To game or not to game: examining differences in presence, arousal and intended aggression after playing or observing a violent videogame

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"Why don't you get off the computer and watch some TV?"

Preface

You are about to read the result of a study I conducted to achieve my Master of Science degree in Psychology at the university of Twente, Enschede, The Netherlands. Although the past months were very busy because finding a job required more of my attention than I had anticipated for, I can look back at a very enjoyable period. With the lingering graduation period for my previous degree still in my mind, it was refreshing and pleasant to find two supervisors who gave me the support I needed, both with respect to the content of my thesis as well as practical affairs surrounding the experiment itself. Therefore, my compliments as well as my gratitude to Oscar Peters, my first supervisor and Ard Heuvelman, my second supervisor.

Second of all I would like to thank Peter Moor, who was so kind to replace me as the experiment leader for the second session of the experiment, without you I would have had a big problem. I will not individually thank all the participants of the course Media Psychology who made this experiment possible, needless to say, without you there would be no experiment and no thesis.

Thank you friends and family for your interest in my work (this time I will not thank you for listening to my worries since I barely had them). Finally, thank you Marleen for your support and critical input in the times progress was slow or when I just wanted confirmation of my ideas.

Pim van den Broek
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Abstract

This exploratory study examined the difference in intended aggression after playing (active) and observing (passive) a violent video game. The main explaining variables were arousal and presence, independent variables like trait aggression, playtime, game preference, previous experience with the game and gender were analysed as possible interacting variables. It was predicted that participants in the active condition would score higher on the intended aggression scale than participants in the passive condition through more arousal and presence. Results indicate that participants in the active condition were significantly more aroused and perceived greater feelings of presence. However, these variables were not correlated to intended aggression and no differences on intended aggression were found between conditions. Previous experience with the game, gender and a preference for first person shooter (FPS) games proved to interact with condition, however the difference between the active and passive condition was only significant within the group that frequently played FPS games. Moreover, this difference was in the opposite direction as predicted. Although differences within the group that plays FPS games frequently hint toward a difference in intended aggression between the conditions, the results for the explaining variables were too ambiguous and contradictory to draw conclusions from. Until more research is conducted for the specific sub-groups (amongst others FPS players) it is concluded that there is no difference between playing and observing a violent video game.

Introduction

The influence of (violent) media on its users is controversial (Perse, 2001; Sparks and Sparks, 2002), as well as a hot (research) topic, certainly when another violent drama like the 2002 Erfurt shooting in Germany takes place (where 13 people were killed by a nineteen year old). Some critics and the papers were quick in pointing out a scapegoat: violent media like gangster-rap, television and perhaps most importantly: violent videogame (in this case: Counter strike). Headlines like *"software for a massacre"* and *"the killer was trained by a computer game"* leave little doubt about the general attitude that violent computer games cause violent behaviour (Murphy, 2002).

Although there is current research which indicates a fairly strong correlation between violence in real life and playing violent videogames (e.g. Anderson, Gentile and Buckley, 2007; Anderson, 2004), there is also plenty of research that contradicts this (e.g. Sherry, 2001; Ferguson, 2007) or concludes that causation is not easy to indicate at best, mainly because of the many limitations of current research (Freedman, 2001; Cumberbatch, 2004; Boyle and Hibberd, 2005). A discussion of these limitations is out of the scope of this study, for an extensive overview of the limitations of current violent video game studies, also see Rutter and Bryce (2006).

As noted before, a causal relationship between media violence and real life aggression is hard to indicate and has not (yet) been statistically proven. Hence, the use of the word *influence* of (violent) media above instead of *effect,* to point out the complex interplay between social and environmental factors and media. This is opposed to the "effects" tradition, where (perhaps erroneously) the term "effects" suggests a causal relation between media and human behaviour which can be studied in isolation (Giles, 2003; Gauntlett, 1995).

This does not hold some scholars back to claim that 'violent videogames cause real-life violence', i.e. they treat the causal relation as proven (Bushman and Anderson, 2001; Carnagey and Anderson, 2004). Anderson, Gentile and Buckley (2007, 29) without batting an eyelid even claim that *"[...] the evidence (i.e. previous research) strongly points to a significant deleterious effect of violent media on aggression and aggression-related variables"*. Other explanations, such as the shooters' social rejection, feelings of alienation at school, and depression are mostly treated as minor factors compared with video games (Sternheimer, 2007). Ferguson (2007) adds that *"[in the discussion of causes of violent drama's] less than 1% of news stories focused on the responsibility and moral character of the perpetrators themselves"*. Gee (2006) further states:

"[...] claiming that video game violence causes real life violence is akin, I suppose, to the claim that because I have planted lots of corn in Harvest Moon I will run out and plant corn in my back yard—in reality we have as little real corn from Harvest Moon as we have real killings from Grand Theft Auto (which is not to rule out the rare case of either—given enough time even low probability events occur—though, of course, by definition, rarely)."

Perksy and Blascovich (2007) studied this idea, only not in the context of planting crops, but in the transfer of artistic and creative feelings when a (non-violent) video game was played which supposedly stimulated these feelings. No results were found, with explanations ranging from "violent content is more readily transferred and intensified" to "the non-violent condition did not engender creative feelings". Although the results seem to support the words by Gee (2006) and simply banning violent video games from society will unlikely bring down real-life violence, since it is part of a much more complex network of personal and contextual influences, many believe that a ban or censor is the solution.

Banning and censoring violent video games is as a matter of fact at the order of the day. Although Wikipedia is not an official source, an interesting overview of the video game controversy and many examples of censorship and banning in different countries around the world can be found there[1].

This extensive overview and the discussed doubtful relation between media violence and real life violence gives rise to the question whether all this attention and preventive action to protect citizens is not exaggerated, especially in the light of more passive forms of violent media which have been around much longer than semi-realistic violent video games, which only developed in the last few years (the pre-2000 games can hardly be compared to for example movies in terms of realistic graphic violence). It is nevertheless a popular belief that media where the user is actively involved in the violence (i.e. video games), have a greater impact on its users than media where users play a more passive role (e.g. television and movies), this active involvement might cause mediated violence to be experienced as if it was non-mediated, it may be more arousing, seem more "realistic," and be more likely to desensitize viewers (Anderson, Gentile and Buckly, 2007, 75; Bryce and Rutter, 2006, 207; Lombard, Reich, Grabe, Bracken and Ditton, 2000).

This study intends to examine whether this is actually the case, investigating the role of *presence* (or the conviction of being located in a mediated environment) and arousal on aggression after playing or observing a violent video game. It should be noted however that although this study is connected to most violent video game research, it does not intend to interfere in the discussion whether violent media (passive as well as active) indeed cause violent behaviour. The main objective is to examine possible differences between active participation and passive undergoing of violent video games in terms of induced aggression, presence and arousal without comparing the results to non-aggressive forms of media (which is also not possible given the research design).

The follow-up of this chapter first offers a short overview of the theoretical mechanisms that underlie mediated aggression, followed by a brief review of the General Affective Aggression Model (GAAM) which claims to integrate many existing theories. Finally a short overview of measures of aggression that are used in research today will be given.

[1] http://en.wikipedia.org/wiki/Video_game_controversy

Theoretical mechanisms underlying the influence of mediated violence

Media influences can be described along various dimensions (Perse, 2001), some of which will be discussed in this introduction. The first is micro versus macro. The former concerns individual influences whereas the latter is a more societal influence. However, it is a misconception to consider macro level effects are accumulations of micro level effects, as individual influences might differ under the influence of differences in for example education or income.

Another dimension is intentional versus unintentional. To clarify this in the context of commercials the intended influence is obviously to promote something and influence consumers to buy something. However, an unintentional influence when the commercial is repeated too often might be that consumers develop a negative brand image because of irritation. For violent video games the intentional influence is to amuse consumers of the game or serve as an outlet for stress. An unintentional influence is that consumers might start behaving more aggressive in real life as well.

Long term versus short term influence needs little elaboration. The most important aspect here is how long certain influences are expected to last. Arousal for instance last relatively short, whereas the learning of social scripts is more a long term process. Most experimental research focuses on short term influences since these can be measured directly after the stimulus and are less susceptible to variables which are hard to control for.

The last dimension which will be discussed here is the way in which media can influence people individually, the first being cognitive: the way information is acquired – what people learn, how this information is structured and how information needs are satisfied or not. The second dimension is affective – the formation of attitudes, feelings and (positive/negative) evaluations. The third dimension comprises behaviour – observable actions which are potentially elicited by media exposure.

Besides the dimensions of influences, there are several theoretical mechanisms that underlie (i.e. explain) these influences. These theories which are often cited in literature about media effects will be discussed subsequently (Dill and Dill, 1998):

- Social Learning / imitation
- Excitation transfer / arousal
- Desensitization
- Catharsis
- Priming

Social learning

This mechanism, based on Albert Bandura's *social learning theory* (e.g. Bandura, 1971), states that behaviour is learned through observation and imitation of attractive, rewarded models (Sherry, 2001). Much of this learning takes place without an intention to learn and without awareness that learning has occurred (Anderson et al., 2003).

Observational learning can help to explain some of the short-term influences of exposure to violent media when observed behaviour is immediately imitated. Long-term influences on behaviour (i.e. persistency of the behaviour) are first of all dependent on reinforcement from the environment. Reward or punishment influences whether the imitated behaviour will recur in the future. A second way aggressive behaviour can be stimulated is by disinhibition; with age and development, internal impulse controls are created to inhibit aggressive behaviour. These controls can be weakened when aggressive acts are observed (Calvert and Tan, 1994).

Besides the direct imitation of behaviour of models in the media, it is also possible that certain social scripts are learned, which are a guideline for future behaviour (e.g. how to respond to conflict), which can be considered a long-term influence. When violent models are observed in the media, the user of the media might learn (or come to believe) that violence is a good or normal way to solve a conflict.

When the mechanism of social learning is evaluated in the context of violent video games, it predicts that users could translate the aggressive behaviour of their video game character to real life conflict situations because it is rewarding in the game situation (e.g. the player advances in the game or gets bonus points when using violence). From this point of view violent videogames can be considered a simulation of real-life violence and the danger of violent video games that the simulated behaviour will be brought into practise, which makes them potentially more dangerous than television or music which are passive instead of active media (Dill and Dill, 1998). As noted in the introduction, this explanation is often used by the media to point out a scapegoat, in the case of violent excesses in our society.

Arousal and Excitation transfer

Emotions can be described in terms of two basic dimensions, arousal and valence. Arousal is the intensity of the emotion, ranging from feelings of being energized, excited and alert to feeling calm, drowsy and peaceful (Reeves and Nass, 1996, 132). Valence is the direction of the emotion, good or bad, likeable or not likeable, worthy to approach or something to avoid. All arousing experiences have important consequences, in the case of a negatively valenced experience it helps activating primitive *fight or flight* responses and in the case of positive valence it gives an opportunity for pleasure or procreation.

Arousal can influence aggression in four ways. First, arousal from an irrelevant source can increase the vigilance with which people observe the world and it strengthens current behavioural tendencies. In the case that a person has aggressive feelings or thoughts, high arousal can be the enabling factor to act out these feelings and behave aggressively. If a person is provoked to aggress at the time that increased arousal occurs, heightened aggression can result (Reeves and Nass, 1996; Anderson and Bushman, 2002).

Second, arousal plays an important role in the theory of *excitation transfer* (Zillman, 1971), which takes place when adrenaline produced by an exciting stimulus carries over to a later activity which may be mislabelled as the cause of the excitement (Reeves and Nass, 1996). In the context of media violence, an exciting mediated experience might result in an excess of arousal. Successively a person gets into an argument with someone else which results in physical confrontation, unaware that the physiological excitation is the residue of the mediated experience and not caused by the argument itself. However, this seems only plausible when the period between the stimulus and the other activity is not too long (i.e. as arousal fades after the stimulus, so does the chance for excitation transfer) (Giles, 2003). Excitation transfer suggests that the arousal effect may also persist over a longer period of time: even after the arousal has dissipated, the individual may remain potentially aggressive for as long as the self-generated label of “angry” persists (Anderson and Bushman, 2002).

However, there are some limitations concerning the source of the arousal; when arousal is elicited by sources antagonistic or unlike an aggressive provocation, it is less susceptible to transfer. The reason for this may be that for instance pleasant experiences also produce feelings and thoughts opposite to anger and the likelihood that a person will misattribute euphoric arousal to provocation is small (Tyson, 1998).

Moreover, Sherry (2001) states an inverse effect of excitation transfer: although a stimulus might be initially exciting, arousal might be replaced by fatigue or boredom after prolonged exposure to the stimulus (e.g. long game play sessions). Excitation transfer would then predict a reduction in aggressive tendencies.

Third, arousal can have another long term influence on aggression: highly arousing experiences (mediated or not) are associated with better memory for the experience (Reeves and Nass, 1996), possibly contributing to the internalisation of aggressive scripts in the context of social learning .

A fourth and as yet untested possibility is that unusually high or low levels of arousal may be aversive states (i.e. an internal state which is unwanted), and may therefore stimulate aggression in the same way as other aversive or painful stimuli (Anderson and Bushmann, 2002). Zillmann (1983) argued that people experience a cognitive incapacitation when highly aroused, reducing inhibition mechanisms (e.g. situational influences) and increasing the probability of well-learned responses (which might contribute to the display of violent behaviour learned through violent media).

A large number of situational variables influence both physiological and psychological arousal. Exercise increases both, whereas alcohol decreases both. Interestingly, changes in physiological and psychological arousal do not always coincide. Note that this is in important implication for experimental research where both measures of self-report (psychological) and for instance heart rate (physiological) are used to measure aggression. Anderson et al. (2000) for instance found that hot temperatures increase heart rate while simultaneously decreasing perceived arousal. This suggests that heat also might increase aggression through physiological arousal, but this results would not have been found for self-reported arousal.

Desensitization

Whether intentional (e.g. therapeutic desensitization) or unintentional (e.g. by observing media violence), desensitization allows people to become less sensitive (or even apathetic) to certain aspects of their environment. This can be a positive development (e.g. surgeons becoming resistant to distressing sights) or negative (people becoming less sensitive to violence in society). The term “desensitization” in the context of violence has many meanings, amongst others a reduction in physiological arousal or affective reactions to real life violence or a reduction in sympathy for a violence victim. Therefore, Carnagey, Anderson and Bushman (2007) suggest a narrower definition of desensitization: *a reduction in emotion-related physiological reactivity to real violence*.

Anderson et al. (2003) state that the diminution of unpleasant physiological arousal (or negative emotional reactions) as an influence of much exposure to media violence is associated with a heightened likelihood of violent thoughts and behaviours. The underlying theory is that these negative emotions normally have an inhibitory influence on thinking about violence, condoning violence or behaving violently, overexposure to mediated violence diminishes or annuls this effect.

Catharsis

As opposed to the previously discussed mechanisms, catharsis actually predicts a positive influence of violent media on its users. It states that the consumption of violent media offer a way of discharging aggressive feelings by observing (or participating in) a fictional act of violence. In the context of violent video games catharsis provides a way of acting out aggression that is not allowed in the real world (Sherry, 2001). In the psychoanalytic theory this is also called *aggressive drive reduction*, where violent video games offer a way to “drain off” these impulses (Calvert and Tan, 1994).

Catharsis has many historical interpretations, but, as applied to anger and aggression, it was a hypothesis about conservation of emotional energy (Tyson, 1998). Anger or aggression that is once provoked must be expressed in one form or the other. However, in a study where people were provoked and were given the opportunity to aggress against the experimenter afterwards, a decrement in arousal was only found in real life aggression (e.g. physical or verbal) towards the

experimenter, not for fantasy attacks (Tyson, 1998, 148). This implicates that playing an aggressive video game does not lower arousal.

Priming

Priming theory posits that cues from the environment may lead to aggression or hostility due to the priming of semantically related informational nodes (Berkowitz and Rogers, 1986). Or a less formal description: in this approach, concepts that are related (e.g., river and water) can trigger one another and perhaps related behaviours such as thirst and drinking (Farrar and Krcmar, 2006). When this is applied to violent media: when a violent scene is observed, this may activate (or increase the accessibility of) a complex set of thoughts, feelings and behavioural scripts which are related to aggression (Anderson et al., 2003). Because these schema's are more easily available, an interpretational bias is created, which can increase the likelihood that a person will react aggressively in an ambiguous situation, for instance when bumped into on the street.

A long term influence of the priming mechanism strongly relates to the concept of *cultivation*, where media shape people's beliefs about the real world. A striking example is the so called "mean world"-effect; people seriously overestimate the amount of crime in the real world because of large-scale media coverage of violence in our society (Giles, 2003, 21-22), which results in a general climate of fear or unsafety (Van Mierlo and Van den Bulck, 2004).

The General Affective Aggression Model (GAAM)

This model by Anderson and Dill (2000) claims to integrate the influences on the cognitive and the affective dimension into a model for predicting aggressive behaviour after exposure to violent media. Many of the earlier discussed theoretical mechanisms can be recognised, inhibition and desensitisation for instance can be characterised as personal variables, arousal is integrated as a present internal state variable, priming plays a role in present cognitions and affects and (the potential ability to induce) presence can be characterised as a media variable (although presence is also dependent on personal variables and someone's internal state). The model is depicted in Figure 1 on the next page.

The input variables consist of personal and situational variables which influence the internal state of a person. The personal variable for instance encompasses how easily aggression related information is accessible by nature (which can be influenced by previous experiences, so nurture for example by social learning and desensitisation also plays an important role). This variable can for instance be measured by assessing the person on the Buss-Durkee Hostility Inventory (BDHI) (Buss and Durkee, 1957). Situational variables can also influence the accessibility of aggression related knowledge structures, for instance when a person is treated unfair. Anderson and Dill (2000, 772-774) believe that playing a violent video game is such an external factor too (although they do not believe that routinely playing video games increase feelings of hostility or anger).

As said before the input variables influence cognitions and affects (and each other) and arousal, which in turn are influential in the likelihood that a person will react aggressively to a certain situation through the earlier discussed theoretical mechanisms.

In the end, the current internal state influences what behaviour expressed, which might be automatic or controlled (as depicted by the appraisal process). This behaviour in turn might reciprocally influence the situation the person is in (a situational variable): when the person under consideration starts calling names, the argument might escalate, he/she could be hit by the target after which he/she might hit back.

