

STATISTICAL STUDY OF VIDEO GAME EFFECTS ON CHILDREN'S

Sanjay JAİN

Department of Mathematical Sciences, Government College, Ajmer Affiliated to M. D. S. University Ajmer,
Ajmer-305001, India

drjainsanjay@gmail.com

Chander SHAKHER

Research Scholar, Mahatma Gandhi University, Meghalaya

csgshorela200921@gmail.com

ABSTRACT

Objective Video game violence has become a highly politicized issue for scientists and the general public. There is continuing concern that playing violent video games may increase the risk of aggression in players. Less often discussed is the possibility that playing violent video games may promote certain positive developments, particularly related to visuospatial cognition. The objective of the current article was to conduct a meta-analytic review of studies that examine the impact of violent video games on both aggressive behaviour and visuospatial cognition in order to understand the full impact of such games. Methods A detailed literature search was used to identify peer-reviewed articles addressing violent video game effects. Effect sizes 'r' (a common measure of effect size based on the correlational coefficient) were calculated for all included studies. Effect sizes were adjusted for observed publication bias. Results indicated that publication bias was a problem for studies of both aggressive behaviour and visuospatial cognition. Once corrected for publication bias, studies of video game violence provided no support for the hypothesis that violent video game playing is associated with higher aggression. However playing violent video games remained related to higher visuospatial cognition ($r = 0.36$). Conclusions Results from the current analysis did not support the conclusion that violent video game playing leads to aggressive behaviour. However, violent video game playing was associated with higher visuospatial cognition. It may be advisable to reframe the violent video game debate in reference to potential costs and benefits of this medium.

Keywords: Video games, Aggression, Cognition, Visual perception.

INTRODUCTION

Despite the intensity of the debate, research on the relationship between video game violence and aggression (most studies do not consider violent crime specifically) have produced mixed findings. Some articles find a relationship, either causal or correlation between video game violence and aggression [4–6] whereas others do not [7–9]. Examining one of the most cited studies a bit closer provides some illumination of the ambiguity of this research area. Anderson and Dill [6] claim to offer causal evidence for the video game, aggression link. However a close read of their article suggests otherwise. The authors use four separate measures of aggression provided by a “noise blast” program (which punishes players with an irritating white noise) and find significance for only one of the four. Had the authors examined the confidence intervals around the effect size for these findings they would have found that such a confidence interval crosses zero and thus should not be considered “proof” of a positive finding. Thus their experimental study questions the causal link between video game violence and aggression, rather than supports it. The authors also use an unstandardized version of the “noise blast” program. In a similar study, Ferguson et al. [7] using a newly standardized and reliable version of the “noise blast” program found no relationship between violent game exposure and aggression. Ferguson et al. also found that, once family violence exposure was controlled, no correlation relationship between violent game exposure and violent criminal behaviours remained. Thus, any correlation relationship between violent video games and violent criminal activity may simply be a by-product of family violence.

Meta-analyses of violent video games and aggression have also produced mixed findings. Two meta-analyses [10, 11] have found small but positive relationships between violent games and aggression whereas three others [12–14] have found no support for the causal link between video games and aggression. Ferguson [14] specifically found significant problems with publication bias in the video games effects literature, as well a tendency for the use of unstandardized measures of aggression to inflate the relationship between video game violence and aggression. Sherry [13]

2. Study Selection and Categorization

PsycINFO was searched for all articles published between the years of 1995 and April 2007 (this criteria discussed below) that included the following search terms: (video* or computer or arcade) and (game*) and (attack* or fight* or aggress* or violent* or hostile* or ang* or arous* or prosocial or help).

Articles were judged relevant if they met the following criteria:

(a) Articles had to have been published between the years of 1995–current. There were two reasons for examining this time-frame. The first was to examine trends in effect size within “recent” research. Secondly, and perhaps more importantly, Carnagey and Anderson [21] have identified this period (1995-current) as the “third era” in which video game graphics improved markedly over previous eras, on-line playing has become more common, and first-person shooter type games have increasingly predominated the market. This “third era” is marked by a great increase in the inclusion of violent content in commercial video games. It was felt important that the meta-analysis conducted in this article reflect research on the most current gaming technology, as this “third era” is the period in gaming technology, which has caused the most controversy/concern regarding violent effects.

(b) Articles had to examine the effect of playing violent video games on some measure of aggressive behaviour. Articles that did not distinguish between violent and non-violent video games were not included in this analysis, nor were articles concerned only with cognitions, affect, or physiological arousal that did not consider aggressive behaviour.

