Are Video Games Truly Bad? Examining Positive and Negative Effects.

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Abstract

With the rise of video games, the association between violence in video games and aggression has received much attention. As results of previous studies remain mixed, this study focuses on the link between video games and aggression when considering potentially confounding or moderating factors. It was explored if gameplay is still a relevant predictor of aggression once family background is accounted for and if neurodivergent people experience higher aggression during gameplay. Game frustration as a possible cause for aggression was considered and positive effects of gaming were explored. For data analysis, two linear regressions were conducted to examine whether game playing affects trait aggression and if people with certain backgrounds are more likely to experience benefits from play. A mixed effects model measured whether people get aggressive immediately after playing video games even if there are no changes in long-term aggression. Further insight was gained through five follow-up interviews. The results suggest that there is a potential effect of frustration increasing aggression after playing video games, but not in the long-term and not because of game violence. It was identified that game characters can socially influence people more than the social violence in the games. Results also suggest that frustration seems to be a predictor for more post-game aggression in people with ADHD. Interviews revealed that video games provide an escape from arguments and disagreement for those with increased family conflict, and the games can help neurodivergent persons to put their minds on mute. In general, gaming was used as an escape and stress reduction from daily life. It was found to increase people's self-esteem by enhancing emotions of skill and competence and also offered positive social impacts.

Introduction

The foundation for today's video game industry was laid with the release of arcade-based console games in the early 1970s. People could visit gaming halls and restaurants to play their favourite games like Space Invaders or Pacman on coin-operated arcade machines. In the mid 90's many of those games were then ported over to home consoles, which only served to increase their appeal (Rowlands et al., 2016; Sestir & Bartholow, 2010; Green, 2017). From then on there was a rapid growth of the video game industry and nowadays, video games have achieved a place in popular culture all around the world (Rowlands et al., 2016; Sestir & Bartholow, 2010).

Nowadays, the gaming industry is even bigger than Hollywood and is only challenged by the television industry. In 2020 the estimated media revenue worldwide for pay TV and advertising was $400 billion, video games exceeded $160 billion, whereas movies only reached $45 billion of revenue (Mamerow, 2022; Statista, 2022b). Despite being far behind the two biggest gaming markets, China and the United States, Europe's number of gaming users exploded over the years as well. The Interactive Software Federation of Europe (ISFE), which represents the video game industry in Europe, published in 2020 that more than 51% of Europeans aged 6-64 play video games and the average age is 31 (ISFE, 2020). This refutes the stereotypical thought that most video game players are children or adolescents. What is more, COVID-19 boosted the expansion of the European gaming market even more, as statistics reveal that more than 51 million Europeans have begun gaming since the pandemic started, with the overall number of gamers climbing to 329.5 million in 2021 and predicted to exceed 351 million by 2023 (Statista, 2022; Skeldon, 2021).

With the rise of video games concerns from the public became louder (Rowlands et al., 2016). Especially the association between violence in video games and aggression has received much attention and it is asked how effective violent video games are in increasing

aggression when other factors associated with aggression are controlled for.

Video Games and Aggression

Aggression in itself is defined as physical or non-physical behaviour that is directed to harm or injure another person (Lemmens et al., 2010). To understand the link between violent video games and aggression the General Aggression Model (GAM) has been used. The model derives from already existing theories of aggression, such as cognitive neo-association theory, script theory, excitation transfer theory and social learning theory. These theories themselves have a great deal of overlap, which is why GAM seeks to combine them into a single model (Anderson & Bushman, 2002). In more detail, GAM proposes that personal variables such as gender or trait aggression, which is the proclivity to hold hostile beliefs, express anger and engage in verbal and physical aggression (Sherrill et al., 2016), as well as several situational variables such as hot temperatures, alcohol intoxication, or the degree of violence in video games, influence people's internal state, which include affect, cognition, and arousal. According to GAM, these internal states impact people's appraisal and decision-making processes which in turn influence behaviour (Verheijen et al., 2018; Bushman & Anderson, 2020).

In more detail, personal and situational variables influence affect by regulating moods and emotions. For example, situational factors like hot temperatures or pain can increase the personal variable trait aggression, which in turn leads to greater aggressive affect (Allen et al., 2018). Additionally, personal and situational factors can increase or decrease physiological and psychological arousal. Arousal from exercising, for example, can be misplaced as anger, thereby raising the risk of aggressiveness (Allen et al., 2018). In fact, many situational variables can increase arousal and aggressive affect, even non-violent video games. For example, sport video games like FIFA or perceptual skill games like Tetris that require rapid

responses and concentration can influence arousal by increasing blood pressure and heart rate (Anderson et al., 2010). However, the aggressive affect and physiological arousal ingested by a violent or non-violent video game diminish quickly, different to aggressive cognition (Anderson et al., 2010). Certain situational variables can activate aggressive thoughts through priming, for example, the exposure to violent video games. As a matter of fact, aggression-related perceptual and social schemata that include aggressive behavioural scripts are learned and are rehearsed constantly while playing violent video games (Anderson et al., 2010).

To sum up, a person's current internal state is comprised of affect, cognition, and arousal; changes in these variables modify the likelihood of aggression. Cognition is seen as the most likely route by which violent video games induce long-term aggression (Anderson et al., 2010). Yet, affect, cognition, and arousal can also interact and reciprocally influence each other (Allen et al., 2018). For example, priming aggressive cognition through the exposure to violent video games might increase feelings of anger and a desire for vengeance if the person is provoked. In such circumstances, the cognitive effect is viewed as the primary path of impact and the affective effect as a secondary route of impact (Allen et al., 2018). With regard to video games, it was found that the exposure to violence increased aggression through all three routes: cognition, affect and arousal (Verheijen et al., 2018; Bushman & Anderson, 2020).

In recent years, a counter argument has emerged, stating that any link between video games and aggression may not be due to violent content, but rather to other concerns such as frustration and difficulty (Ferguson et al., 2021). To explain this newfound link the frustration-aggression hypothesis was used. Its basic assumption is that frustration increases the tendency to act or react aggressively (Breuer & Elson, 2017). Breuer et al. (2015) examined the hypothesis in relation to video game play and discovered that the violent content in games is insufficient to explain aggression in players. In previous studies, the focus was mostly on violent games and there was only little consideration of non-violent games

(Lemmens et al., 2010). Yet, Breuer et al. (2015) discovered that game characteristics alone seem to be not sufficient enough to explain any effects on aggression. They found that a frustrating outcome, such as losing against a competitor, no matter the genre of the game, can increase postgame aggression.

Overall, the reviewed literature so far remains controversial. While some studies found a link between aggression and video games, others did not (Ferguson et al., 2008; Przybylski & Weinstein, 2019; Vuorre et al., 2022). Hence, it remains unknown if the violent content of the games causes or exacerbates aggressive behaviour, or if violence occurs due to aggressive tendencies that existed before the exposure to these games, rendering video games as irrelevant (Lemmens et al., 2010; Porter & Starcevic, 2007). In particular, there are specific methodological limitations of much research on video games, which makes it difficult to properly disentangle their relationship to aggression.

Video Games, Aggression and Methodological Shortcomings

A common criticism of video game research is that in typical studies participants completed experiments that were designed to imitate play. Mostly video games that were designed to immerse people for hours, which participants only played for a short period of time, were compared with puzzle games that are designed to fill time (Sestir, & Bartholow, 2010). Despite facilitating causal inference, these experimental manipulations of gameplay do not accurately represent play as it occurs naturally (Vuorre et al., 2022). First, most people play video games for a longer period of time, which could increase or decrease any possible effects of video games during and after play. Second, simple puzzle games with few rules and controls tend to be compared to more complex violent games (Scharkow et al., 2015). The shortcoming of such research designs might be overcome by means of prospective, naturalistic studies that measure the effect of video game violence on aggression in a realistic setting (Porter & Starcevic, 2007). Prior literature oftentimes omitted key confounders of aggression that could interfere with a possible link between violent video games and

aggression. Therefore, this study aims to use self-reports of play as well as interviews to capture experienced emotions during play as realistically as possible.

Confounding Factors that may affect the proposed Link of Video Games and Aggression

Video Games and Welfare

Repeatedly exposing children to certain factors like video game violence or also poor parenting can produce aggressive adults (Anderson & Bushman, 2002). Hence, a key predictor of later aggression in life can also be one's developmental environment. Watson et al. (2004) examined two family environments that appear to increase children's risk of developing aggressive behaviour: high-conflict and low-cohesive. Children with a high-conflict family environment that were disciplined by yelling, slapping and hitting, modelled those behaviours and used comparable aggression as a problem-solving strategy (Rana & Malhotra, 2005). Children in low-cohesive family environments, who express aggression in response to a parental request and get no parental response are taught that aggression is a method to avoid punishment. Thus, children will learn that aggression helps with problem-solving as well. This instilled use of aggressiveness becomes the primary approach for achieving social goals, and it can extend to the school setting and peers (Rana & Malhotra, 2005). If individuals learned aggressiveness through low-cohesive or high-conflict family environments it is important to consider if game playing is still a relevant predictor of aggression and, if it is, whether it is especially harmful for this group to play video games due to their greater risk of aggression.