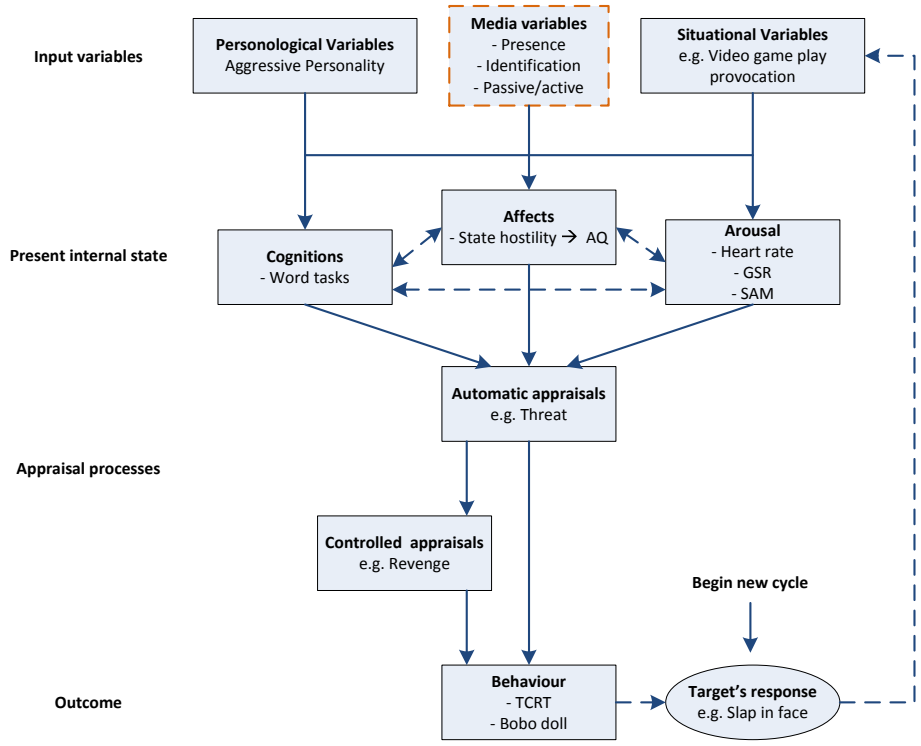

Figure 1: Schematic depiction of a single episode of the GAAM model

Measurement of aggression

The measurement of aggression is as controversial (i.e. the validity of current aggression scales) as the question whether violent media (or more specifically violent video games) cause aggressive thoughts, feelings and/or behaviour (e.g. Freedman, 2001). The cognitive influence of violent video games on participants is typically measured using reaction time tasks, for instance how quickly (aggressive) words are read aloud from a display (Anderson and Dill, 2000) or the amount of interference caused by certain (aggressive and non-aggressive) words on a modified Stroop task (Kirsh, Olczak and Mounts, 2005). Another method is the way in which participants finish ambiguous incomplete words after exposure to different types of media (Carnagey and Anderson, 2005), for instance H_T which can be completed as HIT (aggressive response) or HAT (non-aggressive response). These scales rely the priming theory to explain the cognitive influence of violent media.

The influence on the affective dimension is mostly measured using self-report scales, for example the State Hostility Scale (Anderson and Dill, 2000, 784) where participants are asked to rate statements like "I feel angry" and "I feel mean" on a 5 point Likert scale where 1 means "strongly disagree" and 5 means "strongly agree". The underlying theory is that violent videogames (but also violent media in general) have a priming effect, which activates hostile thoughts, associations and feelings (Giles, 2003, 66).

Another method is physiological, for instance by measuring Facial ElectromyoGraphic (EMG) activity, for instance over muscles that control the eyebrows and the angle of the mouth (Ravaja, Turpeinen, Saari, Puttonen, Keltikangas-Järvinen, 2008). These EMG's can then be used to index the valence of emotions. Furthermore, Electroencephalography (EEG) can be used to study cortical responses to different stimulus events (e.g. violent and non-violent), where different EEG frequency bands have been associated with various processes, amongst others emotional responses (Salminen, Ravaja, 2008).

Recently researched behavioural influences include pro-social behaviour as represented by decision making in the Prisoner's Dilemma game (Sheese and Graziano, 2005) and the Taylor Competitive Reaction Time (TCRT) task. In the latter method, the participant's goal is to push a button faster than his or her opponent. When participants lose this race, they receive a noise blast at a level supposedly set by the opponent (actually set by the computer). Aggressive behaviour is defined as the intensity and duration of noise blasts the participant chooses to deliver to the opponent (Anderson and Dill, 2000; Carnagey and Anderson, 2005; Bushman, Ridge, Das, Key and Busath, 2007).

Although behavioural measures seem compelling, Farrar, Krcmar and Nowak (2006) state that they are problematic in at least several ways. First, they are more difficult and time consuming to administer than the typical self-report measure. Second, special equipment is typically needed that can be both costly to obtain and time consuming to use, for instance in the case of the TCRT task as described above. Third, despite their seeming external validity, one obvious problem is that the more valid the behavioural measure appears, the less ethical it is to use. Finally these methods mostly take place in a laboratory or an artificial setting which might reduce the external validity of the results, which might not be representative of "real world" violence (Giles 2003, 30; Gauntlett, 1995).

Therefore, a sub-aspect of aggressive behaviour is posed: hypothetical or intended aggressive behaviour, which can be measured by confronting participants with hypothetical situations which might result in conflict and asking participants how they or the person in the situation will react (instead of actually asking participants to react). A method to measure intended aggression by Bushman and Anderson (2002) is the ambiguous story stem protocol in which participants have to indicate what the main character will do or say, think, and feel as the story continues (each story ends with "what happens next?"). A less open-ended (i.e. closed instead of open answers) and more personal (i.e. how would *you* react instead of how would the main character react) version of this protocol was used by Wei (2007) where participants had to indicate how they would react in possible conflict situations choosing from three multiple choice options ranging from physical force to yelling and finding a peaceful solution or doing nothing.

Research topic

It is a popular belief that media where the user is actively involved in the violence (e.g. video games), have a greater impact on its users than media where users play a more passive role (e.g. television and movies), this active involvement might cause mediated violence to be experienced as if it was non-mediated, it may be more arousing, seem more "realistic," and be more likely to desensitize viewers (Anderson, Gentile and Buckly, 2007, 75; Bryce and Rutter, 2006, 207; Lombard, Reich, Grabe, Bracken and Ditton 2000).

However, there is little research that directly compares these two, examples are those by Calvert and Tan (1994) who compared playing in a virtual reality environment with observing the same game play on an external monitor or Tamborini et al. (2000) who compared virtual reality with a traditional desktop environment. However, in both studies conditions were quite different, as this study is interested in comparing a desktop platform with observing the same stimulus (and extrapolate the results to for instance watching television).

One of the limitations of current video game research is that very often incongruent stimuli are used (e.g. two totally different game genres or a slow paced game versus a fast paced game, possibly causing third variable effects, Klimmt, 2001). An example is a study by Anderson and Dill (2000) who used the games Myst (non-violent) and Wolfenstein 3D (violent), which are two totally different games (calm puzzle and fast paced first person shooter). It is presumed that the same limitation holds when playing violent video games is compared to for instance watching a violent TV fragment or playing on a different game platform. Of course it is possible to try and control for the differences by means of a pre-test, but for this study this is no solution since we want to know whether there are for instance differences in induced arousal. Therefore, this study is designed around the same stimulus, namely a violent video game, comparing participants at the controls (the actual video game players) with participants who are just spectators (the passive group). Then, both groups can be compared in terms of aggressive intent. This results in the following main research question:

RQ: Is there a difference in aggressive intent after playing and observing a violent video game?

As noted before, the main difference between videogames and other media is its interactivity which might result in feelings of non-mediation. This concept of non-mediation is strongly related to the concept of *presence*, which is not so much a mechanism or theory about the influence of media, but it might play an important (mediating) role. Witmer and Singer (1998, 225) define the concept of presence as *"the subjective experience of being in one place or environment, even when one is physically situated in another"*, while Lombard and Ditton (1997, 12) define presence as *"the perceptual illusion of non-mediation"*.

According to Witmer, Jerome and Singer (2005), presence in a mediated environment is influenced by several factors, including: the fidelity of its sensory components, the nature of the required interactions and tasks, the focus of the user's attention/concentration, the ease with which the user adapts to the demands of the environment and on the user's previous experiences and current state.

Overall, there are two concepts that explain presence (Witmer, Jerome and Singer, 2005; Eastin and Griffiths, 2006).
The first is *involvement*, defined as *"a psychological state experienced as a consequence of focusing one's mental energy and attention on a coherent set of stimuli or meaningfully related activities or events".* Involvement with media is increased by offering the user an experience that stimulates, challenges, and engages the user either cognitively, physically, or emotionally.

The second aspect is *immersion*; *"a psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences"*. Immersion in a virtual environment (VE) is reduced by distractions from the environment (e.g. light flashes or sounds) and is increased by factors that facilitate direct interaction with the VE and the performance of VE task activities. An example is perceiving oneself as moving inside a simulated environment or directly interacting with other entities in that environment (Witmer and Singer, 1998).

Lee (2004) discerns between three different types of presence humans can experience. *Social presence* refers to the experience of virtual actors as if they are real actors or the experience of virtual objects that manifest humaneness. Next, *self-presence* is described as the experience of a virtual self as the actual self (which might lead to an awareness of themselves inside a virtual environment).

The most interesting form of presence in the context of this study is s*patial presence*, which is described as the sense of being physically located in a virtual environment or experiencing virtual objects as if they are real objects or as Wirth et al. (2007, 495) state: *"The main characteristic of Spatial Presence is the conviction of being located in a mediated environment"*. Note that this definition closely resembles Witmer and Singer's (1998) general definition of presence. However, Wirth et al. (2007) note that this definition emphasises the immersive properties of the medium too much and passes over the internal processes of the user. They state that even if immersive impulses are not provided by the medium, internal processes like imagination can compensate for the deficit. Therefore, spatial presence is not limited to media using sensory rich technology (e.g. VR), but can also occur when using less immersive media (including text based media).

Wirth et al. (2007) propose a two dimensional construct of spatial presence, with the sensation of being physically situated in the virtual environment at the core (coined as "*self-location"*). The second dimension refers to the possibility to act based on mental representations of the mediated space: an individual who is experiencing spatial presence will perceive only the action possibilities of the mediated space and will not be aware of (the possible actions of) the real environment. This dimension is called "*possible actions*". In this thesis, the term *presence* will refer to the definition of *spatial presence* as defined by Wirth et al. (2007).

Involvement is often considered to be a part of the experience of presence. Wirth et al. (2007) see presence as a side effect of media involvement. They conceptualise involvement as "the active and the intense processing of the mediated world", whereas the concept of (spatial) presence refers to the experience of "being in the mediated world". However, focussing one's attention to the mediated environment does not necessarily mean a loss of contact with the real world. Furthermore, if users are for instance involved in the narration of a film or role-playing computer game, they think about the characters, their actions and feelings, but they do not pay attention to the television receiver or the computer mouse in their hands. Wirth et al. (2007) therefore theorise that presence is more a side-effect of higher involvement because the attribution of mental capacity to the mediated world comes at the expense of mental capacity for the real world.

According to these authors, spatial presence is established in stages. First of all it is necessary that a user has a mental model of the mediated environment called a Spatial Situational Model (SSM) and that the user focuses his/her attention to the medium (Attention Allocation). Then, a so called Egocentric Reference Frame[2] (ERF) is constructed from visual information, but also other sensory input like vestibular cues. All perceived objects, including one's own body, are located

[2] a mental model of the world that is organized from a first-person perspective and contains at least the immediate surroundings

in reference to the ERF. Thus, an ERF tells us where we are in a spatial environment. Mediated environments may also offer ERFs, for example, in first-person shooter video games (Schneider, Lang, Shin and Bradley, 2004). However, sensory cues can indicate different ERFs when for instance movement through a 3D environment is visually perceived but vestibular cues (which are not addressed by the game) do not indicate movement. To avoid confusion, users are likely to try to return to the condition of one congruent ERF. This is called the Primary Ego Reference Frame (PERF); the user will prefer to align perceptions and action possibilities with this reference frame. Wirth et al. (2007, 506) state that *"Spatial Presence occurs when a person accepts a mediated environment as PERF, because in this case, perceived self-location, perceived possible actions and mental capacities are all bound to the mediated space."*

Returning to the role of presence in video games, it is mostly expressed in terms of interactivity and interactivity/ active involvement as noted in the first paragraph of this chapter. Interactivity expresses itself in the player's possibility to select a game character which he/she likes the most (in the case of third person video games), or to experience the game as themselves (i.e. players experience the video game world through the window of their own eyes). Most violent games that are played from this perspective are called *First Person Shooters* (FPS). Furthermore, the possibility to manipulate or influence the video game world strengthens the perception of a real world (i.e. the perception of "being there"). To investigate whether people actually do feel more like "they are there" when playing a video game, the following hypothesis is proposed:

H1: playing a violent video game induces greater feelings of presence than observing a violent video game.

As noted before, the impact of violent videogames is presumed to be greater than that of more traditional (violent) media, mainly because of their interactive character. Explanations include more identification with the game character and the mere fact that the user is actively involved instead of an observer, contribute to greater levels of presence.

A study by Farrar, Krcmar and Nowak (2006) found that presence in violent videogames is positively correlated to hostile intentions. Other studies like those of Calvert and Tan (1994), demonstrated that playing a violent game using a Virtual Environment (VE, also known as Virtual Reality, VR) led to more aggressive feelings than observing game play. Although the concept of presence is not explicitly considered in their study, Persky and Blascovich (2007) found that the use of VE (which is presumed to induce more presence than traditional, non-VE environments) led to more self-reported aggressive feelings and more behavioural aggression than playing on a traditional desktop computer platform.
However, a study by Tamborini et al. (2000) found an unexpected trend toward increased presence and hostility in a desktop computer condition over a VE condition. Moreover, Tamborini et al. (2004) found some support for the connection between presence and aggression; however, overall levels of presence did not predict aggression.
Although current research results about the relation between presence and aggression are inconclusive or even contradictory, the following hypotheses are proposed to investigate the influence of presence on aggressive tendencies:

H2a: greater feelings of presence during violent video game play lead to more intended aggression.
H2b: greater feelings of presence during the observation of a violent video game lead to more intended aggression.

Since previous research on the relation between presence and aggression is not conclusive and since there appears to be no previous research on this relation for the observation of a violent video game, the hypothesis is split in two to individually examine the relationship between these two variables for each condition.

As was discussed in the previous chapter, another construct that plays a key role in the influence of violent media is arousal. Calvert and Tan (1994) found a greater physiological arousal for participants who actively played a video game using VE and participants observing game play. To investigate whether the same holds when traditional game play is compared with observation on the same platform, the following hypothesis is proposed:

H3: playing a violent video game induces more arousal than observing a violent video game.

Arousal is very often related to aggressive and violent behaviour through mechanisms of excitation transfer, disinhibition and strengthening of behavioural tendencies (also see the previous chapter). Anderson, Deuser and Deneve (1995) found an indication that arousal induced by high temperatures may increase aggression, confirming the potential mediating role of arousal on behaviour (as conceptualised in the GAAM). Furthermore, physiological arousal has been shown to increase learning from media (Schneider, Lang, Shin and Bradley, 2004), which in turn should make aggressive concepts more accessible, facilitating aggressive behaviour. Barlett, Harris and Bruely (2007) found that the amount of blood in the game Mortal Kombat was positively correlated to the amount of physiological arousal and state hostility. Finally, Boyle and Hibberd (2005, 4) find that *"[...] There is a body of evidence that playing violent video games increases arousal and the possibility of aggression in some players"*. Therefore:

H4a: more arousal leads to more intended aggression after playing violent video games
H4b: more arousal leads to more intended aggression after observing violent video games

Although previous research on the relation between arousal and aggression seems more conclusive, the hypothesis is split again, most of all to be able to study the relation in the context of the observing group.

Another interesting relation is the one between presence and arousal; media researchers have predicted that immersive media (i.e. which induce a lot of presence) increase arousal levels and aggression because users feel they are directly experiencing the violent events. Besides, presence seems to be closely linked to attention (or *involvement*), which in turn is connected to arousal (Dillon, Keogh, Freeman and Davidoff, 2000). Furthermore, it is theorized that highly immersive experiences may influence involuntary (aggressive) emotional responses (Schneider, Lang, Shin and Bradley, 2004), so the relationship between presence and arousal will also be scrutinized.

Furthermore, there are more variables at work. The earlier discussed GAAM model (e.g. Anderson and Dill, 2000), also indicates personal factors, where an aggressive personality seems the most prevailing. It is trivial that a more aggressive person is more likely to have aggressive thoughts and feelings than a person with less disposition to aggression (Bryce and Rutter, 2006).

In their evaluation of the Spanish version of the Aggression Questionnaire (AQ), a scale to measure trait aggression, which will be discussed later on), Santisteban, Alvarado and Recio (2006) found a positive correlation between the score on the AQ and watching television and playing videogames, while extra-curricular reading or moderate amounts of homework were negatively correlated. Measurement of trait aggression allows to analyse the impact of the different conditions on participants with a different disposition to violence (Ravaja, Turpeinen, Saari, Puttonen, Keltikangas-Järvinen, 2008).

Other personal variables that might introduce a third variable effect are frustration and pleasantness of the experience. When for instance a participant does not have any experience with video game play and has troubles with the controls or dislikes the game, he or she can become frustrated or irritated. This can introduce third variable effects on the evaluation of aggressive tendencies and the comparison of playing and watching video games, for instance trough more arousal. However, pleasantness of the experience can also have a positive influence (i.e. less aggressive tendencies) when participants indicate they had a good time (i.e. a catharsis-like effect). Other factors include gender and previous experience with videogames. No hypotheses about these variables are proposed but their interaction with the conditions will be investigated.

Returning to the research question, a deductive approach has been used following the train of thought that playing a violent video game induces more arousal and presence. Since presence and arousal are connected to more aggression in general, it could be that playing a violent video game leads to more intended aggression than observing the same game. However, no hypothesis is proposed about this since the difference in arousal and presence for both conditions (H1 and H3) has not yet been examined. Furthermore, the relationship between presence and aggression in previous research is not conclusive, making inferences about differences in aggression after playing or observing beforehand not sensible. This study intends to explore the differences in aggression between playing and observing a violent video game, focusing on presence and arousal as the most important explaining variables. However, other variables like trait aggression and gender are also taken into account as interacting variables.

Method

To examine the proposed hypotheses and research question, an experiment consisting of two sessions was carried out. Beforehand, a pre-test was conducted to assure the reliability of the scales and to prevent trivial problems with the actual experiment. The participants, stimuli and apparatus and the procedure (for the pre-test as well as both sessions of the actual experiment) will be discussed subsequently.

Participants

For the pre-test, 29 academic students were recruited, twelve of them received credit for their participation, and seventeen voluntarily participated as part of a course. 13 were female, 16 were male, the average age was 22.24 (*SD* = 2.01). For the actual experiment, 180 academic students male (*N* = 53) and female (*N* = 127) with an average age of 20.62 (*SD* = 2.40) were randomly assigned to one of two different experimental conditions, which will be elaborated on below. Participation was voluntarily and rewarded with course credit when both experimental sessions were attended.