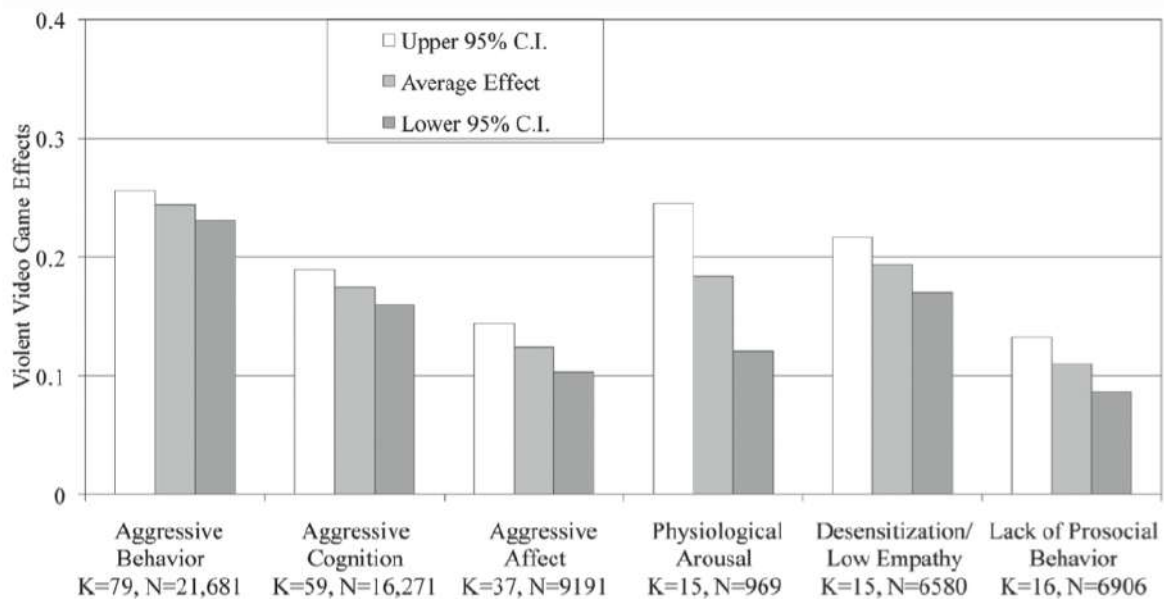
(c) As this study included an analysis of publication bias in peer-reviewed journals, only articles published in peer-reviewed journals were included in the analysis. Book chapters, dissertation manuscripts and unpublished manuscripts were not included in the analysis. Although it would be interesting and valuable to consider publication status (published or unpublished) as a moderator variable in the analysis, there was no evident method for assuring that all relevant unpublished manuscripts could be obtained (including those from unknown authors, or those intentionally or unintentionally suppressed by the authors). A total of 17 published studies comprising of 21 independent observations were found that met the above criteria including a total sample size of 3,602.

3. Effect Size Calculation

Pearson's 'r', a flexible and easily interpreted index of effect size, was used as the effect size estimate in this study. Correlation coefficients were transformed to Fisher's z, weighted, averaged and transformed back to a pooled r, denoted r_+ . In the case in which a study reported non-significant results but failed to provide statistical information (e.g. F-value) the effect size was calculated using the provided means and standard deviations. In the event of multiple measures for the same construct occurring within a study (i.e. multiple dependent or independent measures) simple mean correlations were computed [14]. In studies in which both univariate (e.g. bivariate correlations) and multivariate (e.g. partial correlations) were available, only the latter were included in the meta-analysis, as this provided a better indices of the unique shared variance between violent video game exposure and aggression (as opposed to that due to gender, trait aggression, etc.).

Meta-Analysis 1 : Violent Games Impact on Visuospatial Cognition (The Good) A meta-analysis is a statistical technique whereby scientific studies that test the same or a similar hypothesis (for example, that violent video game exposure compared to neutral video game exposure will result in increased aggression) and the same or a similar outcome (for example, aggressive behaviour) are combined to ascertain the strength (“effect size”) of the average finding. To date there have been a number of meta-analyses of the effect of violent video games on aggressive thoughts, feelings and behaviours.

Here is the Result of the meta-analysis by Anderson et al (2010).



K = number of separate tests of the same hypothesis included in the analysis.

N = number of participants across studies.