In fact, Shao and Wang (2019) found that exposure to violent video games of individuals with a poor family environment had both direct and indirect effects on aggression. The violence in the games could aggravate the already greater risk of state and trait aggression. In contrast, a positive living environment, such as high-cohesive and low-conflicted, also discourage the use of aggressiveness, which could then in turn lessen the

effects of violent video games (Verheijen et al., 2018). Yet, more research is needed to understand if there is a link between living environment, violent video games and aggression, or only between living environment and aggression.

Player Vulnerabilities

A group particularly drawn to video games are neurodivergent individuals. The immersive and embodied aspects of video games help them to better describe their experiences (Meinen, 2023). Prior studies, however, did not explore the negative effects of violent video games on this population. Neurodiversity in general includes those individuals with neurological differences (Mcgee, 2012). The focus of this research will lay on individuals with autism spectrum disorder (ASD) and attention-deficit disorder (ADHD), since they are the largest groups outside of specific learning difficulties (Sumner & Brown, 2015), and video games gained especially high popularity among these two groups (Zolyomi & Schmalz, 2017). ADHD is defined by a persistent pattern of hyperactivity and/or impulsivity as well as inattention that impairs one's development or functioning in everyday life (American Psychiatric Association, 2013a). ASD on the other hand, is a complex developmental condition that involves continuous difficulties with social communication, repetitive behaviour and restricted interests, as well as the possibility to learn, move, or pay attention in different ways (CDC, 2022; American Psychiatric Association, 2013b).

ASD and ADHD are both associated with deficits in impulse control and response inhibition (Mazurek & Engelhardt, 2013). Hence, violent video games might affect neurodivergent people more negatively. In fact, meta-analyses have suggested that exposure to violent video games causes increases in physiological arousal, which could increase aggressive affect, but that it wears off during long playing sessions (Anderson et al., 2010). However, different to typically developing people autistic people's ability to downregulate arousal is impaired (Berkovits et al., 2016). Therefore, they could have a hard time controlling their experienced physiological arousal and the resulting increase in aggressive affect.

Mazurek et al. (2015) asked individuals with ASD about their own negative experiences with video games. They discovered that autistic people oftentimes become easily frustrated due to other players or because the levels get harder and harder, and that frustration is found to be a trigger of aggression (Cohen & Tsiouris, 2020). This finding could suggest that the two groups, or especially autistic people, will only respond with more aggression if they are also frustrated.

Masi et al. (2021) found that extensive playing of video games increased people's ADHD symptoms of impulsivity. In fact, overstimulation, or low frustration tolerance in people with ADHD can lead to impulsive outbursts, that are often perceived as aggression (Ramirez et al., 1997). Meltdowns occur in people with ASD as a physical and emotional reaction to a circumstance from which they cannot escape. They are caused by peaking stressors and nervous system overload, resulting in an explosive behavioural release. Yet, the person is usually unaware of what is going on, therefore there has no intention to harm others (Bedrossian, 2015). Hence, there is the possibility that people with ASD and ADHD will display frustration more when playing games, but not more aggression.

Mazurek et al. (2015) interviewed 58 people with autism to understand the positive effects of video games, and why in particular gaming is so appealing to them. Most of the time answers of stress relief and an escape from reality in which they can do what they cannot do in everyday life were given. Video games help them to hold social interactions, for example with family members (Mazurek et al., 2015). People with ADHD had similar reasons. The games allow them to master skills on their own terms, help with social connections and provide an escape from reality as well. Additionally, they offer a hyperfocus on things that are enjoyable and interesting (Boyle Wheeler, 2020).

Positive Impacts of Gaming

Autistic people and those with ADHD identified a number of benefits from video game play, such as the possibility to master things they cannot do in everyday life, helping with social connections and offering an escape from reality (Mazurek et al., 2015; Boyle Wheeler, 2020). These benefits are likely relevant beyond these specific populations and there is evidence of wider benefits of game playing. Granic et al. (2014) illustrated that video games indeed had positive influences in cognitive, emotional and social domains but that there is still more to learn. In particular, playing video games seems to promote a wide range of cognitive skills, especially shooter games such as Counter-Strike or Battlefield. Individuals that played such games show faster and more accurate attention allocation, higher spatial resolution in visual processing, and enhanced mental rotation (Granic et al., 2014). What is more, studies showed that playing favourite video games increased positive emotions and improved individuals' moods (Ryan et al., 2006; Russoniello, O'Brien, & Parks, 2009). As video games developed, they became highly cooperative or competitive, with over 70% of gamers playing with a friend (Granic et al., 2014). Virtual social communities were created in which players need to make decisions together and decide of whom to trust to be most effective as a group. Therefore, video games that require social interaction can sometimes provide a sense of community. In these communities' social skills and prosocial behaviours can improve which in turn may transfer to peer and family relationships outside of the gaming environment (Granic et al., 2014).

Summary and Hypotheses

Previous studies showed mixed results and/or methodological shortcomings regarding the link between violent video games and aggression. Therefore, further research is needed to examine the association between video games and aggression when taking into account potentially confounding or moderating factors. Hence, this study aims to investigate if

gameplay is still a relevant predictor of aggression once family background is accounted for and, if so, whether it is especially harmful for this group to play video games due to their greater risk of aggression. What is more, it will be examined if neurodivergent individuals (ASD and ADHD) experience more or less aggression during gameplay. Whether they only respond with more aggression when they are also frustrated, or if they will display more frustration when playing games, but not more aggression. Finally, it will be explored if people with a certain family of neurodiversity backgrounds are more likely to experience cognitive, emotional and social benefits from playing video games.

If game violence has an effect on aggression than the following hypotheses would follow:

H1: After controlling for developmental background, neurodiversity and frustration, video game play remains associated with long-term aggression.

H2: After controlling for developmental background, neurodiversity and frustration, video game play remains associated with immediate aggression after playing.

H3: After controlling for developmental background, neurodiversity and frustration, video game play remains associated with cognitive, emotional and social benefits.

Methods

Participants

Participants were recruited via convenience sampling using the SONA-system at the University of Twente. The platform offers the opportunity to share and take part in research studies from students and university staff. Additional convenience sampling was achieved through the researcher's personal network. In total 102 participants took part in the study (50 female; 50 male; one non-binary / third gender; one preferred not to say; *M*age = 26; *SD*age =

8.1). Eleven participants were recruited via SONA and 91 participants over the researcher's personal network. The age ranged from 18 to 60. Most participants were German (N=80), followed by Dutch (N=17), Turkish (N=2), Colombian (N=1), Italian (N=1) and Austrian (N=1), and one preferred not to say. Additionally, most participants were students (N=49), closely followed by working (N=48). A few preferred not to say (N=3), chose unemployed (N=1), or chose other but did not further specify (N=1). High-school degree as an obtained degree was selected most by participants (N=55), followed by Bachelor's degree (N=29), Master's degree (N=13) and other (N=5).

Procedure & Materials

The study consisted of two parts: an initial survey, in which hypothesised relationships were tested based on participants estimates of gaming behaviour, and an in depth semi-structured interview, in which follow-up questions were asked to acquire a better understanding of the different aspects of the study. Both aspects were conducted in English and in German.

Initial Survey

First, participants were given information about the purpose of the study, their task and how long it will take. Further, risks of taking part in the study and how to withdraw from it were listed. Lastly, participants were informed of how their data is stored and contact details of the researcher for additional questions were given. Then participants were asked to complete an online consent form, with which they agreed or denied their voluntary participation in the study. The information sheet and the consent form can be found in Appendix A. Next, they were asked to state their age, gender, nationality, occupation, and level of educational qualification. Subsequently, participants were presented with questionnaires regarding their developmental environment and trait aggression. Further, they

were asked about their preferred games and use frequencies and for each mentioned game they were questioned about state aggression and their experienced frustration when playing as well as how they respond when the game gets hard or feels unfair. Next, a questionnaire of perceived cognitive, emotional and social benefits of video game playing was presented and lastly screening measures for ADHD and ASD. All questionnaires can be found in Appendix C and D and will be discussed in more detail in the following.

Developmental Environment. To observe the nature of participants family environment, a brief version of the Relationship dimension from the Family Environment Scale (FES) by Moos and Moos (1994) was used. The dimension, which consists of the subscales Cohesion, Expressiveness, and Conflict, assesses a person's impression of the quality of their family relationship functioning and involves 16 items. The subscales were analysed separately from each other. The first subscale, Cohesion, assesses the level of commitment, assistance, and support provided by family members to one another. An example would be “In our family there is a feeling of togetherness”. It involves 7 items and shows a good reliability (α= .86). The second subscale, Expressiveness, measures how much family members are encouraged to express their emotions directly. For example, “In our family we can talk openly in our home”. The subscale consists out of 3 items and shows reliability in the sample (α= .60). The last subscale, Conflict, estimates the quantity of openly expressed anger and conflict among family members, an example would be “In our family we raise our voice when we are mad”. It consists out of 6 items and shows a good reliability (α= .84). All items were answered via a 4-point Likert scale (0 = strongly disagree; 1= disagree; 2= agree; 3= strongly agree).