Stimuli and apparatus

The violent video game which was used for this experiment was the first person shooter (FPS) *Unreal Tournament 2004* (UT2004), rated M[3] (Mature) by the Entertainment Software Rating Board[4] (ESRB). The game can be considered the successor of *Unreal Tournament* which was used in the studies by Eastin (2006) and Eastin and Griffiths (2006). This game was chosen because the goal of the game is kill as many opponents as possible while keeping your own deaths to a minimum (i.e. kill-or-be-killed). Thus, the goal of the game is to aggress, as opposed to games where the player has the possibility to solve a problem without using aggression. Furthermore, a first person shooter induces the most presence (e.g. Eastin and Griffiths, 2006; Tamborini et al., 2001).

It was intended to use a current next generation video game (e.g. the recently introduced *Unreal Tournament 3*) since technological advancement is associated with greater levels of presence and arousal (Ivory and Kalyanaraman, 2007). However, this proved to be infeasible due to the unavailability of hardware that fulfilled the recommended specifications of the game. Nevertheless, UT2004 is still more up to date than many of the games used in other studies, like Carmageddon, Mortal Combat and Duke Nukem (Carnagey, Anderson and Bushman, 2007), House of the Dead 2 (Kirsch and Mounts, 2007) or Half-Life and Quake 2 (Schneider, Lang, Shin and Bradley, 2004), which all date from well before the year 2000.

In their experiments, Farrar, Krcmar and Nowak (2006) and Tamborini et al. (2004) enabled “god mode” (i.e. players game characters are invulnerable) in the game to ensure that all participants had the same game experience. However, this takes a lot of excitement out of the game once players come to know it does not matter what they do because they can not die in the game. It is believed that playing in god mode diminishes the external validity (since most players do not cheat), so the game difficulty was set to “easy” in session 1 as well as session 2 to reduce the influence of differences in player’s skill level.

In a study by Calvert and Tan (1994), where active play using a VE was compared to observation of the same game, every observer watched the play of a peer (i.e. every observer saw a different stimulus). To rule out the influence of differences in observed game play (e.g. play style; aggressive or cautious), a game play recording was obtained by saving a game play

[3] Titles rated M (Mature) have content that may be suitable for persons ages 17 and older. Titles in this category may contain intense violence, blood and gore, sexual content and/or strong language.

[4] http://www.esrb.org/ratings/ratings_guide.jsp

session of the experimenter (experienced with first person shooters and UT 2004) using a program called fraps[5]. This recording was used as the stimulus for the passive (or observing) group.

Players as well as observers (at most 20 in total per timeslot) were seated at a PC which exceeded the recommended system specifications of the game. Furthermore, the game was played on a 17" CRT monitor and with headphones. The game was run at maximum detail and a resolution of 1024x768 pixels. The experiment took place in a computer room. Although Kim and Biocca (1997) suggested to diminish the lighting in the room to reduce distracters in the physical environment (e.g. the other players), TL lighting in the room was left on to represent normal conditions as far as possible (it is presumed that players normally do not play in the dark), one of the limitations of current research as noted in the last paragraph of the previous chapter.

Procedure

Pre-test

To assure the reliability of the scales and a smooth course of the actual experiment, a pre-test was conducted among a total of 23 participants. All of them filled out the Aggression Questionnaire (AQ) developed by Buss and Perry (1992) which was used to measure trait aggression. According to Pallant (2003) a scale has a good internal consistency when a Cronbach alpha of .7 or above is reported. For the AQ as a whole, a Cronbach alpha of .83 was found. The subscales scored similar with verbal aggression as an exception; physical aggression (α = .82), verbal aggression (α = .60), anger (α = .77) and hostility (α = .84).

Then participants played (9) or watched (14) UT2004 for ten minutes, after which they were asked to rate their feelings in terms of valence, arousal, dominance and presence through the Self Assessment Manikin (SAM) test which is as implied by the name a self-report scale (Lang, 1985; Schneider, Lang, Shin and Bradley, 2004). Results indicated that participants in the active group felt more pleasant ($t(88) = 1.95$, $p < .04$) and more aroused ($t(88) = 1.98$, $p < .04$), which was consistent with hypothesis 3. Differences in dominance and perceived presence were not found, although the difference in dominance was almost statistically significant ($t(88) = 1.72$, $p < .06$).

Next, participants were asked to complete the intended aggression questionnaire, a modified version of the story completion protocol by Bushman and Anderson (2002) and the MEC Spatial Presence Questionnaire (SPQ) by Vorderer et al. (2004a and 2004b). For the MEC-SPQ a Cronbach alpha of .93 was reported, whereas the subscales of self representation and possible actions scored .87 and .95 respectively. No reliability analysis was conducted for the intended aggression scale since it is a new scale and the scenario's which are used do not necessarily need to correlate to establish a measure of intended aggression (i.e. an aggressive reaction in a certain situation does not mean that a participant reacts similar in a different conflict situation) . All of the above scales will be elaborated on in the next paragraph.

Finally some evaluation questions were proposed to get a better understanding of how participants experienced the game and the (procedure of the) experiment itself. Measured variables were boredom, level of game violence, performance of participants in the game, frustration and difficulty of the game. Results indicated that some of the participants in the passive condition were bored after watching the game fragment. Furthermore, most participants thought the game was violent (17 agreed/totally agreed, 4 were neutral and 2 disagreed). Only one participant in the active condition thought the game was difficult to play and the same holds for frustration; only one participant agreed that playing the game was frustrating.

[5] http://www.fraps.com/

Actual experiment

Session 1

The goal of the first session of the actual experiment was first of all to register some background information about the participants like age, gender, computer/game literacy and if applicable: game preference (e.g. FPS, adventure, puzzle, etc). Furthermore, the AQ was used to measure trait aggression. According to Buss and Perry (1992), trait aggressiveness consists of four distinct subtracts, each represented by a subscale on the AQ: Physical- and Verbal Aggression, Anger, and Hostility. The questionnaire consisted of 27 statements like "Given enough provocation, I may hit another person" and two control statements (e.g. "I can think of no good reason for ever hitting a person"). Participants had to indicate on a 5-point Likert scale to what extent the statement applied to them (1 = extremely uncharacteristic of me to 5 = extremely characteristic). Ratings on each subscale of the AQ and an overall trait aggressiveness rating were calculated by simply summing up the scores on every statement (control statements are reverse scored) within each subscale of the AQ or the whole AQ, respectively.

Eastin and Griffith (2006) theorised that immersion is only realised if the player is not concentrating on the fundamental skills of the game. Therefore participants in the active group concluded session 1 with a 5 minute training session to reduce the possible influence of unfamiliarity with the controls of the video game or lack of experience with video games in the second session. It is also presumed that frustration induced by unfamiliarity with the controls and perhaps with FPS games will be reduced by acquainting participants with the game.

Participants in the passive group were shown a 5 minute recording of a video game play sequence which was comparable (but not the same) with the sequence they would be shown in the second session to familiarise them with the concept of first person shooter games. The duration of the acquaintance session for both conditions was shortened from 10 to 5 minutes because of the suspected boredom of participants in the passive group during the pre-test.

Session 2

The second session took place two weeks after the first session and started off with a 10 minute game play session for the active group and 10 minutes of game play observation for the passive group, consistent with previous video game research literature in terms of duration (Farrar and Krcmar, 2006). Because of the suspected boredom for participants and to raise attention, participants in the passive condition were asked to count the number of "frags" (i.e. kills) of the player in the fragment and report this back in the questionnaire.

Directly after the stimulus, the SAM test was administered to measure self-reported arousal and to establish a first measure of presence by means of an experimental SAM scale as introduced by Schneider, Lang, Shin and Bradley (2004). Since the SAM test also contains a scale for domination and valence of induced emotions, these two variables were also measured. The SAM test can be found in Appendix B.

To establish a measure of intended aggression, a modified version of the story completion protocol (Bushman and Anderson, 2002) was used, comparable with the method used by Wei (2007) to measure hypothetical aggressive behaviour. Although Bushman and Anderson (2002) also used story stems, they asked participants to describe what the main character in the story would think, feel and do/say. Even when the limitations which are brought about when open answers are used (the method for encoding is also not described) are not taken into account, the validity of the third person perspective (e.g. "Todd is in a car accident, what happens next?") in the stories is highly questionable. Participants' answers like "Todd would

stab or shoot the other driver" seem hardly serious and probably not something the participant him/herself would actually do.

Therefore, participants were presented ten story stems in which they were placed in a fictional situation which could result in conflict (e.g. you're rudely cut off in traffic, when you arrive at your destination one minute later, the same driver parks right next to you and you're both stepping out at the same time). After each story, participants were asked what their reaction would be ranging from passive (e.g. "I would say nothing and walk away"), to non-aggressive confrontation (e.g. "I would confront the driver with his/her rude behaviour"), to verbally aggressive (e.g. "I would call the other driver names"), to physically aggressive (e.g. "I would assault the other driver"). The last option was "other", where participants could describe what they would do if none of the options appealed to them (although they were urged to choose one of the multiple choice options). An intended aggression measure was constructed by attributing 0 points for every passive answer, 1 point for every non-aggressive confrontation, 2 points for every verbally aggressive reaction and 3 points for every physically aggressive reaction. Every "other" reaction was interpreted by the experimenter to fit one of the first four categories. Then, all points were summed, resulting in an overall measure of intended aggression. The intended aggression questionnaire (in Dutch) can be found in Appendix C.

Next, participants were asked to fill out the short version of the MEC Spatial Presence Questionnaire (SPQ) (Vorderer et al., 2004a, 2004b). The spatial presence subscale of the questionnaire was administered, resulting in a questionnaire of 8 items (e.g. "I felt like I was actually there in the environment of the presentation") which are measured through a 5-point Likert scale ranging from ranging from 1 ('I do not agree at all') to 5 ('I fully agree'). A spatial presence score was obtained by summing all the scores and dividing by 8. The short MEC-SPQ can be found in Appendix D.

Participants were then asked to answer some evaluation questions about how they rated their experience (i.e., violence level, frustration level, boredom, likeability of the game). Items were rated on 5-point Likert scale ranging from 1 (not at all) to 5 (extremely). The ratings were used as manipulation checks (Konijn, Nije Bijvank and Bushmann, 2007). Appendix E contains the evaluation questions.

Finally, participants were probed for suspicion by an open question at the end of the questionnaire, results indicate that although many participants obviously saw through that the experiment had to do with the impact of violent video games, only a few mentioned the comparison of the active and passive condition.

Results

Hypothesis 1 (H1) predicted that participants in the active (playing) condition would perceive greater feelings of presence than participants in the passive (observing) condition. The SAM presence scale indicated that playing UT2004 produced greater feelings of presence (M = 5.86, SD = 2.27) than observing the game (M = 4.99, SD = 2.67), $F(1,178) = 5.51$, $p < .05$, partial $\eta^2 = .03$. Furthermore, results from the MEC-SPQ indicated similar results, where participants in the active condition (M = 2.40, SD = 0.87) also scored significantly higher, $F(1,178) = 34.67$, $p < .01$, partial $\eta^2 = .16$, than participants in the passive condition (M = 1.63, SD = 0.64). Thus, H1 was confirmed.

Since hypothesis 3 is the same analysis as H1, H3 will be discussed before H2a/2b and 4a/4b which are also related. H3 predicted that participants in the active condition would be more aroused than participants in the passive condition. Results of the SAM arousal scale support H3, participants in the active condition (M = 6.01, SD = 1.57) reported higher levels of arousal than participants in the passive condition (M = 4.44, SD = 2.17). This result was significant, $F(1,177) = 30.51$, $p < .01$, partial $\eta^2 = .15$, thus H3 was confirmed.

Although no hypotheses were proposed about the other SAM scales (valence and dominance), results indicate that participants felt more negative after observing (M = 4.27, SD = 1.75) than after playing (M = 5.50, SD = 2.08) the game, $F(1,178) = 18,57$, $p < .01$, partial $\eta^2 = .09$. Differences in dominance were not significant. To make sure both the active and the passive group were equal in terms of mean trait aggressiveness, a one-way ANOVA was also conducted for the total AQ score. No significant differences were found, so both groups could be considered equal. SPSS output for the aforementioned analyses can be found in Appendix F.

To examine the relation between the dependent variables and presence, arousal and intended aggression in particular, a Pearson product-moment correlation analysis as described by Pallant (2003, 118-122) was conducted for the variables intended aggression, all variables of the SAM scale (valence, arousal, dominance and presence), presence as measured by the MEC-SPQ and the evaluation questions (measuring the variables pleasantness, boredom and frustration). Before running the analysis, the sample was split up in an active and a passive group.

Hypothesis 2a/2b and 4a/4b stated that greater feelings of presence and arousal lead to more intended aggression in both conditions, results indicate no significant relationship between the aforementioned variables to support these hypotheses. Nevertheless, within the active condition a medium correlation was found between arousal and presence as measured by the SAM scale ($r(88) = .37$, $p < .01$) and a small correlation between arousal and presence as measured by the MEC-SPQ ($r(88) = .23$, $p < .05$). A medium correlation between both presence scales (SAM and MEC-SPQ) was found ($r(88) = .41$, $p < .01$). Additionally, the correlation between AQ score and intended aggression was analysed, which resulted in a significant medium correlation ($r(178) = .32$, $p < .01$), the correlation with the physical aggression sub-scale was even higher ($r(178) = .47$, $p < .01$).

Other interesting relations between dependent variables (i.e. with significant medium to large correlations from which conclusions can be drawn or not hypothesised correlations between dependent variables and intended aggression), include a correlation between pleasantness and intended aggression for the active ($r(88) = .30$, $p < .05$) as well as the passive condition ($r(88) = .37$, $p < .01$). Valence correlated the same way with intended aggression, for both active ($r(88) = .25$, $p < .01$) as well as passive ($r(88) = .45$, $p < .01$) conditions. Valence also proved to be related to arousal in the passive condition, a negative correlation was found for the passive condition ($r(88) = -.35$, $p < .01$). The correlation between pleasantness and

valence was also significant with large correlations (active: $r(88) = .72$, $p < .01$; passive: $r(88) = .60$, $p < .01$). Furthermore, within the passive group frustration showed a small negative correlation with intended aggression ($r(88) = .21$, $p < .05$).

As depicted in Table 1, in which an abbreviated correlation matrix is shown (non-significant correlations are omitted), the evaluation variables pleasantness, boredom and frustration proved to significantly correlate with the variables presence and arousal, which were originally pointed out as explaining variables of intended aggression. The ramifications of this result will be discussed in the next chapter. The whole correlation matrix for the dependent variables can be found in Appendix G.

Table 1: correlation matrix for the evaluation questions and explaining variables of intended aggression

Correlations

Condition			Arousal SAM	Presence SAM	Intended aggresssion	Spatial presence MEC
Active	Boredom	Pearson Correlation	-,421**	-,465**		-,328**
		Sig. (2-tailed)	,000	,000		,002
	Pleasantness	Pearson Correlation		,317**	,304**	,261*
		Sig. (2-tailed)		,002	,004	,013
	Frustration	Pearson Correlation		-,229*		
		Sig. (2-tailed)		,030		
Passive	Boredom	Pearson Correlation	-,245*			-,419**
		Sig. (2-tailed)	,020			,000
	Pleasantness	Pearson Correlation			,366**	,386**
		Sig. (2-tailed)			,000	,000
	Frustration	Pearson Correlation	,280**		-,214*	
		Sig. (2-tailed)	,008		,042	

To investigate the possible difference in aggressive intent after playing or observing a violent videogame, first a one-way analysis of variance (ANOVA) was conducted. Results indicate no difference between the experimental conditions. Therefore, possible interaction effects between the condition and other independent variables were investigated. These independent variables were candidates for a two-way analysis of variance (ANOVA):

1. Gender;
2. Hours of video game play per week (playtime);
3. AQ score;
4. Whether participants played FPS games or not (FPS);
5. Whether participants had previous experience with UT2004 before the experiment (yes or no).

Beforehand, the AQ scores were categorised into three equal groups using SPSS to cut points, resulting in the groups; *low* (scores 40 through 56), *medium* (scores 57 through 68) and *high* (scores 69 through 100). For the hours of game play per week this procedure was not possible due to the large number of participants who never played videogames (or less than one hour per week), discrimination between the groups would be too small. Therefore, the variable was categorised in three groups: participants who never played video games, participants who played less than 5 hours per week and participants who played more than five hours per week.

However, as mentioned in the method section, the female participants ($N = 127$) greatly outnumbered the male participants (N = 53). When the interaction condition*gender is to be examined, the cell sizes as depicted in Table 2 are used. Besides the relatively small number of males in the study, the number of "gamers" (i.e. participants who played more than 5 hours per week), the number of participants who played FPS games and the group that had experience with UT2004

was also relatively small. The only fixed variable that resulted in equal groups was the AQ score (which is obvious since SPSS was used to cut for equal groups). Unequal group sizes can result in an *unbalanced* analysis (Garson, 2008; Shaw and Mitchell-Olds, 1993); cells with greater numbers of observation would be given greater emphasis, which might lead to misleading or biased results. This effect is amplified when more independent variables with unequal groups (cells) are used in the analysis. Furthermore, small groups like the participants who play FPS games are divided even more, resulting in cells with even less observations, lowering the power of the analysis.

Table 2: very large differences in observations within cells can result in unbalance

Intended aggresssion		
	Gender	
	Male	Female
Active	M = 10,31 SD = 2,75 N = 26	M = 9,16 SD = 2,98 N = 64
Passive	M = 12,07 SD = 4,23 N = 27	M = 8,67 SD = 2,92 N = 63

In the light of unbalance for ANOVA analysis, Hinkle, Wiersma and Jurs (1998, 452) discuss a two-way ANOVA with *disproportionate* cell frequencies, which means that frequency ratios across rows and columns are not (approximately) the same. When this is the case, the traditional two-way ANOVA procedure is inappropriate for the earlier mentioned reason of overemphasis. However, when Table 2 is scrutinised, the ratios are *proportionate* (i.e. the row ratio is 26/64 and 27/63, the column ratio is 26/27 and 64/63). The same holds for the other independent variables, so individual two-way ANOVA analyses (i.e. condition*gender, condition*playtime, condition*AQ score and condition*FPS) are appropriate, in spite of unequal cell sizes.

However, a prerequisite is added: the number of observations in each cell should meet a certain size to establish a standardised effect size (d). Following the procedure as described by Hinkle, Wiersma and Jurs (1998, 452-453), using d = .75, α = .05 and power = .80, the appropriate sample size for the independent variables with two treatment levels (gender, FPS, experience with UT2004) is set at 35 observations for each level. For the independents with three levels (playtime, AQ score), 40 observations are required for each level. For a two-factor design, it is necessary to satisfy this requirement for *both* independent variables. To illustrate this requirement, playtime is taken as an example in Table 3. The requirements for each level of measurement are depicted at the end of the rows/columns and the minimum sample size for each cell is displayed in bold between brackets next to the actual number of observations. Although condition only requires $29/3 \approx 10$ observations in each cell, playtime requires $35/2 \approx 18$ observations.