CI = confidence Interval, a measure of how variable the data was.

PsycINFO was searched for all articles published between the years of 1995 and April 2007 (as discussed above) that included the following search terms: (video* or computer or arcade) and (game) and (intelligen* or visuo* or visual or spatial or perception or atten*). Criteria for inclusion were generally similar to those discussed under meta-analysis 1, with the exception of criterion (b). Rather than examining aggressive behaviour, articles included in the current analyses were those that, as a dependent variable included measures of visuospatial cognition such as visual rotation, visual memory, visual attention and selection or related abilities Only articles that considered violent games specifically were considered. A total of seven published studies comprising of 14 independent observations were found that met the above criteria including a total sample size of 384.

4. The Positive and Negative Effects of Video Games

Video games are frowned upon by parents as time-wasters, and worse, some education experts think that these games corrupt the brain. Violent video games are easily blamed by the media and some experts as the reason why some young people become violent or commit extreme anti-social behaviour. But many scientists and psychologists find that video games can actually have many benefits – the main one is making kids smart. Video games may actually teach kids high-level thinking skills that they will need in the future.

"Video games change your brain," according to University of Wisconsin psychologist C. Shawn Green. Playing video games change the brain's physical structure the same way as do learning to read, playing the piano, or navigating using a map. Much like exercise can build muscle, the powerful combination of concentration and rewarding surges of neurotransmitters like dopamine strengthen neural circuits that can build the brain.

Below are the good and bad effects of video games, according to researchers and child experts:

4.1 Positive Effects of Video Games

When child plays video games, it gives his brain a real workout. In many video games, the skills required to win involve abstract and high level thinking. These skills are not even taught at school.

Some of the mental skills enhanced by video games include:

4.1.1 Following instructions:

□□ Problem solving and logic - When kids play games such as The Incredible Machine, Angry Birds or Cut the Rope, they train their brain to come up with creative ways to solve puzzles and other problems in short bursts.

□□ Hand-eye coordination, fine motor and spatial skills. In shooting games, the character may be running and shooting at the same time. This requires the real-world player to keep track of the position of the character, where he/she is heading, their speed, where the gun is aiming, if the gunfire is hitting the enemy, and so on. All these factors need to be taken into account, and then the player must then coordinate the brain's interpretation and reaction with the movement in their hands and fingertips. This process requires a great deal of eye-hand coordination and visual-spatial ability to be successful. Research also suggests that people can learn iconic, spatial, and visual attention skills from video games. There have been even studies with adults showing that experience with video games is related to better surgical skills. Also, a reason given by experts as to why fighter pilots of today are more skilful is that this generation's pilots are being weaned on video games.

□□ Planning, resource management and logistics. The player learns to manage resources that are limited, and decide the best use of resources, the same way as in real life. This skill is honed in strategy games such as SimCity, Age of Empires, and Railroad Tycoon. Notably, The American Planning Association, the trade association of urban planners and Maxis, the game creator, have claimed that SimCity has inspired a lot of its players to take a career in urban planning and architecture.

□□ Multitasking, simultaneous tracking of many shifting variables and managing multiple objectives. In strategy games, for instance, while developing a city, an unexpected surprise like an enemy might emerge. This forces the player to be flexible and quickly change tactics.

□□ Quick thinking, making fast analysis and decisions. Sometimes the player does this almost every second of the game giving the brain a real workout. According to researchers at the University of Rochester, led by Daphne Bavelier, a cognitive scientist, games simulating stressful events such as those found in battle or action games could be a training tool for real-world situations. The study suggests that playing action video games primes the brain to make quick decisions. Video games can be used to train soldiers and surgeons, according to the study.

□□ Accuracy - Action games, according to a study by the University of Rochester, train the brains of players to make faster decisions without losing accuracy. In today's world, it is important to move quickly without sacrificing accuracy.

□□ Strategy and anticipation - Steven Johnson, author of Everything Bad is Good For You: How Today's Popular Culture is Actually Making Us Smarter, calls this "telescoping." Gamers must deal with immediate problems while keeping their long-term goals on their horizon.

□□ Situational awareness – Defence News reported that the Army include video games to train soldiers improve their situational awareness in combat. Many strategy games also require players to become mindful of sudden situational changes in the game and adapt accordingly.

□□Developing reading and math skills – Young gamers force them to read to get instructions, follow story-lines of games, and get information from the game texts. Also, using math skills is important to win in many games that involve quantitative analysis like managing resources.