Trait Aggression. To measure long-term aggression (trait aggression), as one dependent variable for the regression part of the study, the Brief Aggression Questionnaire by Webster et al. (2013) was used. The four subscales are: (1) Physical aggression, (2) Verbal aggression, (3) Anger (4) Hostility. They involve 29 items and showed a good reliability in

the sample (α= .85). The first subscale, physical aggression, reflects how physical aggressive a person tends to be, for example “If somebody hits me, I hit back”. The second subscale, verbal aggression, relates to people’s willingness to verbally express aggression. An example would be “When people annoy me, I may tell them what I think of them”. The third subscale, anger, measures people’s anger, by for example stating, “I sometimes feel like a powder key ready to explode”. The last subscale, hostility, measures people’s tendency of hostile thoughts, for example “I wonder why sometimes I feel so bitter about things”. Additionally, all items were answered via a 5-point Likert scale (1= Extremely uncharacteristic of me; 2= Uncharacteristic of me; 3= Neither characteristic nor uncharacteristic of me; 4= Characteristic of me; 5= Extremely characteristic of me).

Gaming Habits, State Aggression and Frustration. Video game habits were measured by asking participants to list their top three currently played video games and additionally the number of hours they would spend per week on each (less than 1 hour; between 1 and 3 hours; between 3 and 5 hours; between 5 and 10 hours; more than 10 hours). It was stated that participants did not have to fill out all three games, but just as much as they tend to play on a regular basis. Participants that were non-gamers were able to skip this part and continued with the short Autism-Spectrum Quotient.

A 5-point Likert scale (1=Strongly Disagree; 2= Somewhat Disagree; 3= Neither Agree nor Disagree; 4= Somewhat Agree; 5= Strongly Agree) measured participants’ level of frustration when playing their top three games. Participants were asked to imagine how frustrated they would feel when they play the first, the second, and the third game that they listed. Two items were used: “When the game gets hard or feels unfair, I get easily frustrated”, and “Sometimes I feel so frustrated when playing that I have to quit the game “. The two items were added to measure participants level of frustration for each game.

To measure the other dependent variable, immediate aggression after playing (state aggression), direct questions linked to the listed video games were asked. The items were

taken from the Brief Aggression Questionnaire by Webster et al. (2013), that is also used in this study to measure trait aggression, yet the items were modified to measure state aggression. Thus, for example “I have become so mad that I have broken things.” changed to “After playing this game, I have become so mad that I have broken things.”. The first three subscales (Physical aggression, Verbal aggression, Anger) were used, but items were taken out of the questionnaire to shorten it. The questionnaire was left with 8 items that were asked per game and via a 5-point Likert scale (1= Extremely uncharacteristic of me; 2= Uncharacteristic of me; 3= Neither characteristic nor uncharacteristic of me; 4= Characteristic of me; 5= Extremely characteristic of me). It showed a good reliability in the sample (α= .85).

Cognitive, Emotional & Social Benefits. To assess the benefits of video game playing a questionnaire by Dupláa et al. (2017) was used. The questionnaire consists of three subscales: Cognitive Benefits, Social Benefits and Emotional Benefits. There was one question for all items: “In your opinion, has playing video games increased or decreased the following:”. An example for the first subscale would be then “Attention”, for the second “Links with family”, and for the third “Feeling lonely”. Yet, according to the researcher the third subscale lacked content validity and did not thoroughly capture why people game, as there are more emotional benefits than “Self-confidence”, a decrease in “Feeling depressed” and a decrease in “Feeling lonely”. Thus, three items were added: “Feeling relaxed”, “Feeling stressed”, and “Feeling worried”. An increase or decrease in the added items capture further emotional benefits of gaming and reflect the researcher's concept of gaming motivation. The questionnaire involved 15 items then and all items were answered via a 3-point Likert scale (1=Decreased; 2= No difference; 3= Increased). In the sample the questionnaire showed a good reliability (α= .78).

Neurodiversity. To identify the neurodiversity of participants two scales were used: (1) Short Autism-Spectrum Quotient (AQ) and (2) Adult ADHD Self-Report Scale (ASRS).

The short version of the Autism Spectrum quotient by Allison et al. (2001) measures the degree to which an adult possesses characteristics associated with the autistic spectrum. The quotient consists of 10 items. There are items where agreement indicated ASD and other where disagreement indicated it. For example, when participant selected definitely or slightly agree for “I often notice small sounds when others do not”, one point can be scored. When participants selected definitely or slightly disagree for, for example: “I find it easy to ‘read between the lines’ when someone is talking to me”, one point can be scored as well. Participants who score six or above are considered to score high on the screening measure and might be autistic. Participants who score under six might not be autistic. The AQ showed poor reliability in the sample (α= .51).

The ADHD Self-Report Scale (ASRS) by Kessler et al. (2005), includes 18 items and assesses the frequency of DSM-IV symptoms of adult ADHD. The Scale is divided into two parts: Part A and Part B. Part A contains nine items that are most predictive in identifying ADHD. Part B contains nine additional items that provide further cues and probes into the patient’s symptoms (Kessler et al., 2005). As Part A already identifies if participants might experience symptoms of ADHD, Part B is excluded from analysis. In more detail, participants that score 24 points or more on Part A, are highly likely to have ADHD. Participants that score between 17-23 points, are likely to have ADHD and if they score 0-17 points, they are not likely to have ADHD. An example of Part A would be “How often are you distracted by activity or noise around you?". The items were answered via a 5-point Likert scale (0= Never; 1= Rarely; 2= Sometimes; 3= Often; 4= Very Often). Part A of the ASRS (α= .82) showed good reliability in the sample.

After filling out all questionnaires, a debrief followed and participants were invited to take part in the second component of the study, the interview (Appendix B). Participants could sign up by stating their email address.

Interviews

In total five interviews were held; participants were chosen via purposive sampling. Participants with higher scores for family conflict and neurodiversity were sought, as well as those playing games with high and low age ratings. One participant was chosen for the interview because they scored higher in trait aggression but there was no increase in state aggression or frustration after gaming. Lastly, a participant that just mentioned 'any story game' when being asked to list their top three played games in the first part of the study was chosen. Nothing could be said about the age rating of the games they played, it was wished to find out if they played violent games and if so whether they were associated with aggression. An overview of all interviewees can be found in Table 1.

Table 1

Demographics Interview

	M	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5
Trait Aggression	2.44	2.79	3.14	2.17	2.48	2.52
State Aggression	1.53	3.13	1.25	2.36	1.13	1
Frustration	2.55	3	1.50	2.50	3	2
Family conflict	3.15	2.50	3.83	3.50	3	1.83
ASD	3.21	3	4	1	9	1
Age rating	2.40	3.67	3	4.33	2.33	-

These participants were then contacted via email to set-up date and time for an online meeting via Microsoft Teams. Recordings were made from all interviews and were stored directly on the researcher's laptop and could only be accessed by a password. The recordings were deleted after anonymised transcripts were made and analysis was finished.

In the beginning the researcher explained the purpose of the interview, before explaining that the interviewee does not have to answer questions, they feel uncomfortable with and that they can withdraw at any time without penalty. Further, it is asked if they consent of being recorded.

For questions the semi-structured interview guide from Shi et al. (2019) was taken as an inspiration. The script overlapped with the researcher's interests by finding the influences of video gaming and why people play video games. It tries to find out more about participant's background by asking: "How many years have you been gaming for?", their motivation of gaming: "What makes you want to start playing?", and what type of games they tend to play. Yet, the script from Shi et al. (2019) focuses more on the positive aspects as well as the negative effects of extensive playing, rather than how people handle frustration and reasons if and why they feel aggressive when playing games. Therefore, the script was modified to understand people 's feelings on how or if they think gaming has affected them negatively or positively with regard to aggression and frustration in particular. Questions concerning game frustration and potential benefits were added to Shi et al. (2019) script, as well as feelings and emotions when playing. Such as, "What type of emotions or situations make you want to start playing?", "Do you gain additional benefits from gaming?", "What do you dislike?", "What makes you want to stop playing or take breaks?", or, "Do you in any way feel influenced by the violent content?" (Appendix E). Interviewees mostly answered the questions directly but also got side-tracked by other things they wanted to share. The interviewer let them speak and also asked follow-up questions, as long as it was relevant to the research question and provided insight that have not been anticipated when the topic guide was developed.