Table 3: example of the minimal cell sample size requirement for playtime

	Intended aggression			
	Hours of game play per week			
	I never play video games	5 hours per week or less	More than 5 hours per week	
Active	M = 8,79 SD = 2,89 N = 43 **(18)**	M = 9,85 SD = 2,79 N = 39 **(18)**	M = 11,50 SD = 3,12 N = 8 **(18)**	**29**
Passive	M = 8,83 SD = 2,72 N = 35 **(18)**	M = 9,21 SD = 3,54 N = 43 **(18)**	M = 13.92 SD = 4,14 N = 12 **(18)**	**29**
	35	**35**	**35**	

The group of participants which plays video games more than 5 hours per week does not meet the size requirement and furthermore the frequency ratio across columns is disproportionate: 43/35 = 1,23, 39/43 = .91 and 8 /12 = .67. For these reasons this independent variable is excluded from the interaction effect analysis. The other independent variables passed the frequency ratio test (when row/column ratio's were compared for the individual independent variables, the ratio difference was always smaller than 36%) as well as the sample size test. Results of these tests as well as the means and standard deviations for every interaction can be found in Appendix H.

The variables gender, AQ score, FPS and previous experience with UT2004 were analysed with a two-way ANOVA. Results indicate significant interaction effects (although with a small effect size) for the FPS variable ($F(1,176) = 5.89$, $p < .02$, partial $\eta^2 = .03$), gender ($F(1,176) = 4.03$, $p < .04$, partial $\eta^2 = .03$) and previous experience with UT2004 ($F(1,176) = 5.58$, $p < .02$, partial $\eta^2 = .03$). AQ score failed to reach a significant interaction effect. Post-hoc comparisons using the Tukey HSD test indicated that the overall mean score for the group with a high AQ score ($M = 11.28$, $SD = 3.41$) was significantly different ($p < .01$) from the medium ($M = 8.82$, $SD = 2.89$) and low scores ($M = 8.75$, $SD = 3.13$), .

Figure 2 depicts the profile plot for FPS, it is striking to see that the difference between the active and the passive condition for the participants that played FPS video games is actually in the opposite direction as predicted. This pattern could also be observed for males and participants that had played UT2004 before, they seem to be more aggressive in the passive than in the active condition. An overview of all results can be found in Appendix I.

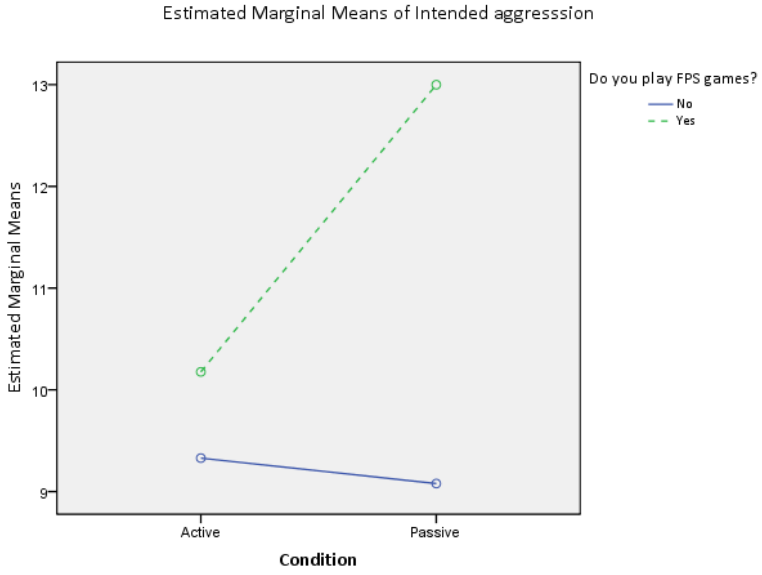

Figure 2: profile plot for the interaction condition*FPS

Since the goal is to look for differences between the active and the passive condition, differences within the groups that showed a significant interaction effect (i.e. gender, FPS and experience with UT2004) were scrutinised. The dataset was split for every independent variable and a one-way ANOVA was repeatedly conducted to examine differences in intended aggression scores within groups. Results indicate a significant difference ($F(1,29) = 5.47$, $p < .03$, partial $\eta^2 = .16$) within the group that played FPS games between the active ($N = 17$, $M = 10.18$, $SD = 2.94$) and the passive ($N = 14$, $M = 13.00$, $SD = 3.78$) condition. This is depicted in Figure 2 by the green dotted line. The difference between conditions within the group that did not play FPS games proved to be non-significant (the blue line). The split and ANOVA for gender and previous experience with UT2004 did not result in significant differences within groups. Although playtime was excluded from the interaction analysis, it is interesting to explore differences within this group, the same one-way ANOVA analysis was conducted after splitting the data. No significant differences within the group was found, although the group that played video games for five or more hours per week showed a mean difference of 2.42 which comes very close to the difference (2.82) within the group that plays FPS games. All results can be found in Appendix J.

In order to find possible explanations for the unexpected difference within the FPS group, additional analyses on other dependent variables were conducted while focussing on the group that plays FPS games (i.e. the sample was split for the FPS variable). A one-way ANOVA was conducted using the variables: valence, arousal, dominance, presence as measured by the SAM scale and presence as measured by the MEC-SPQ. Furthermore, the evaluation questions consisting of the variables pleasantness, boredom and frustration were analysed.

Results indicate that participants who play FPS games and who were in the active condition, felt significantly more aroused ($F(1,29) = 8.74$, $p < .01$) and "present" as measured by the SAM ($F(1,29) = 5.18$, $p < .04$) than their counterparts who were in the passive condition. Furthermore, results on the evaluation variables showed that FPS players in the passive condition rated their experience as significantly more frustrating ($F(1,29) = 24.65$, $p < .01$), boring ($F(1,29) = 13.51$, $p < .01$) and less pleasant ($F(1,29) = 26,58$, $p < .01$) than their counterparts who played the game during the experiment. The means and standard deviations for the variables which showed a significant difference within the group that plays FPS games are displayed in Table 4, all other results can be found in Appendix K.

Table 4: descriptive statistics for the dependent variables which showed a significant difference within the group that plays FPS games

		N	Mean	Std. Deviation
Frustration	Active	17	1,35	,493
	Passive	14	2,71	,994
	Total	31	1,97	1,016
Pleasantness	Active	17	4,71	,849
	Passive	14	2,93	1,072
	Total	31	3,90	1,300
Boredom	Active	17	1,94	1,029
	Passive	14	3,29	,994
	Total	31	2,55	1,207
Arousal SAM	Active	17	5,94	1,819
	Passive	14	3,86	2,107
	Total	31	5,00	2,191
Presence SAM	Active	17	6,82	2,215
	Passive	14	4,86	2,598
	Total	31	5,94	2,555

Examination of the results for the group that does not play FPS games showed a similar pattern: participants who were in the active condition rated their experience as more pleasant (and less frustrating and boring), felt more “present” (although this time measured by the MEC-SPQ) than their counterparts who were in the passive condition.

To check whether hypotheses H2a/2b and H4a/4b (whether presence and arousal correlated with intended aggression) could be falsified or confirmed within the groups that did and did not play FPS games, the correlation analyses between intended aggression and arousal and presence (and the other dependent variables) were re-run. Again the results do not give rise to believe that presence and arousal are correlated to intended aggression (although neither of the evaluation variables significantly correlated with intended aggression within the group that played FPS games). The results can be found in Appendix L.

This chapter is concluded with numbers about the evaluation questions which were only asked to participants in the active condition; whether they had troubles with the controls of the game, whether they thought the game was difficult and whether they won or lost the game. 64 of the 90 (73,3%) participants (strongly) disagreed with the statement that they had troubles with the controls, the mode was 2 (corresponding with “disagree”). Concerning difficulty of the game, 70 of the 90 (77,8%) participants (strongly) disagreed with the statement “I thought the game was difficult to play”, again the mode was 2. Finally, 74 of the 90 participants indicated that they had won the game.

Conclusions and discussion

The results of the current study indicate a difference in intended aggression when the active and the passive condition are compared, but only for the sub-group that (frequently) plays FPS games. Furthermore, the difference for the FPS group was in the opposite direction as predicted (i.e. participants in the passive condition scored higher than those in the active condition). The ramifications of these findings will be discussed later on.

Although a significant difference in induced arousal and presence was found in the direction as predicted by hypotheses H1 and H3 (i.e. participants in the active condition felt more "present" and aroused than participants in the passive condition), these variables did not correlate with intended aggression as predicted by hypotheses 2a/2b and 4a/4b. This result undermines the belief that more arousal and presence automatically result in more aggression. The results for arousal are however in line with a study by Eastin (2006) who used arousal as a covariate in the analysis of aggressive thoughts among female players, without a significant result. Nevertheless, it is interesting to see that the correlation analysis revealed a positive relationship between presence and arousal and the relationship between both measures of presence (SAM and MEC-SPQ). The first finding gives rise to further research into the relationship between presence and arousal (this topic will be discussed in a later chapter, directions for further research), while the second finding can be considered support for the SAM presence scale as a valid measure of presence.

What does the fact that initially no difference in intended aggression between both conditions for the group as a whole could not be found tell us? The most straightforward reason: there is no difference, people do not get more aggressive after playing a violent video game than after watching the same game. Although participants felt more aroused in the active condition, which could be a predictor of violent intentions as proposed by the excitation transfer theory, valence (and pleasantness) was also higher in the active condition. As noted in the introduction arousal elicited by pleasant experiences reduces the likelihood that it is transferred (or misattributed) to aggression (Tyson, 1998). This might also explain the missing relation between arousal and intended aggression.

Another possibility is that other independent variables interact with the experimental condition which could cancel out the mean difference (i.e. a spurious no main effect (Garson, 2008)), for instance because men show more intended aggression in the passive condition when compared to the active condition while woman might react in the opposite way. This pattern can actually be observed when the profile plot for gender in Appendix I is examined. However, results of additional analysis indicate no significant difference when conditions are compared for men and women, respectively. The same holds for another independent variable: although participants that have played UT2004 before seem to react differently to the experimental manipulation, these differences were not significant. Nonetheless, these interactions might attenuate the mean effect, so these interactions can be used to point out certain groups which might be interesting as a starting point for further research, in this case men (participants who played UT2004 before are less interesting when this game is not used again as the stimulus).

What is striking to see is that trait aggression does not interact with condition, although participants with a high AQ score generally score higher on the intended aggression scale (which indicates that the used scale is a valid measure of aggression). The profile plot for AQ score in Appendix I nevertheless hints that participants with a low AQ score might react in the hypothesised direction to the conditions as opposed to the participants who had a medium and high AQ score (which might also attenuate the overall result). An explanation might be that participants with a low AQ score are more sensitive to violent video games than medium/high AQ scoring participants. The other way around is also possible: participants with a medium/high AQ score consume more violent media and are more desensitised than participants who had a low AQ score.

However, it is unclear which, if any variables (arousal, presence, or something else) underlie this result, further research with participants with a low AQ score is warranted.

How about an explanation of the results of participants who play FPS games, which contradict the conclusion that it does not matter whether a game is played or observed? From the viewpoint of desensitisation theory, FPS players could be less sensitive to the active condition (as they are "used" to it), however this does not explain why the score is higher in the passive condition. Since presence and perhaps even more important arousal were actually lower in the passive condition, it is hard to draw conclusions from arousal theories and excitation transfer (since they predict the opposite result). The results for arousal are however in line with a study by Lang, Greenwald, Bradley and Hamm (1993) where positive emotions are associated with greater ECG activity (i.e. higher heart rate) and arousal than negative emotions, thus heart rate is sensitive to valence. In this case, significantly lower valence and arousal scores for the passive condition hint toward the same conclusion. However, in this study arousal was measured using a self report scale instead of a physiological measure, which might lead to different results (e.g. Schneider, Lang, Shin and Bradley, 2004), so further research is warranted to substantiate this. Furthermore, although lower valence might explain lower arousal (which in turn is related to presence), the lower intended aggression scores in the passive condition are not explained.

Tamborini et al. (2000) found similar results where hostile thoughts were also higher in a condition where a violent video game was being observed and compared with active game play. The authors attribute this result to observers' frustration of being excluded from playing themselves or the involvement of players learning the game (which may distract them from hostile thoughts). In this study, participants in the passive condition did prove to be more frustrated than participants in the active condition, disappointment that they had to observe the game instead of playing it is a possibility (in fact, some participants in the passive condition tried to "play" the fragment, thinking they could influence the course of the fragment, although this also might have been caused by not properly reading the instructions of the experiment). Nevertheless, overall frustration proved to be negatively correlated to intended aggression for the passive group as depicted in Table 1. This can be interpreted as more frustration led to less intended aggression, which makes little sense. However, for the active group this correlation was not found. An explanation could be that participants in the passive group interpreted the question differently: perhaps they felt frustrated because they could not play the game (which might have caused disappointment, perhaps a lack of interest) but not because of the fragment itself, as opposed to the active condition where the context of the evaluation question is less ambiguous. A less ambiguous frustration scale could solve this problem by making the distinction between "the fragment itself was frustrating" and "it was frustrating that I could not play the game".

The other explanation by Tamborini et al (2000) for their results, distraction because participants were not proficient with the controls, is also not a likely explanation for the results this study. A lack of proficiency with the game controls was diminished by the first training session. Besides, results of the evaluation questions which assessed troubles with the controls, difficulty and whether they had won or not (which all showed that the game was not too difficult or hard to play) endorsed that these variables did not cause distraction which might have lowered aggressive thoughts (or presence, for which the training session was originally meant: reducing distracters, as proposed by Eastin and Griffith (2006)).

Tamborini et al. (2000) further found that participants who scored high on presence had a much lower level of hostile thought compared to those low on presence. Their explanation was that high presence in a game might deflect hostile thoughts and reduce hostility; participants are so involved with the game that they have no more cognitive capacity to be able to have aggressive thoughts (Bryant and Zillmann, 2002). Although the mean comparison of this study support these

propositions (presence is indeed higher in the active condition and intended aggression lower), the correlation analysis did not result in evidence for this theory (since no correlation between presence and intended aggression was found for both conditions). Persky and Blascovich (2008) ascribe the finding of Tamborini et al. (2000) to relatively unintuitive and non-naturalistic controls for the condition with higher presence (i.e. a VE environment) and not to deflection, but in the context of this study this explanation is not applicable for the same reason that distraction is not applicable. Further research on the relation between presence and intended aggression is needed.

Another explanation for the higher intended aggression score for the passive condition possibly comes from the catharsis theory where FPS players use the game as an outlet for aggression, but only observing the game does not suffice (i.e. does not result in a catharsis effect). The explaining variable in this case could also be presence: when players are more absorbed by the experience or the violence, the act itself may be more satisfying, resulting in a discharge of aggressive feelings instead of a build-up. For the passive condition this effect is not attained because of a lack of presence, in fact the increased frustration and decreased pleasantness might result in the opposite: the build-up of aggression. Pleasantness and presence seem to be interrelated too: pleasantness increases feeling of presence or presence increases feelings of pleasantness. There is reason to believe that it works both ways. Tamborini and Skalski (2006) note that only participants in positive mood states are absorbed in a virtual environment with matching valence because it serves the user's immediate affective needs as predicted by the theory of selective exposure (Zillmann, 2000). However, a study by Rockwell and Bryant (1999) also suggests that higher levels of interactivity (which is strongly related to presence as can be observed in the MEC-SPQ questions) in the context of an entertainment program fostered enjoyment of the program. When this line of argument is continued in the context of the relation between pleasantness and intended aggression, one could say that presence might indirectly influence intended aggression through pleasantness of the experience. Although the mean comparison in this study again supports this theory, the correlation analysis does not (i.e. there is no correlation between the evaluation variables and intended aggression, or the correlation is even in the opposite direction as is the case for pleasantness).Furthermore, it was unknown whether the perceived valence of the game matched the current mood states of the participants possibly harming feelings of presence.

A final explanation comes from Farrar, Krcmar and Nowak (2006), who state that interpretations of violence may vary from viewer to viewer, perhaps even due to the frequency of violent game play. What one person might perceive as very violent, another might perceive as moderately so (note that for instance desensitisation and trait aggression can play an important role here), which might also influence aggressive outcomes. However, the variable playtime was not analysed because balance and cell size conditions were not met. Nevertheless, comparison of the active and passive condition for the group that played games for more than 5 hours per week show a considerable mean difference, hinting that this group might indeed be reacting differently to the experimental conditions.

When the active and the passive group as a whole are compared, no difference in intended aggression could be found, which can also be considered the conclusion of this exploratory study for the time being. Although there were some significant interactions between condition and other independent variables, only one group, the FPS player group, showed a significant mean difference on intended aggression when the conditions were compared. However, not only was this difference in the opposite direction as predicted, this result was also hard to explain from an arousal and presence point of view. Furthermore, other explanations from the catharsis theory or explanations posed in other studies (Tamborini et al., 2000) were only partially supported by the data.

Therefore, it is for now concluded that there is no difference in intended aggression after playing or observing a violent videogame. The results from the FPS group are to such an extent contradictory and ambiguous and based on a small number of observations that the results are declared invalid. As noted before, this has implications for the justification of for instance censorship (a very current example is the expurgation of the popular video game Grand Theft Auto 4 in Australia because of its violent and sexual nature) and banning of violent video games. Censorship is scarcely applied to more passive media like movies on television or in movie theatres and violence can be observed in all its glory if people want to, why is this? The author thinks because of too much attention given to the deleterious influences of violent video games by the mass media when for instance another violent drama takes place. Ferguson (2007, 471) gives a plausible explanation for this: *"[the] desire among policy makers and the public for ready answers. Interestingly it has become tempting for the public and scientists alike to place responsibility for these crimes on external determinants rather than on the individuals who commit the crimes"*. In other words: a scapegoat is needed and violent video games are an easy target since for instance the argument "violent video games train consumers to be killers" seems trivial to everyone.

As noted before, this study does not intend to involve itself in the discussion whether violent media lead to violent behaviour (which is also not possible since non-violent media were not investigated), but the conclusion that there is no difference between playing and observing a violent video game gives reason to believe that Counter strike is as likely the cause for the Erfurt shooting (as mentioned in the introduction) as any violent movie.

In the next chapter the limitations and reservations for the current study will be discussed, along with directions for further research to overcome these limitations and to be able to find more conclusive explanations for possible differences. Moreover, points of interest to improve future research in this field of research will be discussed, which still seems to be in its early stages.

