial behaviours. Moreover, in the long-term, repeatedly playing violent games has been found to contribute to an emotional desensitization towards real-life violence, compounded with a reduced empathy for its victims [Anderson et al., 2010]. The core idea therefore is that an automatic aversive response tends to occur when people are initially confronted with violence. Continued and repeated exposure to it however may attenuate or reduce these responses. This phenomenon is usually defined as emotional desensitization [Arriaga, Gaspar and Esteves, 2011].

The majority of studies in this area have used physiological indexes of arousal to examine the desensitization effect. Carnagey, Anderson and Bushman [2007] have shown that playing a violent video game can cause people to become less physiologically aroused by real-life violence. In their study, participants who played violent games had lower HR and SC when later shown a 10-min videotape depicting authentic scenes of violence, than with those who had previously played nonviolent games. Bartholow, Bushman and Sestir [2006] meanwhile investigated whether repeated long-term exposure to violence would lead to lower emotional responsiveness to real violence, using ERPs as a physiological index of emotional desensitization, due to their association with the activation of the aversive motivational system. P300 evoked potential was recorded when neutral, violent, and negative nonviolent images were presented. A lower amplitude and increased P300 latency occurred amongst heavy players of violent video games compared to with the level elicited by the nonviolent game players. These differences were only evident when violent images were presented but not when subjects were exposed to other negative yet nonviolent images. This therefore suggests that the act of playing games with specifically violent content has a direct impact on emotional desensitization to violence. In the author’s perspective, this result may indicate a “relaxation of avoidant motivational processes specifically associated with violence” (p. 538).

Engelhardt and colleagues [2011] used a similar paradigm to test acute desensitization following violent or a nonviolent video game play. P300 amplitude was again used as an index of emotional desensitization. They found that P300 amplitude elicited by violent images was reduced in individuals exposed to violent video games for short, acute periods of time, but not in individuals with high, chronic exposure. This suggests that short exposure may be insufficient in terms of causing changes in neural responses, as individuals with high chronic exposure could already be emotionally desensitized to violence.

Arriaga, Monteiro and Esteves [2011] have contributed to an understanding of desensitization to real-life violence by looking at both the arousal levels and emotional valence. Psychophysiological measures of arousal (SCR) and self-reported arousal and valence were used to measure emotional desensitization towards real-life affective stimuli which included images with violent, positive and neutral content. Their results indicated that playing a violent game contributed to a reduction both in feelings of displeasure towards violent stimuli and of pleasure towards pleasant stimuli, suggesting that the emotional desensitization effect was not specifically to violent content. In this vein they suggested that playing videogames may affect both motivational systems of avoidance and approach in such a way that it could reduce both the natural avoidance of violent emotional stimuli but also the approach to positively affective events. In the long-term, therefore, this could develop as emotional numbness. Before decisive conclusions can be reached on this particular subject,a further longitudinal study is necessary. In addition to this, the authors also found that for participants with higher videogame habits, this affective attenuation mediated the effect of playing the violent game on aggression, providing further evidence of the negative effects that violent gaming may have at the interpersonal level.

Weber, Ritterfeld and Mathiak [2006] conducted a study of the association between playing violent video games and neural activity by collecting fMRI data of experienced game players during a violent game play. Based on previous studies that suggested the involvement of the orbital frontal cortex, the anterior cingulated cortex (ACC), and the amygdala in emotions, the authors have analysed the role of ACC (part of the medial frontal cortex) in particular, because it seems to be involved in both cognitive and affective processing. Both the activity of the dorsal ACC (dACC) and the rostral ACC (rACC) were analysed, given their distinct association to cognitive and emotional processing respectively. In addition, the activity variation in the dACC, in combination with a reduced activation of the rACC and reduced activity in the amygdala seems to be associated with aggression. In order to test whether involvement in virtual game violence causes distinct neural patterns, the authors developed a within-subject design in which these neural activity patterns were matched to specific game events on a frame-by-frame analyses, by coding nonviolent and violent events into several distinct actions, such as no interaction, safe interaction, imminent danger, under attack, and fighting and killing. In line with their predictions that were based on the association between these structures and aggression, the authors found there to be decreased activity in the affective areas, such as the rACC and the amygdala, and increased activity in the cognitive dACC area. Having said this, several other arguments were advanced to explain this pattern of activation and deactivation during violent actions, amongst which was the possibility that empathy is suppressed when aggressiveness is activated. These results are significant, because they suggest the long-term impacts for experienced game players with this type of game content and the consequent neural patterns that could be associated with a suppression of affective information processing.

Future studies in this line of research would be crucially valuable for understanding the neural brain structures associated with video gaming and the negative effect that violent content in particular could have in the long-term.

In conclusion, research conducted until now has clearly shown that videogame content does matter. Specifically, playing games which portray scenes of violence can have a detrimental effect on emotions (increasing negative affect but also reducing emotions towards others) affective processing, cognitions, and finally, interpersonal relations.

CONCLUSION AND FUTURE DIRECTIONS

Throughout this chapter we have looked at how emotions are experienced and can be measured during gameplay activity; the paradoxical enjoyment of experiencing negative emotions during play; the game features and individual differences that are associated with enjoyment; and the important role of game content on intra and interpersonal outcomes. In particular, we have focused on the short-term effects of playing violent games on anger states, aggressive thoughts and aggressive behavior, and on the problem of desensitization, reduced emotional empathy and suppression of affective information processing.