Data Analysis

Games violence was classified through PEGI (Pan-European Game Information) age ratings. PEGI provides video game age classifications in 38 European countries. The age rating verifies that the game is suitable for players of a specific age. Those PEGI age labels are 3, 7, 12, 16, and 18 (PEGI, Pan-European Game Information, 2017). PEGI 3 contains a very mild form of violence, for example in a comical context or a childlike setting. PEGI 7 also includes very mild forms of violence like implied, non-detailed, or non-realistic violence. PEGI 12 video games depict slightly more graphic violence against fantasy characters or non-realistic violence against human-like characters, any bad language however must be mild. PEGI16 is used if the representation of violence looks the same as in real life. Additionally, the use of bad language in games with a PEGI 16 classification can be more intense, as can the usage of tobacco, alcohol, or illegal narcotics. PEGI 18, the adult rating, is given when the level of violence reaches a point where it depicts gross violence, motiveless killing, or violence against defenceless characters.

Before analysis it was noted that two participants did not answer the questions for the number of hours they played and seven did not mentioned which kind of game they played. Yet, those participants were still considered for analysis as they filled out the questionnaires for state aggression, frustration and benefits. It was obvious that they gamed, but it was unknown what sort of games they played or how many hours they spent playing. Hence, for the interviews a person who gave ‚any story game‘ as an answer was considered, as it was interesting to see the age rating for their story games compared to their results.

R-Studio (v4.1.2; RStudio Team, 2022) was used for analysis and the tidyverse package (Wickham et al.,2019), lme4 package (Bates et al., 2015), and lmerTest package (Kuznetsova et al., 2017) were loaded. Pearson correlations were performed to examine possible relationships between the variables. In the beginning mixed effects models were aimed to use, to analyse trait aggression and benefits. Mixed effects models are a good choice for the present data structure, because they are able to control for correlations within

participants across the three video games. However, they did not converge. Thus, a simpler model was considered: two linear regressions. This bears obvious disadvantages, such as disregarding the nesting data structure. So, different to a mixed effects model these models do not separate between within and between participant effects.

The primary model includes trait aggression as the outcome variable and family environment, the ASD and ADHD scales and frustration as predictor variables. Further, the average time spent playing on the three games and the average age rating (PEGI score) for the games were allowed to interact. The model seeks to determine how game playing affects trait aggression after it is controlled for family background, neurodiversity and frustration. The outcome variable of the second model is benefits with family environment, the ASD and ADHD scales and frustration as predictors. The average of time spent playing and the average of age rating were allowed to interact. The model aims to ascertain if people with certain backgrounds are more likely to experience benefits from playing video games.

For the last analysis the mixed effects model did converge, and the model was conducted for state aggression, with a random intercept for each participant. The model contains state aggression as the outcome variable and family environment, the ASD and ADHD scales and frustration as predictor variables, and time spent playing and age ratings were allowed to interact. The model predicts whether people get aggressive immediately after playing video games, even if there is no long-term change in trait aggressiveness.

For the qualitative part thematic analysis was performed. In particular, deductive analysis was used. The interviews were aimed as follow-up research of the initial survey and were expected to provide further details for answering the hypotheses. It was intended to acquire a better understanding of interviewees starting point of gaming, reasons to play as well as their perceived benefits of gaming. Further, game aggression and frustration as well as the violent content of the games were investigated. Additionally, it was aimed to analyse if neurodiversity and family background influence gaming. Thus, starting codes were built in

advance of the analysis, which were: (1) Starting point of gaming, (2) Benefits, (3) Frustration, (4) Aggression, (5) Violent content, (6) Neurodiversity and (8) Family background. However, during analysis changes were made to the starting codes. Benefits was divided into three smaller codes, which were about the specific benefits found, namely 'Escapism and Stress relief', 'Maintaining Self-Esteem' and 'Differences to other media'. Similarly, the frustration and aggression codes were modified into codes about the causes of those two: 'Difficulty' and 'Social impacts'. The code social impacts also entailed social benefits that were found during analysis. As only one potential person with autism was found to interview and answers were quite similar to those of other respondents, neurodiversity was integrated in the general codes, this was the same for family background.

Results

Descriptive Statistics

The descriptive statistics for outcome and predictor variables can be found in Table 1. The sample included gamers and non-gamers, which is why some variables differed in their sample size. State aggression was found to be non-normally distributed, with skewness of 1.55, *SE* = .08. Before analysis Log Transformation was performed to compensate for the variable's skew.

Approximately 8.8% of the participants scored 6 or above on the ASD scale and 10.7% scored 24 or more on the ADHD scale. Further, 0.5% of the participants reported a formal diagnosis with ASD and 4% indicated a formal diagnosis with ADHD.

Table 2

Descriptive statistics for Outcome and Predictor Variables

		M	*SD*	*Lower quartile*	*Median*	*Upper quartile*
5-point Likert scale	Trait Aggression	2.44	0.53	2.07	2.48	2.80
5-point Likert scale	State Aggression	1.53	0.69	1	1.25	1.94
3-point Likert scale	Benefits	2.12	0.18	2	2.13	2.27
5-point Likert scale	Frustration	2.55	1.16	1.50	2.50	3.50
5-point Likert scale	Hours	1.97	1	1	2	3
5-point Likert scale	Age ratings	2.40	1.18	1.67	2.33	3.33
	ASD	3.21	1.88	2	3	4
5-point Likert scale	ADHD	15.45	6.25	10.50	15	20
4-point Likert scale	Family Cohesion	3.15	0.52	2.86	3.14	3.57
	Family Expressiveness	2.82	0.59	2.33	3	3.33
	Family Conflict	3.15	0.58	2.07	3.17	3.50

For Trait Aggression, ASD, ADHD, Family Cohesion, Expressiveness and Conflict, N= 102, for all other comparison n= 67.

Correlations

Pearson's correlations were performed to identify possible relationships between the variables (Table 2). Ten positive significant correlations were found. Trait aggression was found to be strongly correlated with ADHD, r (96) = .36, $p < .001$. ADHD was also significantly correlated with state aggression, r (62) = .29, $p < .019$, and with frustration, r (62) = .36, $p < .004$. What is more, state aggression was also found to be correlated with diagnosed ADHD, r (63) = .37, $p < .002$.

Additionally, a positive significant correlation was found for trait aggression and family conflict, r (96) = .22, $p < .003$, for state aggression and family conflict, r (64) = .25, p

< .047, and for benefits and family conflict, r (64) = .25, p < .047. Frustration was positively correlated with trait aggression, r (93) = .27, p < .031, and with state aggression, r (93) = .39, p < .001. State aggression and trait aggression were also positively correlated, r (63) = .50, p < .001. Lastly, benefits was positively correlated with age ratings, r (55) = .57, p < .001.

Table 3

Pearson's Correlation between Outcome and Predictor Variables

	1	2	3	4	5	6	7	8
1. Trait Aggression	1							
2. State Aggression	*.50*	1						
3. Benefits	-.15	-.11	1					
4. Family Conflict	*.22*	*.25*	*.31*	1				
5. Frustration	*.27*	*.39*	-.25	.13	1			
6. ADHD	*.36*	*.29*	-.24	.12	*.36*	1		
7. Diagnosed ADHD	.15	*.37*	-.05	.01	.01	.31	1	
8. Age ratings	-.07	-.15	*.57*	-.20	-.16	-.20	-.28	1

Trait Aggression

A linear regression, with only participants that play games, was calculated to answer the first hypothesis, and predict how game playing affects trait aggression after controlling for family background, neurodiversity and frustration. Family cohesion, family expressiveness, family conflict, frustration, ASD and ADHD were used as predictor variables and hours played, and age ratings were allowed to interact. The results of the regression indicated that the predictors explained 38% of variance, R^2 = .38, F(10, 40) = 2.48, p = .02. ADHD was found to be the only significant predictor of/on trait aggression, SE = 0.01, t = 2.06, p < .04.

All results can be found in Table 3.

Table 4

Summary Results of Trait Aggression Linear Regression

Predictors	*B*	*SE*	*t*	*p*
(Intercept)	3.02	.080	3.77	< .001
Hours:Age ratings	0.003	0.07	0.05	.961
Hours	0.03	0.19	0.15	.882
Age ratings	0.04	0.14	0.29	.769
Frustration	-0.01	0.07	-0.13	.899
Family cohesion	-0.17	0.25	-0.69	.491
Family expressiveness	-0.30	0.17	-1.76	.087
Family conflict	-0.003	0.15	-0.02	.984
ASD	-0.01	0.04	-0.31	.76
ADHD	0.03	0.01	2.06	.04

Benefits

Another linear regression, with only participants that play games, was used to answer the third hypothesis, and to identify if people with certain family or neurodiversity backgrounds are more likely to experience benefits from playing video games. Family cohesion, family expressiveness, family conflict, frustration, ASD and ADHD were used as

predictor variables and hours played, and age ratings were allowed to interact. Results indicate that there was no significant effect between benefits and the predictor variables, R^2 = .23, $F(10, 40) = 1.17$, $p = .342$, and no interaction effect was found, $SE = 0.03$, $t = -0.58$, $p < .567$. The results can be found in Table 4.