Limitations and directions for further research

Although some explanations for the current results are explicated in the previous chapter, some findings might also be due to limitations of (the used method for) this study. These limitations can be divided in several categories, amongst others the selection of participants, the measurement of the dependent variables, the method of the experiment and the extrapolation of the results.

Participant selection

It was not possible to select participants according to pre-defined characteristics like their game experience (which proved to be an important variable), the sample was given as is: a class of mostly freshmen participating in a media psychology course. Not only was this group skewed when gender was considered, the number of "gamers" was also disproportionately small. As discussed, this not only influenced the data analysis (the variable playtime had to be dropped from the interaction analysis), but also resulted in small cell sizes (e.g. in the case of the number participants that played FPS games; only 31 participants of the 180 played FPS games) which harms the power of the results. Therefore, the difference that was found within the group that plays FPS games is highly tentative and further research is needed.

Furthermore, the sample mostly consisted of psychology students with an average age of almost 21 years. This inevitably limits the generalisability of the results for for instance lower educated adolescents, participants with a different educational background or elderly people (who might interpret violence differently and might also have different game preferences, as discussed by Lemmens and Bushman (2006)).

The interaction analyses showed gender might also play an important role. As discussed in the previous chapter, these interactions can obscure main effects or attenuate them, which complicates drawing clear conclusions about the influence of condition on intended aggression. Further research could focus more on specific groups like FPS players and men who are supposedly sensitive to the experimental manipulation, or just the other way around: to investigate groups that do not seem to be sensitive to the manipulation (like females and participants who never play video games). Results would probably be much more conclusive and the attenuative influence of different interactions on the main effect would be much lower (this subject has been discussed in the previous chapter). Another remark in the context of participants' background: in the current study participants were only asked whether the play FPS games, but not to what extent (playtime was in general, not specifically focussed on FPS game play). The method used by Farrar, Krcmar and Nowak (2006) who asked participants on a 7-point Likert scale how often they played different game genres is more distinctive and is recommended for further research.

Measurement of dependent variables

Another limitation results from the method used to measure aggression. As discussed in the introduction there are many possibilities to establish a measure of aggression, each with its strengths and flaws. In the end, behavioural measures are the most interesting from a societal point of view (since violent thoughts do not kill or beat up people). However, as Farrar, Krcmar and Nowak (2006) note, the more valid a behavioural measure appears, the less ethical it is to use and this is exactly where the shoe pinches. Furthermore, although measures like the competitive reaction time task (TCRT) have been used successfully, external validity is questionable. As noted in the introduction these measures seem highly artificial, especially in a laboratory setting (i.e. can delivering obnoxious noise blasts in a laboratory really be compared to real life aggressive behaviour like beating someone up or behaving asocial?).

Although the face validity of the measure for intended aggression used in the current study seems trivial (since hypothetical aggressive behaviour is measured), the only limitation is that the intention to do something does not necessarily mean that that behaviour actually manifests in real life (external validity). Nevertheless, theories like those of *reasoned action* (TRA, Fishbein and Ajzen, 1975) and *planned behaviour* (TPB, Azjen, 1988) show that intention (and attitude) are strong predictors of actual behaviour, for more information about these theories also see the cited references.

An important choice that was made to be able to compare groups (and make the experiment less complex) but which may threaten the external validity of the experiment is that the people appearing in the scenario's were sexless (i.e. "someone jumps the queue" and "someone hits you"), this may actually be of importance in real life: for instance hitting someone back in a provoked fight can depend largely on the gender or size of the aggressor, or contextual factors (e.g. the presence of others or the location). It is hard to overcome this problem; a solution might be to match gender (i.e. females are asked what they would do when they are hit by another female and the same is done for men), but this introduces the limitation that the comparison of both groups is troublesome (i.e. how would men react when the other person was a female?).

An alternative to overcome problems of gender of the participant and its congruence with the gender of others in a scenario is the use of a 3rd person perspective as used in the story completion protocol by Bushman and Anderson (2002). However, this approach is less personal and it seems harder to empathise with the situation. Furthermore, participant's answers in the study by Bushman and Anderson (2002) in the manner of "he would shoot or stab the other driver" after asking what the imaginary person in the story would do when he was in a car accident, seem hardly serious/valid for what this participant would behave like himself/herself. Another interesting fact is that this scale hardly correlated to AQ scores in a study by Guimetti and Markey (2007).

Furthermore, participants who are physically strong or for instance trained in a combat sport could be more confident of themselves in a conflict situation. A way to control for this problem is to ask whether participants consider themselves trained in a combat sport and how they evaluate themselves concerning physical strength. The reason this sort of background information (as well as the earlier mentioned playtime per game genre) was not asked was that it is impossible to control for every single difference between participants beforehand and some factors that might have had an influence were only discovered after the start of the experiment. Furthermore, for some limitations like the gender problem choices had to be made, using scenario's with no gender cues or with gender cues (i.e. gender matching). Both alternatives have their own advantages, but the alternative with no gender cues was also practically more attractive (otherwise two different questionnaires had to be used and participants had to be selectively seated).

The way in which (intended) aggression is measured in this study seems to be relatively new and therefore the question whether this scale measures the construct of aggression seems obvious. The analysis showed that participants that had a high AQ score scored significantly higher on intended aggression than participants in the medium/low category. Correlation analysis showed a significant medium correlation between AQ score and intended aggression. Furthermore, Cronbach's alpha for the ten scenarios was .54, which is respectable for a new scale with only ten items (Pallant, 2003).

However, further analysis for a more reliable intended aggression scale based on scenario's is needed, for instance by experimenting with scenario's in different contexts: participants reactions to (violent) provocation, participants reactions in situations where helpful behaviour could (but not necessarily) occur and situations in which exploitative behaviour could occur. Sheese and Graziano (2005) for instance used a modified Prisoner's Dilemma (PD) game to examine competitive and cooperative decision making, where participants could choose for their own benefit at the cost of another participant or to cooperate resulting in benefit for both parties. Furthermore, gender could be matched to the participant (or not) to investigate for instance differences in male aggression towards women and men.

Farrar, Krcmar and Nowak (2006) use a modified version of the AQ to measure state instead of trait aggression by changing all statements (using only the verbal- and physical aggression sub-scales) in the questionnaire to a form which suits an earlier introduced scenario (i.e. “Imagine that you leave this building when you’re done completing this survey. Someone bumps into you, spilling your drink and the contents of your backpack”). This resulted in statements like “I would tell this person openly that I disagree with him or her” instead of “I tell my friends openly when I disagree with them” as in the original questionnaire. Although this seems a valid measure as the AQ has proven to be valid (Santisteban Alvarado, Recio, 2006), some statements would make little sense or would sound vague, like the one mentioned above (participants could wonder: disagree about what?). Furthermore, only one scenario is questionable, even when someone feels aggressive, he/she does might not react aggressively when being bumped into (but might in a more provocative situation, for example when being rudely cut off in traffic).

An aspect that was not considered in this study is the Spatial Situational Model (SSM) and attention to the medium (Attention Allocation) in the context of presence: participants must be able to make a mental representation of the mediated environment and furthermore they have to allocate resources (attention) to the media product to be able to feel “present”. It was presumed that participants considering their age and the fact that they grew up with computers would be able to form a situational model and allocated attention to the stimulus since they were in an experiment. Moreover, to assure that participants in the passive condition were paying attention to the stimulus they were also asked to count the number of “frags” (kills) in the fragment. Nevertheless, as part of the MEC-SPQ described in Vorderer et al. (2004a, 2004b) extra scales with statements like “I devoted my whole attention to the fragment” and “Even now, I still have a concrete mental image of the spatial environment” could have been added (but were not, to be able to conduct the second experimental session in 30 minutes). However, since presence did not relate to intended aggression as predicted, it is strongly recommended to include the scales for SSM and attention allocation from the MEC-SPQ in future research. An alternative measure is the Immersive Tendencies Questionnaire (ITQ) which measures the capability or tendency of individuals to be involved or immersed (Witmer and Singer, 1998).

Furthermore, the relation between presence and arousal can be further studied. Although Dillon, Keogh, Freeman and Davidoff (2000) report mixed findings on this topic, correlation analysis in this study showed a significant relation. Since arousal is closely related to attention (Reeves and Nass, 1996), the link with presence seems obvious. Perhaps it is too bold to state that arousal is a prerequisite to be able to experience presence, but it is clear that it is hard to ignore arousal when talking about presence in the context of violent video games. As noted above the role of attention (and the way this is influenced by arousal) when talking about presence is an interesting topic for further research, especially since presence (or interactivity) is considered the most important difference between violent video games and passive forms of violent media.

Another interesting relation is the one between presence and current mood state as noted in the discussion. The theory of selective exposure predicts that heightened presence only occurs when the valence of the current mood state matches the one of the game because it serves the user’s immediate affective needs. To improve future research on the relation between presence and intended aggression the measurement of the current mood state seems a valuable addition. A simple way to do this is by introducing a pre- and post stimulus measurement of valence using the SAM scale, first asking how participants feel at the moment and after the stimulus what the stimulus made them feel like.

As described in the discussion, a limitation for the measurement of arousal is the fact that a self-report measure has been used. Although the SAM scale is a reliable measure (Bradley and Lang, 1994), participants could actually report that they are not aroused when they in fact are or vice versa (as was the case in the heat study by Anderson et al. (2000), discussed in the introduction). Physiological measures like heart rate and galvanic skin response (GSR) are more accurate and less

manipulatable by participants, both conscious as unconscious (Persky and Blascovich, 2008). However, physiological measurement of arousal can be obtrusive for participants which in this case could influence the game experience and harm feelings of presence (Persky and Blascovich, 2008). Furthermore, it proved to be infeasible both in terms of time and resources to take physiological measures of arousal for this experiment. Further research could for instance show that participants in the passive condition are in fact physiological aroused, but report to be not aroused because they feel bored or frustrated that they could not actually play the game. Then the current results would also be better explainable, for instance by the excitation transfer and arousal theories.

Another interesting question (and limitation) that can be asked in the context of the arousal difference that was found when the active and passive condition are compared is: was this caused by the experimental condition or the fact that playing FPS games (or games in general) was new for most participants? Witmer and Singer (1998, 226) state that *"[...] When experiencing a novel environment however, people are typically more aroused and broadly focused on the tasks to be performed or the situation to be experienced"*. Another factor that might have influenced the results is whether participants liked the game genre at all (Bryce and Rutter, 2005). More evaluation questions like "do you like FPS games like UT2004?" or "would you play FPS games more after this experiment?" could give more insight into this relationship. Again, further research could focus more on specific groups or in this case exclude participants that do not like FPS games. After all, it is less relevant what the influence on this particular group is from a societal point of view since these participants would unlikely play an FPS game in their leisure time.

A final limitation of arousal is its relation with the valence of the source. As noted in the discussion and introduction, a positive valence of the stimulus reduces the likelihood of misattribution or transfer to provocative or negatively valanced situations afterwards. To investigate this further research could focus on negatively valenced violent video games which are scary and meant to induce fear.

A final limitation which will be discussed in the context of the measurement of dependent variables concerns the evaluation questions. It turned out to be that variables like pleasantness, boredom and frustration differed significantly when both conditions were compared. In the current study these were measured by simply asking participants whether they on a five point Likert scale agreed with statements like "observing the fragment was boring" and "playing the game was pleasant". A multiple item scale for these variables is recommended for further research to assure reliability (e.g. Persky and Blascovich (2008) who used a three item sale consisting of the statements "This experiment was fun", "I would have liked the experiment to continue" and "My experience in the game environment was satisfying").

Method and extrapolation of the results

The way in which the experiment was conducted also gives rise to some reservations concerning the outcome of this study. First of all the fact that it was conducted in a PC room with TL lighting and with a maximum of 20 participants at a time. As noted in many narratives (e.g. Goldstein, 2001; Bryce and Rutter, 2005), the extrapolation of the results of many violent media studies is troublesome because the lab based conditions are far away from everyday gaming practices. Further research could be improved by using a simulated living room (Kim and Biocca, 1997) to match lighting and comfort conditions to domestic circumstances (i.e. a comfortable couch with pleasant light instead of a desk chair without arm rests and cold TL lighting). Playing alone instead of together with a group of 20 persons would also represent everyday conditions more, although this could also have certain influences which are interesting to be studied (e.g. in the context of for instance popular events at which many gamers gather to play against and with each other, called LAN parties).

Another limitation is the fact that participants in the passive condition were presented a pre-recorded fragment of the video game. Although this ensures that every participant in the passive condition has the same experience, it possibly introduced more feelings of boredom (and reduced presence and arousal) than watching over the shoulder of another participant like in the study by Calvert and Tan (1994). However, watching over someone else's shoulder gives the possibility to interact with each other. This shared experience could introduce a third variable, although explicit instructions could be given that talking/interaction is not allowed to prevent this. Nevertheless, this approach does not guarantee a identical stimulus for every observer, play style (aggressive versus defensive, risky of cautious) of the player might differ greatly and this is practically impossible to control for. Further research could improve the use of fragments by using of a pre-test in which multiple violent video game play fragments, varying not only the game title, but also the game genre (e.g. first person shooter or third person shooter), play style, etc. are compared to assure that participants are not bored and that differences in pleasantness of the experience can not influence the results.

The game which was used for the experiment, Unreal Tournament 2004, is fairly outdated to today's standards in terms of graphical realism. As noted in the method section, it was the intention to use a state-of-the-art video game, not only because many studies in the field of violent video games used games from well before 2000 (which is not representative for the games that youth plays today), but also because viewing of more realistic or realistically perceived violence is related to more measured aggression (Sherry, 2001). Further research could focus more on recent games. Furthermore, bigger screen sizes than the rather small 17" CRT monitors used in this study could be used to induce more presence (e.g. IJsselsteijn, de Ridder, Freeman, Avons, Bouwhuis, 2001) since presence in general could have been too low to interact with the used measure of aggression. Another way to increase presence is to match the gender of the self in the game (which is occasionally visible, for instance when the player dies) with actual gender. Eastin (2006) found that this gender match increased presence among females.

In the previous chapter the conclusion was drawn that current results indicate no difference between playing and observing a violent videogame in terms of intended aggression. The question however is, to what extent can observing a violent video game be compared to for instance television viewing (the most common form of passive media consumption)? This question can not readily be answered since for instance motivation, attention and enjoyment (or pleasantness) can be different. The same holds for for instance presence: one can imagine that identification with a violent movie character is much higher than with an anonymous game character that is observed. Sherry (2001, 411) notes: *"[...] video game violence tends to be highly abstract, as opposed to the realistic violence portrayed on television. Studies on television and film effects have shown that greater aggression results from the viewing of more realistic or realistically perceived violence"*. Although realism in games has grown considerably the past 7 years (approaching photorealism sometimes), films are still much more realistic than games. This fact suggests that the influence of violent movies might in fact be underestimated in relation to violent video games, although the effect of greater presence (or interactivity) could make up for the difference (nevertheless the results of the current study do not confirm differences caused by greater presence). Further research could focus on the comparison between observing an originally "active" medium (i.e. video games) and a "passive" medium (i.e. television).

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Appendix A - Aggression Questionnaire

Physical Aggression

1. Once in a while I can not control the urge to strike another person
2. Given enough provocation, I may hit another person
3. If somebody hits me, I hit back
4. I get into fights a little more than the average person
5. If I have to resort to violence to protect my rights, I will
6. There are people who pushed me so far that we came to blows
7. I can think of no good reason for ever hitting a person (C)
8. I have threatened people I know
9. I have become so mad that I have broken things

Verbal Aggression

1. I tell my friends openly when I disagree with them
2. I often find myself disagreeing with people
3. When people annoy me, I may tell them what I think of them
4. I can not help getting into arguments when people disagree with me
5. My friends say that I'm somewhat argumentative

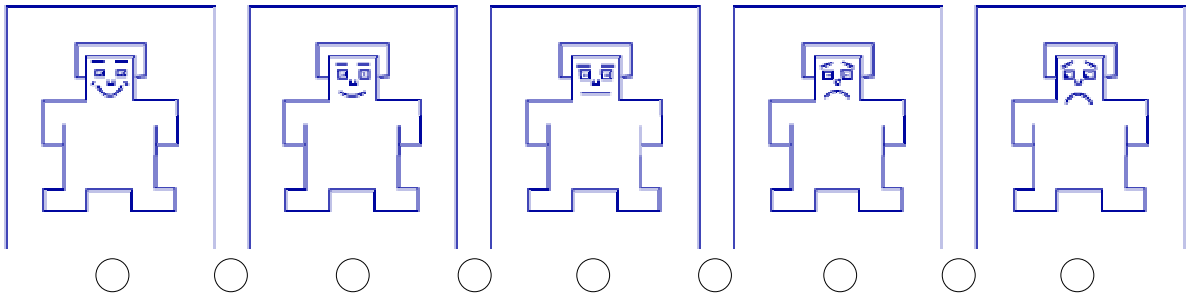
Anger

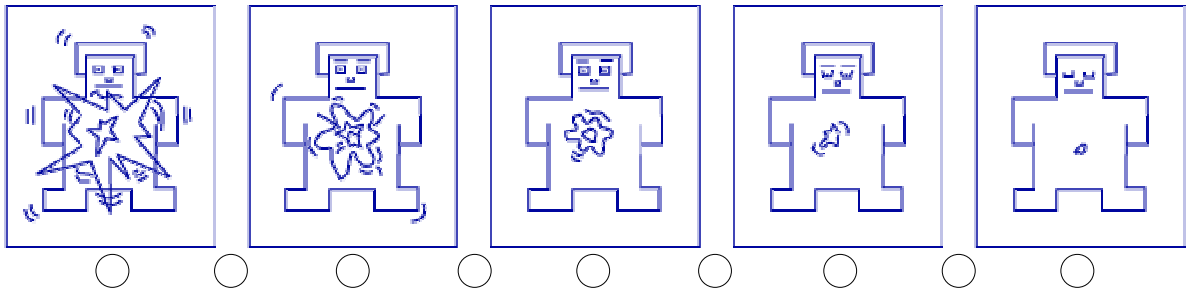
1. I flare up quickly but get over it quickly
2. When frustrated, I let my irritation show
3. I sometimes feel like a powder keg ready to explode
4. I am an even-tempered person (C)
5. Some of my friends think I'm a hothead
6. Sometimes I fly off the handle for no good reason
7. I have trouble controlling my temper