□□Perseverance – In higher levels of a game, players usually fail the first time around, but they keep on trying until they succeed and move on to the next level.

□□Pattern recognition – Games have internal logic in them, and players figure it out by recognizing patterns.

□□Inductive reasoning and hypothesis test - James Paul Gee, professor of education at the University of Wisconsin-Madison, says that playing a video game is similar to working through a science problem. Like students in a laboratory, gamers must come up with a hypothesis. For example, players in some games constantly try out combinations of weapons and powers to use to defeat an enemy. If one does not work, they change hypothesis and try the next one. Video games are goal-driven experiences, says Gee, which are fundamental to learning. Mapping – Gamers use in-game maps or build maps on their heads to navigate around virtual worlds. Memory - Playing first person shooter games such as Call of Duty and Battlefield series enables players to effectively judge what information should be stored in their working memory and what can be discarded considering the task at hand, according to a study published in the Psychological Research. Concentration - A study conducted by the Appalachia Educational Laboratory reveal that children with attention-deficit disorder who played Dance Dance Revolution improve their reading scores by helping them concentrate. Improved ability to rapidly and accurately recognize visual information - A study from Beth Israel Medical Center NY, found a direct link between skill at video gaming and skill at keyhole, or laparoscopic, surgery. Taking risks - Winning in any game involves a player's courage to take risks. Most games do not reward players who play safely. Teamwork and cooperation when played with others – Many multiplayer games such as Team Fortress 2 involve cooperation with other online players in order to win. These games encourage players to make the most of their individual skills to contribute to the team. According to a survey by Joan Ganz Cooney Center, teachers report that their students become better collaborators after using digital games in the classroom. Management – Management simulation games such as Rollercoaster Tycoon and Zoo tycoon teach players to make management decisions and manage the effective use of finite resources. Other games such as Age of Empires and Civilization even simulate managing the course of a civilization. Simulation, real world skills. The most well known simulations are flight simulators, which attempt to mimic the reality of flying a plane. All of the controls, including airspeed, wing angles, altimeter, and so on, are displayed for the player, as well as a visual representation of the world, and are updated in real time.

Estimating skills Reasoned judgments

How to respond to challenges

How to respond to frustrations

How to explore and rethink goals, etc

Video games introduce your kid to computer technology and the online world. You should recognize that we are now living in a high-tech, sophisticated world. Video games make your kid adapt and be comfortable with the concepts of computing. This is particularly important for girls who typically are not as interested in high technology as much as boys. Video games allow you and your kid to play together and can be a good bonding activity. Some games are attractive to kids as well as adults, and they could be something that they share in common. When your child knows more than you, he can teach you how to play and this allows you to understand your child's skills and talents.

Video games make learning fun. Your kid likes games because of the colors, the animation, the eye candy, as well as the interactivity and the challenge and the rewards of winning. The best way to learn

is when the learner is having fun at the same time. That's why video games are natural teachers. Having fun gives your kid motivation to keep on practicing, which is the only way to learn skills. Video games are also capable of making difficult subjects such as math fun. Video games can make your kid creative. A study by the Michigan State University's Children and Technology Project found a relation between video game playing and greater creativity, regardless of gender, race or type of video game played. (In contrast, use of cell phones, the Internet and computers other than video games was unrelated to creativity, the study found).

Video games can improve your kid's decision making speed. People who played action-based video and computer games made decisions 25% faster than others without sacrificing accuracy, according to a study from the University of Rochester. Other studies suggests that most expert gamers can make choices and act on them up to six times a second—four times faster than most people, and can pay attention to more than six things at once without getting confused, compared to only four by the average person. Surprisingly, the violent action games that often worry parents most had the strongest beneficial effect on the brain, according to cognitive neuroscientist Daphne Bavelier, who studies the effect of action games at Switzerland's University of Geneva and the University of Rochester in New York.

Video games increase your kid's self-confidence and self-esteem as he masters games. In many games, the levels of difficulty are adjustable. As a beginner, your kid begins at the easy level and by constant practicing and slowly building skills; he becomes confident in handling more difficult challenges. Since the cost of failure is lower, he does not fear making mistakes. He takes more risks and explores more. Your kid can transfer this attitude to real life.

Games that involve multiple players encourage your child to work cooperatively to achieve his goals. Your kid learns to listen to the ideas of others, formulate plans with other kids, and distribute tasks based on skills. Some online games are even played internationally, and this can introduce your kid to players of different nationalities and cultures. This fosters friendships among different people.