Table 5

Summary Results of Benefits Linear Regression

Predictors	*B*	*SE*	*t*	*p*
(Intercept)	1.93	0.31	6.27	< .001
Hours:Age ratings	-0.02	0.03	-0.58	.567
Hours	0.05	0.07	0.69	.492
Age ratings	0.06	0.06	1.16	.254
Frustration	-0.02	0.03	-0.62	.536
Family cohesion	0.08	0.09	0.87	.391
Family expressiveness	-0.07	0.07	-1.02	.313
Family conflict	0.04	0.06	0.63	.532
ASD	-0.01	0.02	-0.56	.569
ADHD	-0.01	0.01	-1.26	.214

State Aggression

A mixed-effects model was used to answer the second hypothesis. It measured

whether people get aggressive immediately after playing video games, even if there is no long-term change in trait aggressiveness. Hence, in this analysis only participants that play video games are included. The random effect was ID, with predictor variables of family cohesion, family expressiveness, family conflict, frustration, ASD and ADHD. Further, hours played, and age ratings were allowed to interact. The between participants standard deviation was .11 and the residual standard deviation was .57. Significant effects were found for frustration on state aggression, $B = 0.13$, $t = 5.5$, $p < .001$, and for ADHD on state aggression, $B = 0.02$, $t = 2.01$, $p = .049$. All other effects were non-significant and can be found in Table 5.

Table 6

Summary Results of State Aggression Mixed Effects Model

Predictors	*B*	*SE*	*df*	*t*	*p*
(Intercept)	0.30	0.40	60.43	0.75	.457
Hours:Age ratings	0.01	0.01	81.44	0.46	.644
Hours	0.01	0.05	78.4	0.30	.766
Age ratings	.02	0.05	82.38	0.45	.655
Frustration	0.13	0.02	96.12	5.50	< .001
Family cohesion	-0.12	0.14	42.34	-0.81	.42
Family expressiveness	-0.01	0.09	47.10	-0.08	.939
Family conflict	-0.08	0.08	50.91	-0.99	.327

ASD	-0.02	0.02	44.92	-1.05	.3
ADHD	0.02	0.01	51.24	2.01	.049

Exploratory Analyses

A Welch Two Sample t-test was conducted to compare gamers and non-gamers with respect to Trait Aggression. The 67 participants who gamed (M = 2.4, SD = 0.5) compared to the 35 participants that do not play video games (M = 2.5, SD = 0.5) demonstrated no significantly different trait aggression, $t(92) = -0.03$, $p = .759$. Additionally, another three Welch Two Sample t-test were conducted to compare gamers and non-gamers with respect to ASD, ADHD, and family conflict. Participants who gamed (M = 3.1, SD = 1.9) compared to non-gamers (M = 3.3, SD = 1.8) did not significantly differ in ASD. Likewise, gamers (M = 15.53, SD = 6.11) did also not significantly differ from non-gamers (M = 15.4, SD = 6.5) in terms of ADHD. However, significant effects were found for family conflict, $t(90) = 2.15$, p = .03. The 67 participants who gamed (M = 1.8, SD = 0.6) compared to the 35 participants that do not play video games (M = 1.9, SD = 0.6) demonstrated a difference in family conflict.

Since linear regression found no effect for benefits mean scores for the listed benefits were calculated, with the result that cognitive benefits (M = 2.4, SD = 0.4) and emotional benefits (M = 2.4, SD = 0.4) were slightly higher than social benefits (M = 2.2, SD = 0.4).

Interviews

For the interviews, the results were ordered in the following categories: Starting point of gaming, escapism and stress relief, maintaining self-esteem, differences to other media, social impacts, difficulty, and violent content. The order was chosen because it narratively helps to understand why participants game and what pros and cons, they experience through

it. It was also intended to address the research question by discussing potential causes of aggression and how participants deal with them.

Starting Point of Gaming

Across all five interviews, the gaming started when they were children, mostly around the age of 8 or 9. Their perceived benefit when they started gaming, was enjoyment, and they wished to continue having access to the medium. They all played a lot during their childhood and teenage years. Yet, they reported that their play time decreased with age. One participant explained that since he started going to the gym, he almost quit gaming as his priorities changed. Nowadays, they mostly play on the weekend, or late in the evening due to them having a job or other hobbies. Nevertheless, they all still have multiple reasons to play.

Escapism and Stress relief

The participants with high scores on the brief AQ reported that they never made a connection between gaming and if or not, it helps with their thoughts and feelings. Gaming was seen as a hobby, something to do in leisure time. Yet, the participant stated that gaming could indeed help them to put their mind on mute: “Whenever I play, I don’t think. I am just fantasising of what to do next, without really thinking”. It was found that this was the case for other interviewees as well: “I like that I can dive into a whole different world and that I can forget about mine”. They can enter a world in which they can relax and take a break from their stressful lives.

One person that signed up for the interview was found to score moderately high in family conflict. In the interview they said that oftentimes they start playing because of a stressful environment due to conflicts with friends or within the family. Yet, their playtime only increases a bit more: “It helps to blend out the conflicts. But it is not a method to compensate for them. The problems are not gone through gaming, but in the first place they help to clear my head”. Another one stated that frustrating days motivate them to play. As an example, they named a recent event in which their colleagues did their work badly and the

interviewee got scolded for it: “That really frustrated me and then basically the first thing I did, after taking a shower was getting into bed and turning on my Xbox”. Across all five interviews participants agreed that gaming is an easy way to escape reality, without them having to take much effort. They are involved directly into this other world, and it offers them the possibility to do things they cannot do in everyday life.

Maintaining Self-Esteem

Video games made participants feel skilled and competent in part because they make it easier to engage in behaviour not possible in reality. The one participant that scored above the threshold of ASD explained that: “I like plants, but I cannot build myself a big plants bed outside or a forest. However, when I play Animal Crossing, I am able to do so”. They explained further that some of their games remind them of puzzling or crafting which they also like to do. Yet, they can play the games without much effort: “I also like crafting but after that I always have to clean”. Games also often directly presented participants with clear markers of progress and achievement. Two interviewees mentioned that for them gaming is about their achievement in the game and experiencing that their character or own skill level, levels up. The success found in the video games offered the participants the opportunity to increase their self-esteem, one participant reported that: “I was not the best student in school, I did not have any motivation to change that, and I also wasn’t the most popular kid. I guess I used the games as an escape from reality back then, I was like: It is not going well in real life, at least let me be good in the video games”.

Nevertheless, some participants reported that they took their experienced game frustration sometimes with them in the real world, but mostly when they were younger. The interviewee with moderately higher family conflict explained: “For example when I played Counterstrike and then lost a match and someone came into my room, like my parents or one of my siblings, it could have happened that I yelled at them. So, something like: What do you want? Just go away!”. Participants explained that this was because they paid far more

attention to the games and made them a part of their identity than they do nowadays: “My life does not depend on it, it is just for fun.”. However, the interviewee who scored higher on the brief AQ reported that they took their frustration with them in the real world quite recently and they yelled at the people around them. A lot of different things also happened on this day and the frustration experienced through the game was just “the cherry on top”, hence it is hard to isolate the game as the specific cause for aggression as it is rather an interplay of different causes.

Differences to other media

In contrast to other media, games offer the opportunity to interact with the world: “I like that I have to work with my character through missions. It is better than a book and also better than a movie, because there I can’t do anything, I cannot interact”. Mostly the storyline was what makes a video game different to a movie or a book. One participant that just mentioned ‘any story game’ as their most played game, reported that it is mainly about the story for them and not any specific game. Participants mentioned that it was about being a part of the game and that the story is unfolding as a reward for their efforts: “I always get a small push of adrenaline whenever an important scene comes up. I kind of lose my connection to me and my body and I am just in the game. It is just that I can relax”.

Yet, there was also a non-story element that makes a video game different to a movie or a book: the possibility to explore a world a not only follow a story. One participant gave an example from ‘The Legend of Zelda: Breath of the Wild’: “I really like the whole make of the game and like the overall storyline that you have to like to save the Kingdom and save the Princess and stuff like that. But I think it's more of the riding around and finding out a lot of stuff about the world that you're in while you are Link”.

Beliefs of cognitive benefits gained through gaming, like decision making were named as well. One participant even thinks that in his environment there was a difference between gamers and non-gamers and their response rate when driving. Further, another interviewee

believed that their strategical thinking improved: “because you have to assess the situation. And that is what makes it fun”.

Social Impacts

There was one last benefit mentioned: the social aspect. A lot of the interviewee’s made new friends through gaming. One explained that: “It does not matter how you look or if you are poor or rich. You can find new friends based on your character without social expectations”. This was especially meaningful for them because they were not the most popular back in school, but it was alright how they were because other people online accepted them. On the other hand, video games also offered the interviewees to play with already existing friends. “The social aspect is also a great benefit. I kind of like that they function like a social glue. It is just fun to play with others”, the participant further explained that multiplayer games, like Mario Kart, help to bring their friends together. Another one believes that video games improved their teamwork since they learned how to work together as a team to be able to defeat the other. Yet, playing with others also had negative effects.