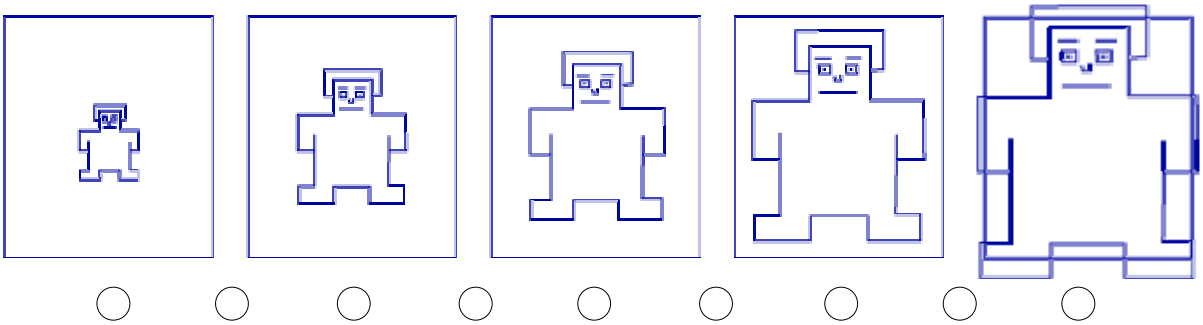
Hostility

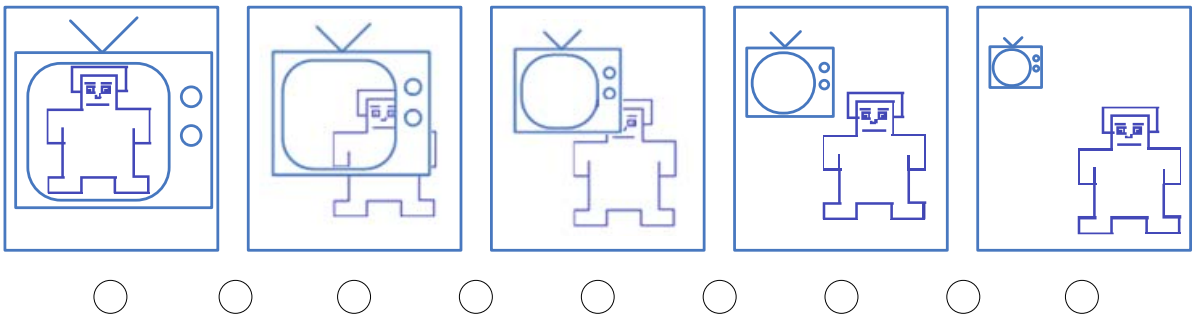
1. I am sometimes eaten up with jealousy
2. At times I feel I have gotten a raw deal out of life
3. Other people always seem to get the breaks
4. I wonder why sometimes I feel so bitter about things
5. I know that "friends" talk about me behind my back
6. I am suspicious of overly friendly strangers
7. I sometimes feel that people are laughing at me behind my back
8. When people are especially nice, I wonder what they want

Appendix B - The Self Assessment Manikin (SAM) test









Appendix C – Story stem questionnaire

1. Je bent in je auto op weg naar college en je staat te wachten voor een rood stoplicht. Wanneer het groen wordt en je optrekt, word je plotseling afgesneden en ondanks dat je hard remt kan je niet voorkomen dat je bumper geschampt wordt door de andere auto. De andere auto gaat er in volle vaart vandoor. Na controle lijkt het erop dat je geen blijvende schade aan de auto hebt. Wanneer je even later parkeert en uit je auto stapt, zie je ineens dat de auto die je zojuist heeft afgesneden naast je staat en de chauffeur ook net uitstapt. Jullie blikken ontmoeten elkaar, wat doe je?

A) Niets, ik keer me om en ga richting de collegezaal

B) Ik spreek degene aan op het onbeschofte rijgedrag

C) Ik ga schelden

D) Ik ga degene te lijf

E) Anders, namelijk:

2. Je bent uit eten met je partner. Jullie gaan zitten en na een half uur komt de ober de bestelling opnemen. De tijd gaat daarna langzaam voorbij en hoewel het gezellig is krijgen jullie steeds meer honger. Jullie staan net op het punt om te vertrekken als de ober er een uur nadat jullie besteld hebben met het eten aankomt. Wat doe je?

A) Ik blijf rustig zitten terwijl het eten neergezet wordt

B) Ik vraag waarom het zo lang geduurd heeft

C) Ik zeg dat het niet meer hoeft en mompel net hard genoeg iets in de trant van "klote tent"

D) Ik smijt het reeds klaargelegde bestek op tafel en loop op hoge poten het restaurant uit

E) Anders, namelijk:

3. Je staat bij de bakker, de winkel staat vol en er is geen nummersysteem. Desondanks blijf je wachten omdat je graag dat lekkere brood wilt hebben. Na een kwartier gewacht te hebben ben je bijna aan de beurt als er van achter iemand zich langs je heen wringt en een grote bestelling plaatst bij de bakker. Wat doe je?

A) Niets, ik wacht wel

B) Ik onderbreek de bestelling van de voordringer met "ik dacht dat ik aan de beurt was"

C) Ik ga vloeken of de voordringer uitschelden

D) Ik duw de voordringer weg en bestel zelf

E) Anders, namelijk:

4. Je zit alleen in de trein in de stilte coupe te studeren als er naast je twee mensen gaan zitten die nogal luidruchtig aan het praten en lachen zijn. Na je tien minuten geïrriteerd te hebben besluit je vriendelijk te vragen of het wat zachter kan. Er wordt geluisterd en het wordt stil. Echter, niet lang daarna begint het weer van voor af aan. Wat doe je?

A) Ik sta op en ga in een ander treinstel zitten

B) Ik vraag nogmaals vriendelijk of het wat zachter kan

C) Ik verhef mijn stem en zeg op boze toon tegen de mensen dat ze niet de enigen in de trein zijn

D) Ik gooi een krant naar de mensen en neem een dreigende houding aan

E) Anders, namelijk:

5. Na een avondje stappen ben je op zoek naar je fiets. Je weet toch echt zeker dat je hem bij de kerk had geplaatst. Ineens zie je in je ooghoek iemand met een fiets slepen en je hebt het vermoeden dat het jouw fiets is. Je gaat erop af en ziet dat het jouw fiets is. Wat doe je?

A) Ik keer me om en ga op zoek naar een agent

B) Ik spreek de dief aan en zegt dat dit mijn fiets is

C) Ik begin te schreeuwen en schelden dat ik onmiddellijk mijn fiets terug wil

D) Ik sla de dief en pak mijn fiets terug

E) Anders, namelijk:

6. Het is half 5 ‘s nachts en je bent net naar een verjaardagsfeest geweest. Het is stil op straat en je bent op de fiets op weg naar huis. Verderop zie je iemand langs de kant van de weg staan, nietsvermoedend fiets je er langs als degene opeens uithaalt en je vol in het gezicht slaat. Voordat je in de gaten hebt wat er precies gebeurd is, ben je al een meter of 10 van de luid lachende persoon verwijderd. Wat doe je?

A) Ik fiets door terwijl ik aan mijn gezicht voel of het bloedt4

B) Ik vraag waar dit voor nodig was2

C) Ik begin te vloeken en te schelden1

D) Ik stap af en loop terug om degene een portie klappen terug te geven3

E) Anders, namelijk:

7. Je staat met vrienden in een discotheek, het is erg druk op de dansvloer en het is er warm. Jullie hebben een goede avond, maar er staat al de hele tijd al een erg vervelende groep naast jullie. Juist als jullie naar een ander deel van de zaal willen gaan zwalkt één van hen praktisch in je armen en gooit een vol glas bier over je kleren, je bent kletsnat. Wat doe je?

A) Niets, ik draai me snel om want ik wil mijn vrienden niet uit het oog verliezen in de mensenmassa2

B) Ik vraag “kan je niet wat beter uitkijken?”3

C) Ik kijk kwaad en begin te schelden4

D) Ik geef degene een elleboog en duw de dronkaard de menigte in1

E) Anders, namelijk:

8. Je staat in de rij bij de kassa in de supermarkt om je avondeten te kopen. Het is redelijk druk en je moet je haasten anders kom je in tijdnood voor een afspraak na het eten. De klant voor je is echter iemand die heeft besloten om het volledige bedrag van 5,65 uit te tellen in muntjes van 20 cent of kleiner. Het duurt erg lang en je ziet dat de caissière moeite moet doen om haar ergernis te verbergen. Wat doe je?

A) Ik wacht rustig, ik weet hoe zwaar je portemonnee kan worden met al dat muntgeld4

B) Ik vraag “heeft u geen bankbiljetten bij zich?”1

C) Ik zucht hard en zeg “schiet eens op met al dat kleine rot geld”3

D) Ik duw degene weg met de mededeling “ik ga wel eerst, dit duurt me te lang”2

E) Anders, namelijk:

9. Je zit met een vriend(in) in de bioscoop, voor jullie zit een tweetal dat weinig geïnteresseerd lijkt in de film. Als ze niet met elkaar praten zijn ze wel bezig met hun telefoon of het lastig vallen van mensen met vervelende opmerkingen. Andere mensen in de zaal hebben al veelvuldig tot stilte gemaand zonder resultaat. Op een gegeven moment gaat de telefoon van één van beiden over en er wordt luid opgenomen, wat doe je?

A) Niets, ik ga compleet op in de film1

B) Ik vraag “zou je niet willen bellen tijdens de film?”2

C) Ik vraag met verheven stem “zouden jullie #@$% op willen rotten? Bellen doe je maar buiten de zaal!”3

D) Ik trap tegen de stoel voor me, zo hard dat de persoon voor me voorover valt4

E) Anders, namelijk:

10. Je loopt tijdens koopavond alleen te winkelen. De winkels gaan bijna sluiten, dit is ook te merken aan het aantal mensen in de stad. Als je langs een donker steegje loopt zie je in een flits hoe iemand door 2 jongeren in elkaar geslagen wordt. Wat is je eerste reactie?

A) Ik loop snel door, dat is niet mijn probleem, bovendien: straks krijg ik ook nog klappen3

B) Ik roep “hey houd daar eens mee op!” in de hoop dat ik daarmee de aandacht van andere mensen trek4

C) Ik schreeuw “stelletje laffe honden, kunnen jullie wel met zijn tweeën tegen één?!”2

D) Ik schiet degene te hulp, met een beetje geluk schakel ik de aanvaller die met de rug naar me toe staat direct uit1

E) Anders, namelijk:

Appendix D - MEC Spatial Presence Questionnaire (MEC-SPQ)

1. I felt like I was actually there in the environment of the presentation.
2. It was as though my true location had shifted into the environment of the presentation.
3. I felt as though I was physically present in the environment of the presentation.
4. It seemed as though I actually took part in the action of the presentation.
5. I had the impression that I could be active in the environment of the presentation.
6. I felt like I could move around among the objects in the presentation.
7. The objects in the presentation gave me the feeling that I could do things with them.
8. It seemed to me that I could do whatever I wanted in the environment of the presentation.

Appendix E - Evaluation questions

Have you ever played UT2004 before this experiment?

Yes
No

What do you think of your skills in the game / the skills of the player in the fragment? [6]

Very bad
Bad
Not bad/not good
Good
Very good

Unreal Tournament 2004 is violent

Totally agree
Agree
Neutral
Disagree
Totally disagree

I had problems with the controls of the game[7]

Totally agree
Agree
Neutral
Disagree
Totally disagree

Playing/Observing Unreal Tournament 2004 was frustrating

Totally agree
Agree
Neutral
Disagree
Totally disagree

Playing/Observing Unreal Tournament 2004 was pleasant

Totally agree
Agree
Neutral
Disagree
Totally disagree

Playing Unreal Tournament 2004 was easy / Unreal Tournament 2004 seems easy to play

Totally agree
Agree
Neutral
Disagree
Totally disagree

[6] Dependent on which condition the participant was in

[7] Question was only asked in the active experimental condition

Playing/Observing Unreal Tournament 2004 was boring

Totally agree
Agree
Neutral
Disagree
Totally disagree

Did you win or lose the game?[8]

Won
Lost

What do you think the experiment was about?

<open question to probe for suspicion>

[8] Question was only asked in the active experimental condition

Appendix F - SPSS output for testing of hypotheses 1 and 3

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Valence SAM	Active	90	5,50	2,079	,219	5,06	5,94	1	9
	Passive	90	4,27	1,747	,184	3,90	4,63	1	7
	Total	180	4,88	2,012	,150	4,59	5,18	1	9
Arousal SAM	Active	89	6,01	1,570	,166	5,68	6,34	1	9
	Passive	90	4,44	2,173	,229	3,99	4,90	1	9
	Total	179	5,22	2,049	,153	4,92	5,53	1	9
Dominance SAM	Active	90	5,58	1,817	,192	5,20	5,96	1	9
	Passive	90	5,21	1,540	,162	4,89	5,53	1	9
	Total	180	5,39	1,690	,126	5,15	5,64	1	9
Presence SAM	Active	90	5,86	2,266	,239	5,38	6,33	1	9
	Passive	90	4,99	2,671	,282	4,43	5,55	1	9
	Total	180	5,42	2,508	,187	5,05	5,79	1	9
Totale score AQ	Active	90	62,17	12,855	1,355	59,47	64,86	41	96
	Passive	90	63,63	13,198	1,391	60,87	66,40	40	100
	Total	180	62,90	13,012	,970	60,99	64,81	40	100
Spatial presence MEC	Active	90	2,4014	,87359	,09208	2,2184	2,5844	1,00	4,50
	Passive	90	1,7306	,63653	,06710	1,5972	1,8639	1,00	3,75
	Total	180	2,0660	,83309	,06209	1,9434	2,1885	1,00	4,50

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Valence SAM	Between Groups	68,450	1	68,450	18,570	,000
	Within Groups	656,100	178	3,686		
	Total	724,550	179			
Arousal SAM	Between Groups	109,850	1	109,850	30,513	,000
	Within Groups	637,211	177	3,600		
	Total	747,061	178			
Dominance SAM	Between Groups	6,050	1	6,050	2,133	,146
	Within Groups	504,944	178	2,837		
	Total	510,994	179			
Presence SAM	Between Groups	33,800	1	33,800	5,509	,020
	Within Groups	1092,111	178	6,135		
	Total	1125,911	179			
Totale score AQ	Between Groups	96,800	1	96,800	,570	,451
	Within Groups	30209,400	178	169,716		
	Total	30306,200	179			
Spatial presence MEC	Between Groups	20,251	1	20,251	34,666	,000
	Within Groups	103,981	178	,584		
	Total	124,232	179			

Appendix G – Correlation matrices for the dependent variables

Correlations

Condition			Valence SAM	Arousal SAM	Dominance SAM	Presence SAM	Boredom	Pleasantness	Frustration	Intended aggresssion	Spatial presence MEC
Active	Valence SAM	Pearson Correlation	1	,054	,610**	,128	-,430**	,720**	-,750**	,248*	,031
		Sig. (2-tailed)		,617	,000	,231	,000	,000	,000	,019	,775
		N	90	89	90	90	90	90	90	90	90
	Arousal SAM	Pearson Correlation	,054	1	,172	,368**	-,421**	,121	,003	,070	,234*
		Sig. (2-tailed)	,617		,107	,000	,000	,259	,977	,517	,028
		N	89	89	89	89	89	89	89	89	89
	Dominance SAM	Pearson Correlation	,610**	,172	1	,378**	-,333**	,597**	-,513**	,222*	,219*
		Sig. (2-tailed)	,000	,107		,000	,001	,000	,000	,036	,038
		N	90	89	90	90	90	90	90	90	90
	Presence SAM	Pearson Correlation	,128	,368**	,378**	1	-,465**	,317**	-,229*	,169	,414**
		Sig. (2-tailed)	,231	,000	,000		,000	,002	,030	,112	,000
		N	90	89	90	90	90	90	90	90	90
	Boredom	Pearson Correlation	-,430**	-,421**	-,333**	-,465**	1	-,531**	,440**	-,194	-,328**
		Sig. (2-tailed)	,000	,000	,001	,000		,000	,000	,066	,002
		N	90	89	90	90	90	90	90	90	90
	Pleasantness	Pearson Correlation	,720**	,121	,597**	,317**	-,531**	1	-,711**	,304**	,261*
		Sig. (2-tailed)	,000	,259	,000	,002	,000		,000	,004	,013
		N	90	89	90	90	90	90	90	90	90
	Frustration	Pearson Correlation	-,750**	,003	-,513**	-,229*	,440**	-,711**	1	-,205	-,125
		Sig. (2-tailed)	,000	,977	,000	,030	,000	,000		,053	,240
		N	90	89	90	90	90	90	90	90	90
	Intended aggresssion	Pearson Correlation	,248*	,070	,222*	,169	-,194	,304**	-,205	1	,091
		Sig. (2-tailed)	,019	,517	,036	,112	,066	,004	,053		,394
		N	90	89	90	90	90	90	90	90	90
	Spatial presence MEC	Pearson Correlation	,031	,234*	,219*	,414**	-,328**	,261*	-,125	,091	1
		Sig. (2-tailed)	,775	,028	,038	,000	,002	,013	,240	,394	
		N	90	89	90	90	90	90	90	90	90

Passive	Valence SAM	Pearson Correlation	1	-,351**	,250*	,046	-,225*	,601**	-,543**	,450**	,281**
		Sig. (2-tailed)		,001	,017	,664	,033	,000	,000	,000	,007
		N	90	90	90	90	90	90	90	90	90
	Arousal SAM	Pearson Correlation	-,351**	1	-,018	,051	-,245*	-,103	,280**	-,006	,156
		Sig. (2-tailed)	,001		,864	,632	,020	,335	,008	,952	,143
		N	90	90	90	90	90	90	90	90	90
	Dominance SAM	Pearson Correlation	,250*	-,018	1	,031	-,151	,203	-,121	,162	,355**
		Sig. (2-tailed)	,017	,864		,774	,155	,055	,254	,128	,001
		N	90	90	90	90	90	90	90	90	90
	Presence SAM	Pearson Correlation	,046	,051	,031	1	-,206	,146	-,125	-,094	,113
		Sig. (2-tailed)	,664	,632	,774		,051	,169	,241	,380	,289
		N	90	90	90	90	90	90	90	90	90
	Boredom	Pearson Correlation	-,225*	-,245*	-,151	-,206	1	-,445**	,205	-,174	-,419**
		Sig. (2-tailed)	,033	,020	,155	,051		,000	,053	,102	,000
		N	90	90	90	90	90	90	90	90	90
	Pleasantness	Pearson Correlation	,601**	-,103	,203	,146	-,445**	1	-,639**	,366**	,386**
		Sig. (2-tailed)	,000	,335	,055	,169	,000		,000	,000	,000
		N	90	90	90	90	90	90	90	90	90
	Frustration	Pearson Correlation	-,543**	,280**	-,121	-,125	,205	-,639**	1	-,214*	-,187
		Sig. (2-tailed)	,000	,008	,254	,241	,053	,000		,042	,078
		N	90	90	90	90	90	90	90	90	90
	Intended aggresssion	Pearson Correlation	,450**	-,006	,162	-,094	-,174	,366**	-,214*	1	,135
		Sig. (2-tailed)	,000	,952	,128	,380	,102	,000	,042		,205
		N	90	90	90	90	90	90	90	90	90
	Spatial presence MEC	Pearson Correlation	,281**	,156	,355**	,113	-,419**	,386**	-,187	,135	1
		Sig. (2-tailed)	,007	,143	,001	,289	,000	,000	,078	,205	
		N	90	90	90	90	90	90	90	90	90