As advocated by many researchers, emotions, like many other basic processes, are embodied phenomena [Cacioppo, Tassinary and Bertson, 2007], and in any attempt to measure them we should take into account their different components, and analysing the way they interact and contribute towards capturing emotions during play. For example, several limitations have been identified when relying solely on evaluative reports of emotions. These include the (a) difficulties that some individuals face in recognizing, describing or remembering their emotions; (b) the *social desirability bias* that may exist in self-reports and interviews; and (c) the dilemma researchers have of choosing the precise words to include in a survey, while attempting to measure affective feelings, associated with the inherently imperfect relationship between language and its capacity to accurately describe emotion [Sloboda and Juslin, 2001].

Physiological and neurological responses meanwhile are continuous and involuntary, thereby reducing the subjectivity of self-reports and some of the bias in researchers' interpretations of responses. Despite the clear potential of physiological, neurological, biochemical, and behavioural expressions as objective evidence of emotions, several concerns have also been raised. Many authors emphasize that to be considered a valid indicator of affective experience, biological and physical responses should match the subjective experience of individuals. However, research has suggested several difficulties in finding a robust relationship with the experience of emotion by the individual and physical indicators of emotion [Vul, Harris, Winkielman and Pashler, 2009]. Researchers attempting to capture players' emotional responses while gaming have reported difficulties in matching the physiological data to the player's subjective emotional experience [Boyle, Connolly, Hainey and Boyle, 2012]. It is possible, for example, that a player might be emotionally aroused for varying reasons and these may or may not be related to the game itself [Ravaja et al., 2006]. Each physiological system also fulfils several functions within the organism independent of their relation to emotions. The often described 'many-to-one' relationship between psychological processing and physiological response [Cacioppo et al., 2007] allows for physiological measures to be linked to a variety of psychological processes besides emotions (e.g., perception, attention, thoughts). Therefore we should keep in mind that physiological responses are not direct indexes of well-characterized feelings. Also relevant are the research findings indicating that many emotional processes can also occur without an individual's awareness, suggesting that an implicit processing may also take place [Berridge and Winkielman, 2003]. Consequently it is unsurprising that in several circumstances there is no clear relationship between neural and physiological responses and the experience of emotion. Furthermore, it is also possible that some physiological activity can occur for instrumental reasons, such as the way faking an emotion's expression can activate some major facial muscles. For example, the zygomaticus major muscle is often activated when an individual is smiling, but the individual may express a fake smile for numerous reasons, and therefore it is not accurate to conclude that the simple existence of a physiological indicator denotes the underlying existence of an emotion [Bradley and Lang, 2007].

Modern neuroscience approaches to emotion have also found that there is no single region of the brain reserved for emotion as many distinct emotional processes have distinct brain circuitry [Davidson and Scherer, and Goldmith, 2003]. In addition to this, most physiological and neurological measures rely on specific changes that are affected by many other factors. For example, fMRI techniques rely on blood blow changes in brain areas that might be involved in neural activity, but many factors (e.g., oxygen consumption, blood volume) also influence the results of fMRI, besides neural activity [Harmon-Jones and Harmon-Jones, 2012]. Cardiac activity is also innervated by both the sympathetic and parasympathetic nervous system and therefore phasic and tonic responses of HR could be related to different emotional processes; in many studies phasic HR is used to assess valence [Mandryk and Atkins, 2007], while tonic HR is often used to measure arousal [Arriaga, Esteves, Carneiro and Monteiro, 2008]. Nevertheless, several other processes, such as attention, also tend to be associated to HR responses. For example, a decrease in HR tends to be associated with the beginning and termination of attentional engagement to stimuli events [Andreassi, 2000]. Consequently, some caution should always be made when considering each system response as evidence of emotional processes, and concurrent measures of these three systems can be valuable for the study of emotions in gaming in a more dynamic and integrated way. It is therefore important to continue examining the phasic emotional responses of relevant events during the game activity, as well as their relation to motivational systems and meta-emotions.

Another interesting venue is the work that has been developed in the field of human–computer interaction (HCI) research in a new area of investigation that was recently called “affective gaming” [Liu, Agrawal, Sarkar, and Chen, 2009]. Scholars working in this field have developed models for continuously modeling emotion during virtual interaction with technologies to accommodate individual player’s characteristics [Mandryk and Atkins, 2007]. By studying the dynamic difficulty adjustment (DDA) mechanisms to tailor game-playing experiences automatically to the individual characteristics, Liu and colleagues [2009] developed an affect-base DDA model for video games that was capable of recognizing physiological responses of anxiety in each player. In their study, several physiological responses (cardiovascular activity, electrodermal activity – both tonic and phasic responses - and EMG activity) were analyzed so as to measure anxiety, while participants were playing a video game. The level of difficulty was changed in accordance with the levels of anxiety that were being recorded. Their results suggested that gaming experience was enhanced when the game was capable of recognizing player’s affective states and adjust the game difficulty levels accordingly. The majority of participants reported feeling firmly satisfied and perceived the affect-based DDA as more challenging than a performance-based DDA. Modelling affective states during video games is at an early stage, but we expect this to be a rich area of research in the coming years.

The rapid *development* in computer *technology* can bring more realism and sense of presence to virtual environment games, and so special concern must be attached to the game content in which players engage. In this chapter we have reviewed the negative consequences of playing with violent games, but we are also keen to emphasize that playing prosocial games can have the opposite effect by increasing pro-social behavioural tendencies, as several recent studies have shown [Gentile et al., 2009]. Because content really does matter and interferes with our emotional experience in both virtual and real environments as well our interpersonal relationships, we should *envision the development of challenging and enjoyable games that can bring valuable and healthy* benefits for all players.

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