Multiplayer games are seen as fun by most participants, as long as they are not losing against their opponent. “I am really competitive”, was one of the sentences that was said the most when talking about multiplayer games. Most participants reported that they were frustrated about the mistakes they made, they knew that they could have done it better. “Whenever I lose against someone who is on the same skill level or even under mine, that gets me frustrated. Because I know that I could have done it better”, however, this frustration was not followed by aggressive behaviour or non-verbal displays of aggression. Yet, they reported that whenever a match gets intense it can happen that they scream against their PC or console or also quit the game: “When I am losing five to six times in a row then I oftentimes quit the game because I can’t see it anymore”. Participants seemed to target their anger at the game or the gaming machine rather than their fellow players.

Nevertheless, losing was also seen by most as a normal consequence when gaming: “There are people above my skill level, and I accept that”. In fact, most participants were affected by a different aspect when playing multiplayer games: “It is not about the game or my abilities but rather about the community”. Participants reported negative and mean comments that were made when they have lost a game. “Online communities can be very toxic”, reported one interviewee, “If someone is better than you, they will arrogantly let you know”. This aspect is the reason that most of the participants decide to quit the game: “I’m annoyed because of the people. This was the reason why I took a longer break from a game. Nowadays I do not take it personally anymore, because I do my own thing and I can do it well. If other people make wrong decisions, that’s not my problem”. However, in the past they were upset relatively quickly by those comments.

Interviewees reported that quitting a game does not only happen for games with online communities but also for games, like Mario Kart, in which your opponents can sit right next to you on the couch: “When I play games with other people and notice that I get frustrated I oftentimes quit playing and just watch the others play instead”. They reported that they would rather stop the game than to aggravate their frustration, as this could lead to them yelling at those around them. A lot of times there are also side comments from opponents that can trigger getting frustrated or getting angry, but mostly it was reported that this was all in a fun way, because the games are played with friends.

Difficulty

In multiplayer games, the opponents’ comments can trigger frustration, but none of the participants reported higher aggression. They did get loud sometimes, by which they screamed against their console, but it was not directed against another human.

In contrast, single-player games were mainly ended due to difficulty and frustration, rather than aggression. The participant that scored above the threshold of ASD reported that: “At some point I lose my patience, because I am annoyed of doing the same thing over and

over again. I just feel tense and sometimes puff out of frustration. But I notice that quickly and then stop the game, because I don't want to deal with it". One participant that scored high in trait aggression but not in state reported that in their everyday life, they tend to get aggressive easily, but it mainly happens in their head and also goes away quickly. In their games, they can get angry sometimes but not aggressive. They explained that through their frustration they can get loud occasionally, but only if they are alone and normally, they just quit the game.

Violent Content

Participants with a high game age rating did not describe any link between the violent content portrayed in the games and feelings of aggression. One interviewee mentioned: "From the three games I play I would say that Tekken is the one that I get least frustrated from, even though it has the most violent content. What really hits me are games like FIFA, in which you can celebrate if you score a goal and by that mock the other person a bit". Another one explained that it is mostly the thrill that someone is shooting them, and they must shoot back because they are so invested in the game and do not want to start over again when getting killed, which leads to emotions.

What is more, the violent content was also deemed unrealistic. It was reported that the violence in the games is very American because everybody has a gun. However, this is not allowed in Germany and thus the interviewee cannot imagine themself in this position. Hence, they think that the violence does not really affect them. The same interviewee reported that the language influenced them more than the violent content when playing Red Dead Redemption: "It is more like the commentary or whatever the main character makes. That is sometimes very like funny to me and that I really take out into the world with me".

Red Dead Redemption is a game that has violent scenes but also non-violent ones. The participant highlights that what they take away from the game are not necessarily the violent scenes but rather the good and the bad language. As an example, they explained: "You're like

riding your horse 90% of the time and then like the main character always says something like ‘yeah boy’. It is fairly cute, and I also say that to my own horse now”. This suggests that characters can socially influence people more than the social violence in games.

Discussion

This study investigated if playing video games causes aggression or whether associations between aggression and video games may reflect overlaps between game playing and other risk factors, such as family dynamics, frustration, ADHD and ASD. Further, potential benefits of video game play were explored, and gamers were compared to non-gamers with respect to trait aggression, ASD, ADHD and their family environment.

Video Game play, Aggression and possible confounding Factors

Video game violence was not found to influence state aggression. However, frustration with the game, while controlling for age rating and how long the game is played, did influence state aggression. A correlation between the two shows that if frustration during the game increases experienced aggression after the game increases as well. This finding supports the frustration-aggression hypothesis and supports the argument that any link between video games and aggression may not be due to the violent content of the games but rather due to frustration (Ferguson et al., 2021). Similarly, a correlation between trait aggression and frustration shows that frustration is also a correlating factor when considering long-term aggression. Interviews revealed that game difficulty, teamworking and social rudeness were the causes of frustration, rather than the violent content. This frustration could lead them to scream against their console, but typically interviewees did not target their anger

against other players. They rather just stopped the game before their frustration could turn into aggression.

Interviewees reported that in the past it could happen that they took the frustration experienced in the game out into the real world and yelled at their family. However, this was because they paid far more attention to the games and made them a part of their identity. This would mean that video games matter much more to younger people and is in line with most studies that claim aggression in adolescents after gameplay. In contrast, to Anderson and Bushman (2002) who claimed that repeated exposure of children to media violence produces aggressive adults, this study found that any-game related aggression is likely to be weaker with age.

It has to be noted that not only did video game violence have no effect on state aggression, but it also had no effect on any of the outcome variables. There was also no difference between gamers and non-gamers regarding trait aggression. The only effect of games found was a correlation that suggests that people perceive more benefits from higher age rating games. Through the interviews, it was found that games with a storyline were seen as beneficial. Interviewees explained that they are able to dive into the story and relax from their real world. Story games that were mentioned were for example Red Dead Redemption, which has a PEGI 18 rating. Nonetheless, what is taken away from the games are not necessarily the violent scenes, as they also lack realism, but people get rather socially influenced by the characters of the game. Interviews revealed that especially the characters' language is integrated into everyday language use. This suggests that characters can socially influence people more than the social violence in games and that neither the self-reported playing of violent video games nor the self-reported playing of non-violent video games is associated with immediate aggression nor long-term aggression.

Nevertheless, results showed that ADHD influenced aggression and a positive correlation between the two indicates that participants who scored high on ADHD reported

higher trait aggression. ADHD is associated with deficits in impulse control and response inhibition (Mazurek & Engelhardt, 2013). Hence, experiencing higher trait aggression is not found to be a consequence of gaming, but rather a possible vulnerability of ADHD. In regard to reporting higher aggression after gameplay, two positive correlations were found for state aggression and ADHD and state aggression and diagnosed ADHD. Another positive correlation between ADHD and frustration showed that ADHD is likely to make any effect of frustration higher. The effect of frustration on state aggression that was found through the mixed-effects model, as well as the just yet significant effect of ADHD on state aggression, shows that people with ADHD will only respond with more aggression after gameplay if they are also frustrated. People with ADHD are already associated with displaying higher levels of aggression (Johnson & Rosen, 2000). Hence, this finding suggests that video games, particularly those featuring potentially frustrating elements, such as difficulty, teamworking, and social rudeness, can further increase symptoms of aggression in people with ADHD. Nevertheless, no person with diagnosed ADHD nor a high score on the ASRS scale was found for the interview, thus frustrating game elements could also differ for people with ADHD.

Anderson and Bushman (2002) indicated that a key predictor of later aggression in life can also be one's developmental environment. In fact, family conflict was found to be correlated with trait aggression. What is more, a correlation was also found between family conflict and state aggression, suggesting that people in a high-conflict family environment experience more aggression after gameplay. A t-test further showed that gamers are more likely to come from high-conflict families than non-gamers. Hence, games could be used as a method to escape arguments. In fact, a correlation between benefits and family conflict highlights that people from a high-conflict family also perceive more benefits when gaming. This finding is supported by the interviews as it was found that gaming helps to blend out the

conflicts, but there are not gone through it. Gaming is seen as a method to clear one's head and escape reality for a short period of time.

Video Game play and additional Benefits

Interviews revealed that there are additional reasons to play. Not only was it found that the participant that had a moderately high level of family conflict used gaming to help them to clear their head, but also other interviewees reported that gaming helped them to blend out life conflicts. Gaming was found to be an escapism and stress relief. One potential person with autism reported that they can put their mind on mute. Even though other interviewees reported similar experiences, this might be especially important for neurodivergent people. Many autistic people experience high levels of anxiety and daily stress, which they cannot easily escape from. Video games were found to offer neurodivergent people some degree of solace and a temporary escape and are thus often thought of as being one of the few fully immersive media, through which anxiety and daily stress can be reduced (Mazurek et al., 2015). In fact, video games differed from other media.

On the one hand, multiplayer video games offer the opportunity to find new friends or to play with already existing ones. Single-player games, on the other hand, can either provide a storyline or offer non-story elements. In contrast to a book or a movie, video games make the players feel as though they are a part of the game, with the storyline continuing to unfold as a reward for the players' efforts. Non-story elements provide players with the possibility to explore a world on their own with which they can interact.