Correlations

		Totale score AQ	Physical aggression (P)	Verbal aggression (V)	Anger (A)	Hostility (H)	Intended aggresssion
Totale score AQ	Pearson Correlation	1,000	,753**	,641**	,788**	,674**	,318**
	Sig. (2-tailed)		,000	,000	,000	,000	,000
	N	180,000	180	180	180	180	180
Physical aggression (P)	Pearson Correlation	,753**	1,000	,457**	,459**	,173*	,471**
	Sig. (2-tailed)	,000		,000	,000	,020	,000
	N	180	180,000	180	180	180	180
Verbal aggression (V)	Pearson Correlation	,641**	,457**	1,000	,403**	,256**	,296**
	Sig. (2-tailed)	,000	,000		,000	,001	,000
	N	180	180	180,000	180	180	180
Anger (A)	Pearson Correlation	,788**	,459**	,403**	1,000	,403**	,175*
	Sig. (2-tailed)	,000	,000	,000		,000	,019
	N	180	180	180	180,000	180	180
Hostility (H)	Pearson Correlation	,674**	,173*	,256**	,403**	1,000	-,013
	Sig. (2-tailed)	,000	,020	,001	,000		,867
	N	180	180	180	180	180,000	180
Intended aggresssion	Pearson Correlation	,318**	,471**	,296**	,175*	-,013	1,000
	Sig. (2-tailed)	,000	,000	,000	,019	,867	
	N	180	180	180	180	180	180,000

Appendix H - Ratio and Sample size tests

Intended aggression

Gender

	Male	Female	Ratio	Size
Active	M = 10,31	M = 9,16		
	SD = 2,75	SD = 2,98		
	N = 26 **(15)**	N = 64 **(15)**	**0,41**	**29**
Passive	M = 12,07	M = 8,67		
	SD = 4,23	SD = 2,92		
	N = 27 **(15)**	N = 63 **(15)**	**0,43**	**29**
Ratio	**0,96**	**1,02**		
Size	**29**	**29**		

Intended aggression

Hours of game play per week

	I never play video games	5 hours per week or less	More than 5 hours per week	Ratio	Size
Active	M = 8,79	M = 9,85	M = 11,50		
	SD = 2,89	SD = 2,79	SD = 3,12		
	N = 43 **(18)**	N = 39 **(18)**	N = 8 **(18)**	**0,14**	**29**
Passive	M = 8,83	M = 9,21	M = 13.92		
	SD = 2,72	SD = 3,54	SD = 4,14		
	N = 35 **(18)**	N = 43 **(18)**	N = 12 **(18)**	**0,07**	**29**
Ratio	**1,23**	**0,91**	**0,67**		
Size	**35**	**35**	**35**		

Intended aggression

AQ scores

	Low	Medium	High	Ratio	Size
Active	M = 9,16	M = 8,66	M = 10,92		
	SD = 3,19	SD = 2,24	SD = 2,98		
	N = 32 **(18)**	N = 32 **(18)**	N =26 **(18)**	**0,04**	**29**
Passive	M = 8,31	M = 9,00	M = 11,56		
	SD = 3,05	SD = 3,49	SD = 3,74		
	N = 29 **(18)**	N = 29 **(18)**	N = 32 **(18)**	**0,03**	**29**
Ratio	**1,10**	**1,10**	**0,81**		
Size	**35**	**35**	**35**		

Intended agression

Do you play FPS games?

	Yes	No	Ratio	Size
Active	M = 10,18	M = 9,33		
	SD = 2,94	SD = 2,94		
	N = 17 **(15)**	N = 73 **(15)**	**0,23**	**29**
Passive	M = 13,00	M = 9,08		
	SD = 3,78	SD = 3,36		
	N = 14 **(15)**	N = 76 **(15)**	**0,18**	**29**
Ratio	**1,21**	**0,96**		
Size	**29**	**29**		

Intended aggression

Have you ever played UT2004 before this experiment?

	Yes	No	Ratio	Size
Active	M = 9,71	M = 9,42		
	SD = 2,61	SD = 3,10		
	N = 21 **(15)**	N = 69 **(15)**	**0,30**	**29**
Passive	M = 11,83	M = 8,91		
	SD = 4,43	SD = 3,10		
	N = 24 **(15)**	N = 66 **(15)**	**0,36**	**29**
Ratio	**0,89**	**1,05**		
Size	**29**	**29**		

Appendix I – Interaction effect analyses

Condition*Gender

Descriptive Statistics

Dependent Variable:Intended aggresssion

Condition	Gender	Mean	Std. Deviation	N
Active	Male	10,31	2,753	26
	Female	9,16	2,977	64
	Total	9,49	2,946	90
Passive	Male	12,07	4,233	27
	Female	8,67	2,924	63
	Total	9,69	3,695	90
Total	Male	11,21	3,660	53
	Female	8,91	2,949	127
	Total	9,59	3,334	180

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Intended aggresssion

F	df1	df2	Sig.
2,061	3	176	,107

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Condition + Gender + Condition * Gender

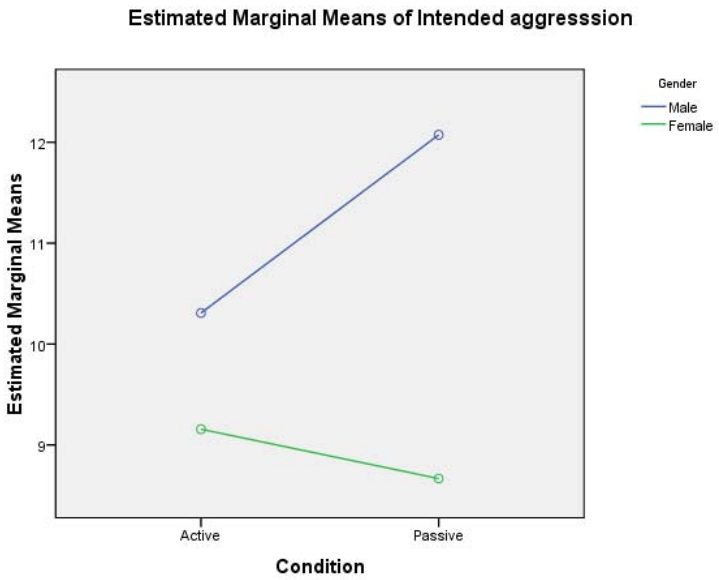
Tests of Between-Subjects Effects

Dependent Variable:Intended aggresssion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	245,750[a]	3	81,917	8,268	,000	,124	24,803	,992
Intercept	15107,178	1	15107,178	1524,728	,000	,897	1524,728	1,000
Condition	15,236	1	15,236	1,538	,217	,009	1,538	,234
Gender	194,241	1	194,241	19,604	,000	,100	19,604	,993
Condition * Gender	47,566	1	47,566	4,801	,030	,027	4,801	,587
Error	1743,828	176	9,908					
Total	18540,000	180						
Corrected Total	1989,578	179						

a. R Squared = ,124 (Adjusted R Squared = ,109)

b. Computed using alpha = ,05



Condition*Playtime

Descriptive Statistics

Dependent Variable:Intended aggresssion

Condition	Hours of game play per week	Mean	Std. Deviation	N
Active	I never play video games	8,79	2,891	43
	5 hours per week or less	9,85	2,787	39
	more than 5 hours per week	11,50	3,117	8
	Total	9,49	2,946	90
Passive	I never play video games	8,83	2,717	35
	5 hours per week or less	9,21	3,536	43
	more than 5 hours per week	13,92	4,144	12
	Total	9,69	3,695	90
Total	I never play video games	8,81	2,796	78
	5 hours per week or less	9,51	3,198	82
	more than 5 hours per week	12,95	3,873	20
	Total	9,59	3,334	180

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Intended aggresssion

F	df1	df2	Sig.
1,554	5	174	,176

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Condition + Playtime + Condition * Playtime

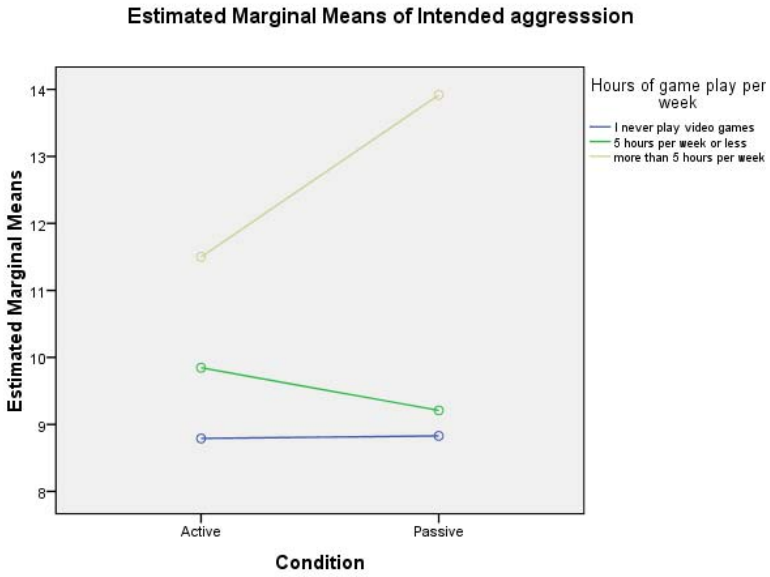
Tests of Between-Subjects Effects

Dependent Variable:Intended aggresssion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	310,380[a]	5	62,076	6,432	,000	,156	32,162	,997
Intercept	12474,514	1	12474,514	1292,621	,000	,881	1292,621	1,000
Condition	10,691	1	10,691	1,108	,294	,006	1,108	,182
Playtime	233,851	2	116,926	12,116	,000	,122	24,232	,995
Condition * Playtime	36,345	2	18,172	1,883	,155	,021	3,766	,388
Error	1679,198	174	9,651					
Total	18540,000	180						
Corrected Total	1989,578	179						

a. R Squared = ,156 (Adjusted R Squared = ,132)

b. Computed using alpha = ,05



Condition*AQ score

Descriptive Statistics

Dependent Variable:Intended aggresssion

Condition	AQ scores	Mean	Std. Deviation	N
Active	Low	9,16	3,194	32
	Medium	8,66	2,238	32
	High	10,92	2,979	26
	Total	9,49	2,946	90
Passive	Low	8,31	3,048	29
	Medium	9,00	3,485	29
	High	11,56	3,741	32
	Total	9,69	3,695	90
Total	Low	8,75	3,129	61
	Medium	8,82	2,878	61
	High	11,28	3,407	58
	Total	9,59	3,334	180

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Intended aggresssion

F	df1	df2	Sig.
1,462	5	174	,205

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Condition + AQcategorised + Condition * AQcategorised

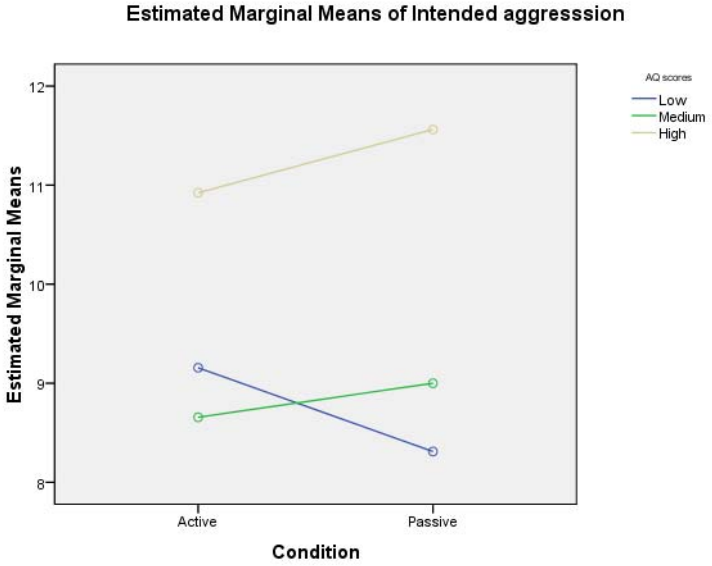
Tests of Between-Subjects Effects

Dependent Variable:Intended aggresssion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	262,212[a]	5	52,442	5,283	,000	,132	26,413	,987
Intercept	16496,564	1	16496,564	1661,723	,000	,905	1661,723	1,000
Condition	,094	1	,094	,009	,923	,000	,009	,051
AQcategorised	236,653	2	118,326	11,919	,000	,120	23,838	,994
Condition * AQcategorised	18,496	2	9,248	,932	,396	,011	1,863	,210
Error	1727,366	174	9,927					
Total	18540,000	180						
Corrected Total	1989,578	179						

a. R Squared = ,132 (Adjusted R Squared = ,107)

b. Computed using alpha = ,05



Condition*FPS

Descriptive Statistics

Dependent Variable:Intended aggresssion

Condition	Do you play FPS games?	Mean	Std. Deviation	N
Active	No	9,33	2,944	73
	Yes	10,18	2,942	17
	Total	9,49	2,946	90
Passive	No	9,08	3,362	76
	Yes	13,00	3,783	14
	Total	9,69	3,695	90
Total	No	9,20	3,156	149
	Yes	11,45	3,586	31
	Total	9,59	3,334	180

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Intended aggresssion

F	df1	df2	Sig.
,925	3	176	,430

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Condition + FPS + Condition * FPS

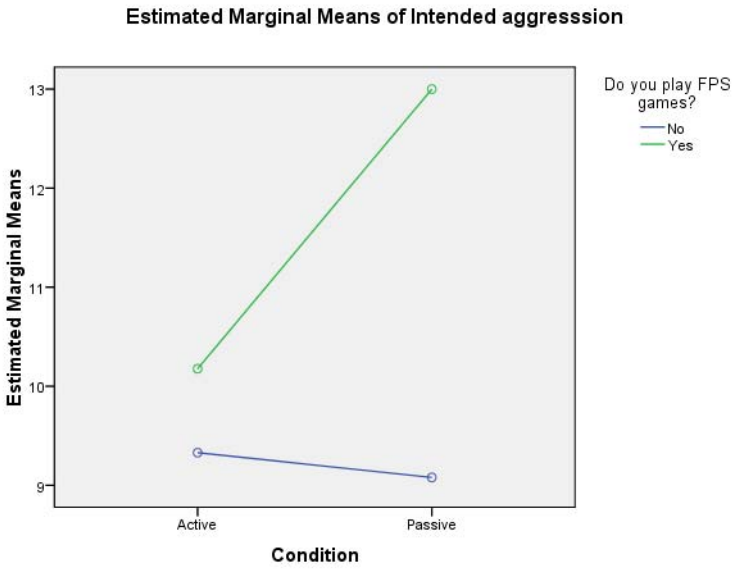
Tests of Between-Subjects Effects

Dependent Variable:Intended aggresssion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	193,471[a]	3	64,490	6,319	,000	,097	18,958	,964
Intercept	11006,681	1	11006,681	1078,542	,000	,860	1078,542	1,000
Condition	42,162	1	42,162	4,131	,044	,023	4,131	,525
FPS	144,747	1	144,747	14,184	,000	,075	14,184	,963
Condition * FPS	60,121	1	60,121	5,891	,016	,032	5,891	,675
Error	1796,106	176	10,205					
Total	18540,000	180						
Corrected Total	1989,578	179						

a. R Squared = ,097 (Adjusted R Squared = ,082)

b. Computed using alpha = ,05



Condition*ExperienceUT2004

Descriptive Statistics

Dependent Variable:Intended aggresssion

Condition	Have you ever played Unreal Tournament 2004 before this experiment?	Mean	Std. Deviation	N
Active	No	9,42	3,055	69
	Yes	9,71	2,610	21
	Total	9,49	2,946	90
Passive	No	8,91	3,072	66
	Yes	11,83	4,430	24
	Total	9,69	3,695	90
Total	No	9,17	3,063	135
	Yes	10,84	3,808	45
	Total	9,59	3,334	180

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Intended aggresssion

F	df1	df2	Sig.
3,325	3	176	,021

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Condition + ExperienceUT2004 + Condition * ExperienceUT2004

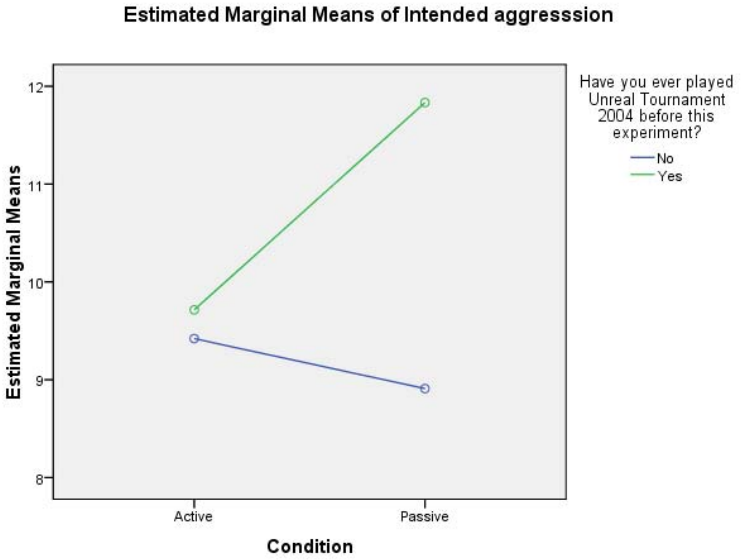
Tests of Between-Subjects Effects

Dependent Variable:Intended aggresssion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
Corrected Model	153,693[a]	3	51,231	4,911	,003	,077	14,734	,905
Intercept	13370,683	1	13370,683	1281,801	,000	,879	1281,801	1,000
Condition	21,737	1	21,737	2,084	,151	,012	2,084	,300
ExperienceUT2004	87,085	1	87,085	8,349	,004	,045	8,349	,820
Condition * ExperienceUT2004	58,170	1	58,170	5,577	,019	,031	5,577	,651
Error	1835,885	176	10,431					
Total	18540,000	180						
Corrected Total	1989,578	179						

a. R Squared = ,077 (Adjusted R Squared = ,062)

b. Computed using alpha = ,05



Appendix J – One-way ANOVA's for interacting independent variables

Gender

Descriptives

Intended aggresssion

Gender		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Male	Active	26	10,31	2,753	,540	9,20	11,42	6	17
	Passive	27	12,07	4,233	,815	10,40	13,75	3	20
	Total	53	11,21	3,660	,503	10,20	12,22	3	20
Female	Active	64	9,16	2,977	,372	8,41	9,90	4	18
	Passive	63	8,67	2,924	,368	7,93	9,40	2	15
	Total	127	8,91	2,949	,262	8,40	9,43	2	18