Video games that require your kid to be active, such as Dance Dance Revolution and Nintendo Wii Boxing give your kid a good workout. When playing these active games for 10 minutes, your kid spends energy equal to or exceeding that produced by spending the same amount of time on a three miles an hour treadmill walk.

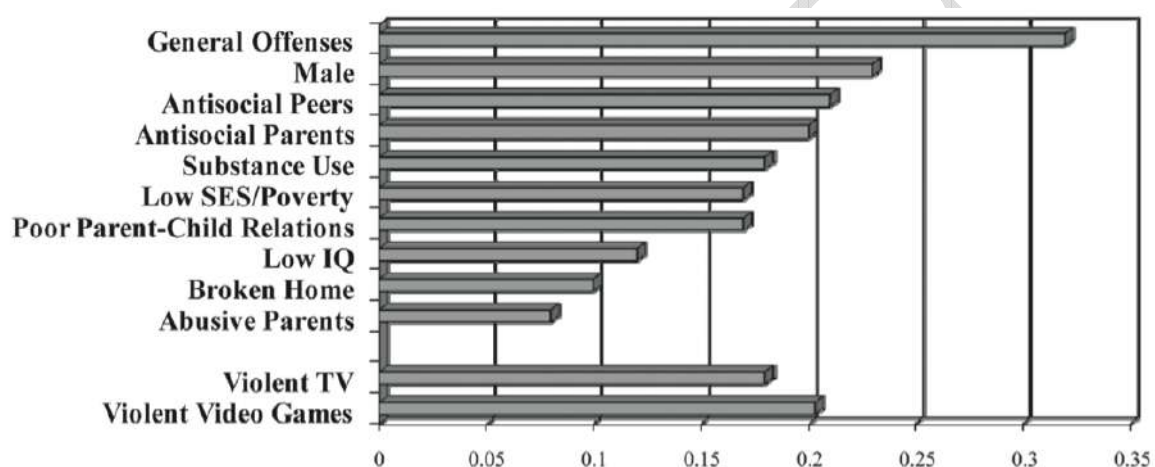
Kids are not necessarily drawn to video games because of their violence. The attraction lies in their being rewarded by awesome displays of explosions, fireworks, and yes, blood splattering. Also, violent games have the most emotional appeal for kids. But these factors are only secondary to what kids actually enjoy in these games - the opportunity to develop and master skills and have the freedom to make choices in the game universe. Violent video games may act as a release of pent-up aggression and frustration of your kid. When your kid vents his frustration and anger in his game, this diffuses his stress. Games can provide a positive aggression outlet the same way as football and other violent sports. Playing video games is safer than having your teens do drugs, alcohol and street racing in the real world.

4.2 Negative Effects of Video Games

Most of the bad effects of video games are blamed on the violence they contain. Children who play more violent video games are more likely to have increased aggressive thoughts, feelings, and behaviours, and decreased prosocial helping, according to a scientific study (Anderson & Bushman, 2001). The effect of video game violence in kids is worsened by the games' interactive nature. In many games, kids are rewarded for being more violent. The act of violence is done repeatedly. The child is in control of the violence and experiences the violence in his own eyes (killings, kicking, stabbing and shooting). This active participation, repetition and reward are effective tools for learning behaviour. Indeed, many studies seem to indicate that violent video games may be related to

aggressive behaviour (such as Anderson & Dill, 2000; Gentile, Lynch & Walsh, 2004). However, the evidence is not consistent and this issue is far from settled. Many experts including Henry Jenkins of Massachusetts Institute of Technology have noted that there is a decreased rate of juvenile crime which coincides with the popularity of games such as Death Race, Mortal Kombat, Doom and Grand Theft auto. He concludes that teenage players are able to leave the emotional effects of the game behind when the game is over. Indeed there are cases of teenagers who commit violent crimes who also spend great amount of time playing video games such as those involved in the Columbine and Newport cases. It appears that there will always be violent people, and it just so happen that many of them also enjoy playing violent video games.

Here I am mentioning some longitudinal factors for youth violence; this is adapted from US Department of Health and Human Service (2001), Bushman and Huesmann (2006) and Anderson et al (2010), as in [10].