Similar to Granic et al. (2014), who stated that gaming can increase positive emotions and improve one's mood, this study found that video games offer the opportunity to increase people's self-esteem. Interviews revealed that video games help people to feel skilled and competent, because it is easier to engage in some behaviours that are not possible in real life,

such as building a forest or making new friends. Further, video games present clear markers of progress and achievement. The success experienced in the games made people feel better about themselves, especially when they were younger.

Strengths, Limitations and Future Research

Compared to most previous literature, this study considered potentially confounding or moderating factors, when exploring the link between video games and aggression. Game frustration was taken into account as a counter argument of post-game aggression and indeed results of this study suggested that any effect of video game play was due to frustration and not because of the game violence. This sheds new light into the controversial view of video games and suggests that video games can increase immediate aggression after play, but not in the long-term and not because of the violent content. What is more, the study was based on self-reports to measure the effect of video game violence on aggression in a realistic setting and offered interviews, as a chance for participants to elaborate their answers.

Nevertheless, only five interviews could be held due to a limited amount of time during a Master of Science course of study. Only one possible neurodivergent person and two persons moderately high in family conflict could be recruited. Hence, a few more interviews could give further insight into people's perceptions of the games. Important to consider is that in the initial study, there was a general lack of participants who either scored high for ASD or were ever diagnosed. Hence, there was not much variance. From the one interviewee it was found that the benefits of video games were perceived as high and video games helped them to escape from daily life. Nonetheless, it was also discovered that they recently shouted at their friends while playing video games with them. A lot of frustrating things happened on the particular day, which is why it is hard to isolate the game as the specific cause for aggression. Therefore, more research directly on this population is needed to understand how autistic

people experience video games. If they experience mostly positive effects, like Mazurek et al. (2015) found in their study, or if they are also at risk for more negative effects like it was found through the interviews.

What is more, interviews revealed that game characters can socially influence people more than the social violence in the games. Hence, for in-game research, it could be worth looking into the extent to which people adopt or do not adopt the pro- and anti-social attitudes and behaviours of the characters they play rather than the violence.

Lastly, the questionnaire design for gaming habits could be improved. It happened a few times that participants did not answer the questions about the number of hours they played or did not state the name of their game. Instead of a scale, the number of hours participants play could be asked as an open-ended question. Open-ended questions encourage a spontaneous response from individuals and even avoid the bias that may result from suggesting responses. Yet, the question should be explicit in wording to ensure that it is not overseen or misinterpreted (Reja et al., 2003). What is more, in the study there is a general instruction to list three games and the number of hours spent playing them, at the beginning of the gaming habit scale (see Appendix D for illustration). However, this instruction is not repeated for each new game. Hence, it would be advisable to add concrete instructions to each game option, such as: 'Please write your first game in the box below'.

Conclusion

This study aimed to shed new light into the association between violence in video games and aggression. The results suggest that video games can increase immediate aggression after play, but not in the long-term and not because of the violent content. Frustration was found to be a potential effect of increasing aggression after playing video games, especially in people with ADHD. Potential causes for frustration were game difficulty, teamworking, and social rudeness. Further, it was found that higher trait aggression is not a

consequence of gaming, but it is correlating with ADHD. Interviews revealed that video games offer an escape from arguments for people with higher family conflicts and can help neurodivergent persons to put their minds on mute. Gaming was also associated with positive social impacts and was used as an escape and stress relief from everyday life. Additionally, it was found to increase people's self-esteem by enhancing feelings of skill and competence. For the future, it is suggested to focus research on the extent to which people adopt or do not adopt the pro- and anti-social attitudes and behaviours of the characters they play, since it was identified that game characters can socially influence people more than the social violence in the games.

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Appendices

Appendix A: Information Sheet and Informed consent

Information Sheet

Thank you for accepting this invitation to participate in this study! Please read the following information carefully.

Purpose of the study: This study is conducted by Samira Kommander, a Master Psychology student at the University of Twente and is supervised by Dr. Steven Watson. The study will take approximately **20-30 minutes** and offers a voluntarily second part, in which you will have the chance to talk more in depth about your answers of this first part. The outcome of this study will be used for the Master Thesis of the researcher and may also be presented in academic publications or conferences.

What is your task: As a participant, you will be asked to fill out questionnaires regarding your family dynamics, level of aggression, use of video games as well as the experienced level of frustration and aggression while and after playing and your perceived benefits of video games in general. You will also be asked some potentially sensitive questions about your personality, environment and how you interact with others.

Who can take part: Anyone above the age of 18 is welcome to participate. Be aware that you **do not** have to play video games to take part.

Risks of taking part: Some potentially sensitive questions about your family dynamics and autism-spectrum disorder and attention-deficit disorder are asked. If you encounter distress, you can withdraw at any time.

How you can withdraw: You can withdraw from the study by closing your browser or tab without explaining the reason and without any penalty. However, once the study is complete and you do not wish to take in the second part, your data cannot be removed as you cannot be identified. If you voluntarily decide to attend the second part of the study it requires for you to provide some contact details, hence your anonymity would be voided. Nevertheless, your data will be securely stored, and once data analysis will be complete your identifiable data will be removed from the database before it is made available to anyone outside the research team. For those who decide against the second part of the study the data is entirely anonymous.

Data storage and security: If you participate in this first part of the research, your consent that the researcher is allowed to collect and keep your data in accordance with the data policy

of the BMS faculty at the University of Twente. Data will be made anonymous before it may be made public to the scientific community by being hosted on the open science framework (https://osf.io/). You will not be personally identifiable in any way.

Contact details:
Samira Kommander s.kommander@student.utwente.nl

Contact Information for Questions about Your Rights as a Research Participant
If you have questions concerning your rights as a participant of this study, or wish to obtain information, ask questions, or address your concerns with someone other than the researcher, please contact the project supervisor by s.j.watson@utwente.nl or directly contact the ethics committee under ethicscommittee-bms@utwente.nl.

Taking part in the study
- I have read and understood the information sheet. I have been able to ask questions concerning the study, and my questions have been answered well.

- I consent voluntarily to participate in this study and understand that I have the right to withdraw from the study at any time, without explanation.

- I understand that taking part in the study involves filling out different questionnaires regarding my family environment, level of aggression, gaming habits and perceived benefits of it as well as screening measures for ADHD and ASD.

Use of the information in the study
- I understand that the information I provide will be used exclusively for the purposes of this study and will be stored anonymously.

Future use and reuse of the information by others
- In accordance with the BMS data policy, I grant permission for the researcher to keep the data that I provide for a minimum of 10 years.

By selecting "I agree", you are consenting to the conditions described above.

o I agree
o I disagree

Appendix B: Debriefing given to participants at the end of the survey

This study investigates if aggression is a result of playing video games or whether associations between aggression and video games may reflect overlaps between game playing

and other risk factors for aggression.

In particular, you were asked about your general level of aggression as well as your experienced aggression after playing specific games. We also considered whether frustration rather than aggressiveness might explain why video games and aggression have been linked in previous research. We also considered whether there are positive impacts of gaming. Lastly, you filled out two screening measures for autism-spectrum disorder (ASD) and attention-deficit disorder (ADHD). We are interested in how (or if) ASD and ADHD affect how people experience video games. These measures are not clinical assessments and are not sufficient for a diagnosis. We are interested only in the extent to which traits of autism or ADHD affect how people experience video games. As researchers, we are not qualified to discuss sensitive health matters with you and hence cannot present you with your scores. If you feel uncertain about your responses or are interested, you can calculate your scores for free via the following links:

https://docs.autismresearchcentre.com/tests/AQ10.pdf
http://www.goodmedicine.org.uk/files/adhd.asrs_.screen.pdf

If you wish to follow up on one of the two measures, because you think you might experience ASD or ADHD, the researcher recommends you to contact a health practitioner such as your family doctor in the first instance.

The second phase of this study offers you the chance to talk more in depth about your answers through a short interview. If you would like to participate, please state your e-mail address below. Participation will be completely voluntarily. The researcher will contact you soon with further instructions. Bear in mind that supplying your e-mail will mean you will no longer be anonymous, and we will be able to link your scores to you personally, but once data has been analysed your identifiable information will be deleted and will not be shared beyond the research team.