ANOVA

Intended aggresssion

Gender		Sum of Squares	df	Mean Square	F	Sig.
Male	Between Groups	41,327	1	41,327	3,216	,079
	Within Groups	655,390	51	12,851		
	Total	696,717	52			
Female	Between Groups	7,610	1	7,610	,874	,352
	Within Groups	1088,438	125	8,708		
	Total	1096,047	126			

FPS

Descriptives

Intended aggresssion

Do you play FPS games?		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
No	Active	73	9,33	2,944	,345	8,64	10,02	4	18
	Passive	76	9,08	3,362	,386	8,31	9,85	2	18
	Total	149	9,20	3,156	,259	8,69	9,71	2	18
Yes	Active	17	10,18	2,942	,714	8,66	11,69	6	17
	Passive	14	13,00	3,783	1,011	10,82	15,18	6	20
	Total	31	11,45	3,586	,644	10,14	12,77	6	20

ANOVA

Intended aggresssion

Do you play FPS games?		Sum of Squares	df	Mean Square	F	Sig.
No	Between Groups	2,324	1	2,324	,232	,631
	Within Groups	1471,636	147	10,011		
	Total	1473,960	148			
Yes	Between Groups	61,207	1	61,207	5,470	,026
	Within Groups	324,471	29	11,189		
	Total	385,677	30			

ExperienceUT2004

Descriptives

Intended aggresssion

Have you ever played Unreal Tournament 2004 before this experiment?		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
No	Active	69	9,42	3,055	,368	8,69	10,15	4	18
	Passive	66	8,91	3,072	,378	8,15	9,66	2	17
	Total	135	9,17	3,063	,264	8,65	9,69	2	18
Yes	Active	21	9,71	2,610	,570	8,53	10,90	6	16
	Passive	24	11,83	4,430	,904	9,96	13,70	3	20
	Total	45	10,84	3,808	,568	9,70	11,99	3	20

ANOVA

Intended aggresssion

Have you ever played Unreal Tournament 2004 before this experiment?		Sum of Squares	df	Mean Square	F	Sig.
No	Between Groups	8,815	1	8,815	,939	,334
	Within Groups	1248,266	133	9,385		
	Total	1257,081	134			
Yes	Between Groups	50,292	1	50,292	3,680	,062
	Within Groups	587,619	43	13,666		
	Total	637,911	44			

Playtime

Descriptives

Intended aggresssion

Hours of game play per week		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
I never play video games	Active	43	8,79	2,891	,441	7,90	9,68	4	18
	Passive	35	8,83	2,717	,459	7,90	9,76	5	14
	Total	78	8,81	2,796	,317	8,18	9,44	4	18
5 hours per week or less	Active	39	9,85	2,787	,446	8,94	10,75	4	16
	Passive	43	9,21	3,536	,539	8,12	10,30	2	17
	Total	82	9,51	3,198	,353	8,81	10,21	2	17
more than 5 hours per week	Active	8	11,50	3,117	1,102	8,89	14,11	7	17
	Passive	12	13,92	4,144	1,196	11,28	16,55	6	20
	Total	20	12,95	3,873	,866	11,14	14,76	6	20

ANOVA

Intended aggresssion

Hours of game play per week		Sum of Squares	df	Mean Square	F	Sig.
I never play video games	Between Groups	,028	1	,028	,003	,953
	Within Groups	602,088	76	7,922		
	Total	602,115	77			
5 hours per week or less	Between Groups	8,295	1	8,295	,809	,371
	Within Groups	820,193	80	10,252		
	Total	828,488	81			
more than 5 hours per week	Between Groups	28,033	1	28,033	1,964	,178
	Within Groups	256,917	18	14,273		
	Total	284,950	19			

Appendix K – Dependent variable analysis for the FPS group

Descriptives

Do you play FPS games?			N	Mean	Std. Deviation	Std. Error
No	Valence SAM	Active	73	5,14	2,016	,236
		Passive	76	3,89	1,588	,182
		Total	149	4,50	1,909	,156
	Arousal SAM	Active	72	6,03	1,520	,179
		Passive	76	4,55	2,181	,250
		Total	148	5,27	2,022	,166
	Dominance SAM	Active	73	5,32	1,832	,214
		Passive	76	5,05	1,413	,162
		Total	149	5,18	1,632	,134
	Presence SAM	Active	73	5,63	2,233	,261
		Passive	76	5,01	2,701	,310
		Total	149	5,32	2,493	,204
	Totale score AQ	Active	73	61,68	12,862	1,505
		Passive	76	63,51	13,584	1,558
		Total	149	62,62	13,222	1,083
	Spatial presence MEC	Active	73	2,3887	,81532	,09543
		Passive	76	1,6743	,64552	,07405
		Total	149	2,0243	,81421	,06670
	Frustration	Active	73	2,77	1,242	,145
		Passive	76	3,45	1,088	,125
		Total	149	3,11	1,211	,099
	Pleasantness	Active	73	3,27	1,592	,186
		Passive	76	1,83	,900	,103
		Total	149	2,54	1,473	,121

	Boredom	Active	73	2,62	,995	,116
		Passive	76	3,59	1,035	,119
		Total	149	3,11	1,124	,092
Yes	Valence SAM	Active	17	7,06	1,600	,388
		Passive	14	6,29	1,600	,286
		Total	31	6,71	1,419	,255
	Arousal SAM	Active	17	5,94	1,819	,441
		Passive	14	3,86	2,107	,563
		Total	31	5,00	2,191	,393
	Dominance SAM	Active	17	6,71	1,263	,306
		Passive	14	6,07	1,940	,518
		Total	31	6,42	1,608	,289
	Presence SAM	Active	17	6,82	2,215	,537
		Passive	14	4,86	2,598	,694
		Total	31	5,94	2,555	,459
	Totale score AQ	Active	17	64,24	13,003	3,154
		Passive	14	64,29	11,289	3,017
		Total	31	64,26	12,058	2,166
	Spatial presence MEC	Active	17	2,4559	1,11798	,27115
		Passive	14	2,0357	,50103	,13391
		Total	31	2,2661	,90585	,16270
	Frustration	Active	17	1,35	,493	,119
		Passive	14	2,71	,994	,266
		Total	31	1,97	1,016	,182
	Pleasantness	Active	17	4,71	,849	,206
		Passive	14	2,93	1,072	,286
		Total	31	3,90	1,300	,234

	Boredom	Active	17	1,94	1,029	,250
		Passive	14	3,29	,994	,266
		Total	31	2,55	1,207	,217

ANOVA

Do you play FPS games?			Sum of Squares	df	Mean Square	F	Sig.
No	Valence SAM	Between Groups	57,460	1	57,460	17,532	,000
		Within Groups	481,788	147	3,277		
		Total	539,248	148			
	Arousal SAM	Between Groups	80,455	1	80,455	22,558	,000
		Within Groups	520,734	146	3,567		
		Total	601,189	147			
	Dominance SAM	Between Groups	2,564	1	2,564	,963	,328
		Within Groups	391,543	147	2,664		
		Total	394,107	148			
	Presence SAM	Between Groups	14,174	1	14,174	2,300	,132
		Within Groups	906,001	147	6,163		
		Total	920,174	148			
	Totale score AQ	Between Groups	124,454	1	124,454	,710	,401
		Within Groups	25750,740	147	175,175		
		Total	25875,195	148			
	Spatial presence MEC	Between Groups	19,001	1	19,001	35,306	,000
		Within Groups	79,114	147	,538		
		Total	98,115	148			
	Frustration	Between Groups	17,230	1	17,230	12,675	,000
		Within Groups	199,831	147	1,359		
		Total	217,060	148			

	Pleasantness	Between Groups	77,750	1	77,750	46,977	,000
		Within Groups	243,297	147	1,655		
		Total	321,047	148			
	Boredom	Between Groups	35,445	1	35,445	34,366	,000
		Within Groups	151,616	147	1,031		
		Total	187,060	148			
Yes	Valence SAM	Between Groups	4,589	1	4,589	2,385	,133
		Within Groups	55,798	29	1,924		
		Total	60,387	30			
	Arousal SAM	Between Groups	33,345	1	33,345	8,739	,006
		Within Groups	110,655	29	3,816		
		Total	144,000	30			
	Dominance SAM	Between Groups	3,090	1	3,090	1,204	,282
		Within Groups	74,458	29	2,568		
		Total	77,548	30			
	Presence SAM	Between Groups	29,686	1	29,686	5,180	,030
		Within Groups	166,185	29	5,731		
		Total	195,871	30			
	Totale score AQ	Between Groups	,020	1	,020	,000	,991
		Within Groups	4361,916	29	150,411		
		Total	4361,935	30			
	Spatial presence MEC	Between Groups	1,355	1	1,355	1,690	,204
		Within Groups	23,262	29	,802		
		Total	24,617	30			
	Frustration	Between Groups	14,228	1	14,228	24,649	,000
		Within Groups	16,739	29	,577		
		Total	30,968	30			

Pleasantness	Between Groups	24,252	1	24,252	26,582	,000
	Within Groups	26,458	29	,912		
	Total	50,710	30			
Boredom	Between Groups	13,879	1	13,879	13,507	,001
	Within Groups	29,798	29	1,028		
	Total	43,677	30			

Appendix L – Correlation matrix for the FPS group

Correlations

Do you play FPS games?	Condition			Valence SAM	Arousal SAM	Dominance SAM	Presence SAM	Boredom	Pleasantness	Frustration	Intended aggresssion	Spatial presence MEC
No	Active	Valence SAM	Pearson Correlation	1	,017	,593**	,045	-,327**	,706**	-,714**	,198	,055
			Sig. (2-tailed)		,888	,000	,703	,005	,000	,000	,093	,645
			N	73	72	73	73	73	73	73	73	73
		Arousal SAM	Pearson Correlation	,017	1	,103	,390**	-,443**	,148	,019	,051	,224
			Sig. (2-tailed)	,888		,391	,001	,000	,216	,873	,669	,058
			N	72	72	72	72	72	72	72	72	72
		Dominance SAM	Pearson Correlation	,593**	,103	1	,273*	-,222	,560**	-,456**	,205	,182
			Sig. (2-tailed)	,000	,391		,019	,059	,000	,000	,083	,124
			N	73	72	73	73	73	73	73	73	73
		Presence SAM	Pearson Correlation	,045	,390**	,273*	1	-,409**	,244*	-,147	,141	,469**
			Sig. (2-tailed)	,703	,001	,019		,000	,038	,216	,233	,000
			N	73	72	73	73	73	73	73	73	73
		Boredom	Pearson Correlation	-,327**	-,443**	-,222	-,409**	1	-,503**	,365**	-,141	-,402**
			Sig. (2-tailed)	,005	,000	,059	,000		,000	,001	,233	,000
			N	73	72	73	73	73	73	73	73	73
		Pleasantness	Pearson Correlation	,706**	,148	,560**	,244*	-,503**	1	-,670**	,330**	,317**
			Sig. (2-tailed)	,000	,216	,000	,038	,000		,000	,004	,006
			N	73	72	73	73	73	73	73	73	73
		Frustration	Pearson Correlation	-,714**	,019	-,456**	-,147	,365**	-,670**	1	-,184	-,158

		Sig. (2-tailed)	,000	,873	,000	,216	,001	,000		,119	,182
		N	73	72	73	73	73	73	73	73	73
	Intended aggresssion	Pearson Correlation	,198	,051	,205	,141	-,141	,330**	-,184	1	,116
		Sig. (2-tailed)	,093	,669	,083	,233	,233	,004	,119		,328
		N	73	72	73	73	73	73	73	73	73
	Spatial presence MEC	Pearson Correlation	,055	,224	,182	,469**	-,402**	,317**	-,158	,116	1
		Sig. (2-tailed)	,645	,058	,124	,000	,000	,006	,182	,328	
		N	73	72	73	73	73	73	73	73	73
Passive	Valence SAM	Pearson Correlation	1	-,376**	,199	,031	-,221	,528**	-,505**	,381**	,187
		Sig. (2-tailed)		,001	,086	,788	,055	,000	,000	,001	,105
		N	76	76	76	76	76	76	76	76	76
	Arousal SAM	Pearson Correlation	-,376**	1	-,048	-,022	-,230*	-,101	,333**	,027	,244*
		Sig. (2-tailed)	,001		,677	,853	,046	,387	,003	,819	,033
		N	76	76	76	76	76	76	76	76	76
	Dominance SAM	Pearson Correlation	,199	-,048	1	,007	-,131	,133	-,120	,176	,395**
		Sig. (2-tailed)	,086	,677		,953	,259	,252	,304	,128	,000
		N	76	76	76	76	76	76	76	76	76
	Presence SAM	Pearson Correlation	,031	-,022	,007	1	-,170	,171	-,097	-,069	,104
		Sig. (2-tailed)	,788	,853	,953		,143	,140	,403	,553	,372
		N	76	76	76	76	76	76	76	76	76
	Boredom	Pearson Correlation	-,221	-,230*	-,131	-,170	1	-,462**	,152	-,152	-,433**
		Sig. (2-tailed)	,055	,046	,259	,143		,000	,189	,191	,000
		N	76	76	76	76	76	76	76	76	76
	Pleasantness	Pearson Correlation	,528**	-,101	,133	,171	-,462**	1	-,574**	,220	,373**
		Sig. (2-tailed)	,000	,387	,252	,140	,000		,000	,056	,001

			N	76	76	76	76	76	76	76	76	76
		Frustration	Pearson Correlation	-,505**	,333**	-,120	-,097	,152	-,574**	1	-,130	-,122
			Sig. (2-tailed)	,000	,003	,304	,403	,189	,000		,263	,294
			N	76	76	76	76	76	76	76	76	76
		Intended aggresssion	Pearson Correlation	,381**	,027	,176	-,069	-,152	,220	-,130	1	,095
			Sig. (2-tailed)	,001	,819	,128	,553	,191	,056	,263		,415
			N	76	76	76	76	76	76	76	76	76
		Spatial presence MEC	Pearson Correlation	,187	,244*	,395**	,104	-,433**	,373**	-,122	,095	1
			Sig. (2-tailed)	,105	,033	,000	,372	,000	,001	,294	,415	
			N	76	76	76	76	76	76	76	76	76
Yes	Active	Valence SAM	Pearson Correlation	1	,302	,318	,127	-,643**	,428	-,742**	,370	-,116
			Sig. (2-tailed)		,239	,213	,628	,005	,087	,001	,144	,656
			N	17	17	17	17	17	17	17	17	17
		Arousal SAM	Pearson Correlation	,302	1	,672**	,354	-,436	,110	-,254	,154	,264
			Sig. (2-tailed)	,239		,003	,163	,080	,676	,324	,555	,306
			N	17	17	17	17	17	17	17	17	17
		Dominance SAM	Pearson Correlation	,318	,672**	1	,785**	-,639**	,439	-,325	,166	,449
			Sig. (2-tailed)	,213	,003		,000	,006	,078	,203	,524	,070
			N	17	17	17	17	17	17	17	17	17
		Presence SAM	Pearson Correlation	,127	,354	,785**	1	-,553*	,503*	-,340	,187	,262
			Sig. (2-tailed)	,628	,163	,000		,021	,040	,181	,471	,310
			N	17	17	17	17	17	17	17	17	17
		Boredom	Pearson Correlation	-,643**	-,436	-,639**	-,553*	1	-,450	,660**	-,306	-,118
			Sig. (2-tailed)	,005	,080	,006	,021		,070	,004	,232	,652

		N	17	17	17	17	17	17	17	17	17
	Pleasantness	Pearson Correlation	,428	,110	,439	,503*	-,450	1	-,484*	-,053	,076
		Sig. (2-tailed)	,087	,676	,078	,040	,070		,049	,840	,772
		N	17	17	17	17	17	17	17	17	17
	Frustration	Pearson Correlation	-,742**	-,254	-,325	-,340	,660**	-,484*	1	-,132	,058
		Sig. (2-tailed)	,001	,324	,203	,181	,004	,049		,614	,824
		N	17	17	17	17	17	17	17	17	17
	Intended aggresssion	Pearson Correlation	,370	,154	,166	,187	-,306	-,053	-,132	1	,000
		Sig. (2-tailed)	,144	,555	,524	,471	,232	,840	,614		1,000
		N	17	17	17	17	17	17	17	17	17
	Spatial presence MEC	Pearson Correlation	-,116	,264	,449	,262	-,118	,076	,058	,000	1
		Sig. (2-tailed)	,656	,306	,070	,310	,652	,772	,824	1,000	
		N	17	17	17	17	17	17	17	17	17
Passive	Valence SAM	Pearson Correlation	1	-,049	-,085	,376	-,010	,422	-,496	-,095	,464
		Sig. (2-tailed)		,868	,773	,185	,972	,133	,071	,746	,095
		N	14	14	14	14	14	14	14	14	14
	Arousal SAM	Pearson Correlation	-,049	1	,266	,488	-,456	,131	-,205	,125	-,268
		Sig. (2-tailed)	,868		,358	,077	,101	,654	,483	,669	,354
		N	14	14	14	14	14	14	14	14	14
	Dominance SAM	Pearson Correlation	-,085	,266	1	,170	-,131	,077	,171	-,294	-,033
		Sig. (2-tailed)	,773	,358		,561	,655	,795	,559	,308	,912
		N	14	14	14	14	14	14	14	14	14
	Presence SAM	Pearson Correlation	,376	,488	,170	1	-,459	,162	-,374	-,219	,248
		Sig. (2-tailed)	,185	,077	,561		,098	,580	,187	,451	,393

		N	14	14	14	14	14	14	14	14	14
	Boredom	Pearson Correlation	-,010	-,456	-,131	-,459	1	-,340	,400	-,102	-,215
		Sig. (2-tailed)	,972	,101	,655	,098		,234	,156	,728	,460
		N	14	14	14	14	14	14	14	14	14
	Pleasantness	Pearson Correlation	,422	,131	,077	,162	-,340	1	-,815**	,380	,148
		Sig. (2-tailed)	,133	,654	,795	,580	,234		,000	,181	,613
		N	14	14	14	14	14	14	14	14	14
	Frustration	Pearson Correlation	-,496	-,205	,171	-,374	,400	-,815**	1	-,164	-,325
		Sig. (2-tailed)	,071	,483	,559	,187	,156	,000		,576	,256
		N	14	14	14	14	14	14	14	14	14
	Intended aggresssion	Pearson Correlation	-,095	,125	-,294	-,219	-,102	,380	-,164	1	-,162
		Sig. (2-tailed)	,746	,669	,308	,451	,728	,181	,576		,579
		N	14	14	14	14	14	14	14	14	14
	Spatial presence MEC	Pearson Correlation	,464	-,268	-,033	,248	-,215	,148	-,325	-,162	1
		Sig. (2-tailed)	,095	,354	,912	,393	,460	,613	,256	,579	
		N	14	14	14	14	14	14	14	14	14