Appendix C: Questionnaires Provided to the Participants

Brief Family Environment Scale

	Strongly Disagree	Disgree	Aagree	Strongly Agree
In our family we really help and support each other. (1)	○	○	○	○
In our family we spend a lot of time doing things together at home. (2)	○	○	○	○

In our family we work hard at what we do in our home. (3)	○	○	○	○	
In our family there is a feeling of togetherness. (4)	○	○	○	○	
My family members really support each other. (5)	○	○	○	○	
I am proud to be a part of our family. (6)	○	○	○	○	
In our family we really get along well with each other. (7)	○	○	○	○	
In our family we can talk openly in our home. (8)	○	○	○	○	
In our family we sometimes tell each other about our personal problems. 9)	○	○	○	○	
In our family we begin discussions easily. (10)	○	○	○	○	
In our family we argue a lot. (11) *	○	○	○	○	
In our family we are really mad at each other a lot. (12) *	○	○	○	○	
In our family we lose our tempers a lot. (13) *	○	○	○	○	
In our family we often out down each other. (14) *	○	○	○	○	
My family members sometimes are violent. (15) *	○	○	○	○	
In our family we raise our voice when we are mad. (16) *	○	○	○	○	

Trait Aggression

	Extremely uncharacteristic of me	Uncharacteristic of me	Neither characteristic nor uncharacteristic of me	Characteristic of me	Extremely characteristic of me

Once in a while I can't control the urge to strike another person. (1)	○	○	○	○	○
Given enough provocation, I may hit another person. (2)	○	○	○	○	○
If somebody hits me, I hit back. (3)	○	○	○	○	○
I get into fights a little more than the average person. (4)	○	○	○	○	○
If I have to resort to violence to protect my rights, I will. (5)	○	○	○	○	○
There are people who pushed me so far that we came to blows. (6)	○	○	○	○	○
I can think of no-good reason for ever hitting a person. (7)*	○	○	○	○	○
I have threatened people I know. (8)	○	○	○	○	○
I have become so mad that I have broken things. (9)	○	○	○	○	○
—					
I tell my friends openly when I disagree with them. (10)	○	○	○	○	○
I often find myself disagreeing with people. (11)	○	○	○	○	○
When people annoy me, I may tell them what I think of them. (12)	○	○	○	○	○
I can't help getting into arguments when people disagree with me. (13)	○	○	○	○	○
My friends say that I'm somewhat argumentative. (14)	○	○	○	○	○
—					
I flare up quickly but get over it quickly. (15)	○	○	○	○	○
When frustrated, I let my irritation show. (16)	○	○	○	○	○

I sometimes feel like a powder keg ready to explode. (17)	○	○	○	○	○
I am an even-tempered person (18)*	○	○	○	○	○
Some of my friends think I'm a hothead. (19)	○	○	○	○	○
Sometimes I fly off the handle for no good reason. (20)	○	○	○	○	○
I have trouble controlling my temper. (21)	○	○	○	○	○
I am sometimes eaten up with jealously. (22)	○	○	○	○	○
At times I feel I have gotten a raw deal out of life. (23)	○	○	○	○	○
Other people always seem to get the breaks. (24)	○	○	○	○	○
I wonder why sometimes I feel so bitter about things. (25)	○	○	○	○	○
I know that 'friends' talk about me behind my back. (26)	○	○	○	○	○
I am suspicious of overly friendly strangers. (27)	○	○	○	○	○
I sometimes feel that people are laughing at me behind my back. (28)	○	○	○	○	○
When people are especially nice, I wonder what they want. (29)	○	○	○	○	○

Cognitive, Emotional, Social Benefits

In your opinion, has playing video games increased or decreased the following:

	Decreased	No difference	Increased

Cognitive Benefits			
Attention (1)	○	○	○
Memory (2)	○	○	○
Reaction/ response speed (3)	○	○	○
Problem solving. (4)	○	○	○
Reasoning. (5)	○	○	○
Social Benefits	○	○	○
Links with family. (6)			
Links to other age groups. (7)	○	○	○
Links with existing friends. (8)	○	○	○
Links with new friends. (9)	○	○	○
Emotional Benefits	○	○	○
Self-confidence. (10)			
Feeling depressed. (11)	○	○	○
Feeling lonely (12).	○	○	○
Feeling stressed (13).	○	○	○
Feeling relaxed (14).	○	○	○
Feeling worried (15).	○	○	○

Short Autism-Spectrum Quotient

	Definitely disagree	Slightly disagree	Slightly agree	Definitely agree
I often notice small sounds when others do not. (1)	○	○	○	○
I usually concentrate more on the whole picture, rather than the small details. (2)	○	○	○	○
I find it easy to do more than one thing at once. (3)	○	○	○	○
If there is an interruption, I can switch back to what I was doing very quickly. (4)	○	○	○	○
I find it easy to 'read between the lines' when someone is talking to me. (5)	○	○	○	○
I know how to tell if someone listening to me is getting bored. (6)	○	○	○	○
When I'm reading a story, I find it difficult to work out the character's intentions. (7)	○	○	○	○
I like to collect information about the categories of things (e.g., types of car, types of bird, types of train, types of plant etc.) (8)	○	○	○	○
I find it easy to work out what someone is thinking or feeling just by looking at their face. (9)	○	○	○	○
I find it difficult to work out people's intentions. (10)	○	○	○	○

Adult ADHD Self-Report Scale

	Never	Rarely	Sometimes	Often	Very Often
How often do you make careless mistakes when you have to work on a boring or difficult project? (1)	○	○	○	○	○
How often do you have difficulty keeping your attention when you are doing boring or repetitive work? (2)	○	○	○	○	○
How often do you have difficulty concentrating on what people say to you, even when they are speaking to you directly? (3)	○	○	○	○	○

How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done? (4)	○	○	○	○	○
How often do you have difficulty getting things in order when you have to do a task that requires organization? (5)	○	○	○	○	○
When you have a task that requires a lot of thought, how often do you avoid or delay getting started? (6)	○	○	○	○	○
How often do you misplace or have difficulty finding things at home or at work? (7)	○	○	○	○	○
How often are you distracted by activity or noise around you? (8)	○	○	○	○	○
How often do you have problems remembering appointments or obligations? (9)	○	○	○	○	○
—					
How often do you fidget or squirm with your hands or feet when you have to sit down for a long time? (10)	○	○	○	○	○
How often do you leave your seat in meetings or other situations in which you are expected to remain seated? (11)	○	○	○	○	○
How often do you feel restless or fidgety? (12)	○	○	○	○	○
How often do you have difficulty unwinding and relaxing when you have time to yourself? (13)	○	○	○	○	○
How often do you feel overly active and compelled to do things, like you were driven by a motor? (14)	○	○	○	○	○
How often do you find yourself talking too much when you are in social situations? (15)	○	○	○	○	○
When you're in a conversation, how often do you find yourself finishing the sentences of the people you are talking to, before they can finish them themselves? (16)	○	○	○	○	○
How often do you have difficulty waiting your turn in situations when turn taking is required? (17)	○	○	○	○	○
How often do you interrupt others when they are busy? (18)	○	○	○	○	○

Appendix D: Measurement of Gaming Habits

Over the next few questions, you will be asked to list three games you play regularly at the moment and the number of hours you spend playing them during the week.

First start with your most played one, answer the questions to it and then continue with your second and your third.

If you do not have three games, it is alright to leave the others out.

If you do not game at all, please click below to be sent to the next questionnaire.

Gaming Habits – First Game

	Less than 1 hour	Between 1 and 3 hours	Between 3 and 5 hours	Between 5 and 10 hours	More than 10 hours
Game Option 1:	○	○	○	○	○

Frustration

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
When the game gets hard or feels unfair, I get easily frustrated. (1)	○	○	○	○	○
Sometimes I feel so frustrated while playing that I have to quit the game. (2)	○	○	○	○	○

State Aggression

	Extremely uncharacteristic of me	Uncharacteristic of me	Neither characteristic nor uncharacteristic of me	Characteristic of me	Extremely characteristic of me
After playing this game, given enough provocation, I may hit another person. (1)	○	○	○	○	○

After playing this game, I have threatened people I know. (2)	○	○	○	○	○
After playing this game, I have become so mad that I have broken things. (3)	○	○	○	○	○
—					
After playing this game, I often find myself disagreeing with people. (4)	○	○	○	○	○
After playing, I can't help getting into arguments when people disagree with me. (5)	○	○	○	○	○
After playing this game, I flare up quickly but get over it quickly. (6)	○	○	○	○	○
After playing this game, I sometimes feel like a powder key ready to explode. (7)	○	○	○	○	○
After playing this game, I have trouble controlling my temper. (8)	○	○	○	○	○

Gaming Habits – Second Game

	Less than 1 hour	Between 1 and 3 hours	Between 3 and 5 hours	Between 5 and 10 hours	More than 10 hours
Game Option 2:	○	○	○	○	○

→ Followed by questionnaires of Frustration and State Aggression

Gaming Habits – Third Game

	Less than 1 hour	Between 1 and 3 hours	Between 3 and 5 hours	Between 5 and 10 hours	More than 10 hours
Game Option 3:	○	○	○	○	○

→ Followed by questionnaires of Frustration and State Aggression

Appendix E: Interview Guide

Interview Guide

- How many years have you been gaming for?
- What determines how long you play for?
    - Weekend?
- What makes you want to start playing?
    - Emotions, situations, etc.
- What type of game(s) do you play? (Combine with results of study)
    - What do you enjoy?
        - Do you gain additional benefits from gaming? (Follow up questions)
    - What do you dislike? – What makes you want to stop playing or take breaks?
- Do you get angry/ frustrated when playing – and after playing?

    → Why?
    - Do you take your frustration out outside of gaming?
        - Why / Why not?
        - Common occurrence or not?
    - Do you in any way feel influenced by the violent content?