Too much video game playing makes your kid socially isolated. Also, he may spend less time in other activities such as doing homework, reading, sports, and interacting with the family and friends. Some video games teach kids the wrong values. Violent behaviour, vengeance and aggression are rewarded. Negotiating and other nonviolent solutions are often not options. Women are often portrayed as weaker characters that are helpless or sexually provocative. Games can confuse reality and fantasy.

Academic achievement may be negatively related to over-all time spent playing video games. Studies have shown that the more time a kid spends playing video games, the poorer is his performance in school. (Anderson & Dill, 2000; Gentile, Lynch & Walsh, 2004). A study by Argosy University's Minnesota School on Professional Psychology found that video game addicts argue a lot with their teachers, fight a lot with their friends, and score lower grades than others who play video games less often. Other studies show that many game players routinely skip their homework to play games, and many students admitted that their video game habits are often responsible for poor school grades.

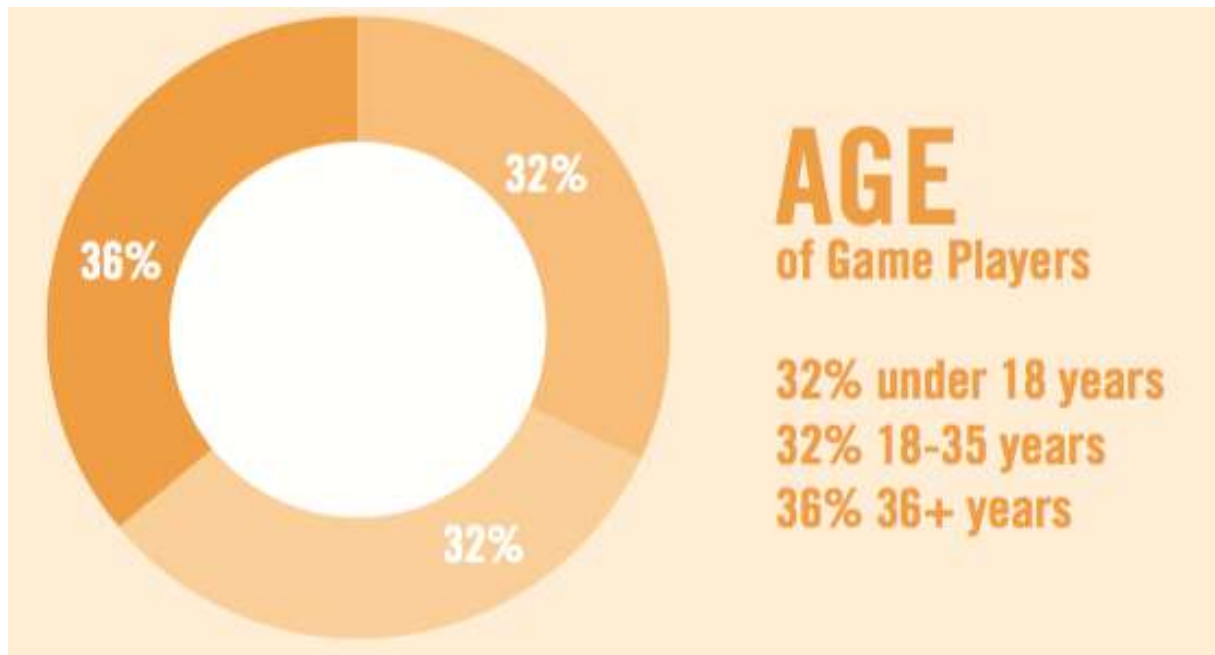
Although some studies suggest that playing video games enhances a child's concentration, other studies, such as a 2012 paper published in *Psychology of Popular Media Culture*, have found that games can hurt and help children's attention issues - improving the ability to concentrate in short bursts but damaging long-term concentration.

Video games may also have bad effects on some children's health, including obesity, video-induced seizures, and postural, muscular and skeletal disorders, such as tendonitis, nerve compression, carpal tunnel syndrome. When playing online, your kid can pick up bad language and behaviour from other people, and may make your kid vulnerable to online dangers. A study by the Minneapolis-based National Institute for Media and the Family suggests that video games can be addictive for kids, and that the kids' addiction to video games increases their depression and anxiety levels. Addicted kids also exhibit social phobias. Not surprisingly, kids addicted to video games see their school

performance suffer. Kids spending too much time playing video games may exhibit impulsive behaviour and have attention problems. This is according to a new study published in the February 2012 issue of the Journal of Psychology and Popular Media Culture. For the study, attention problems were defined as difficulty engaging in or sustaining behaviour to reach a goal.

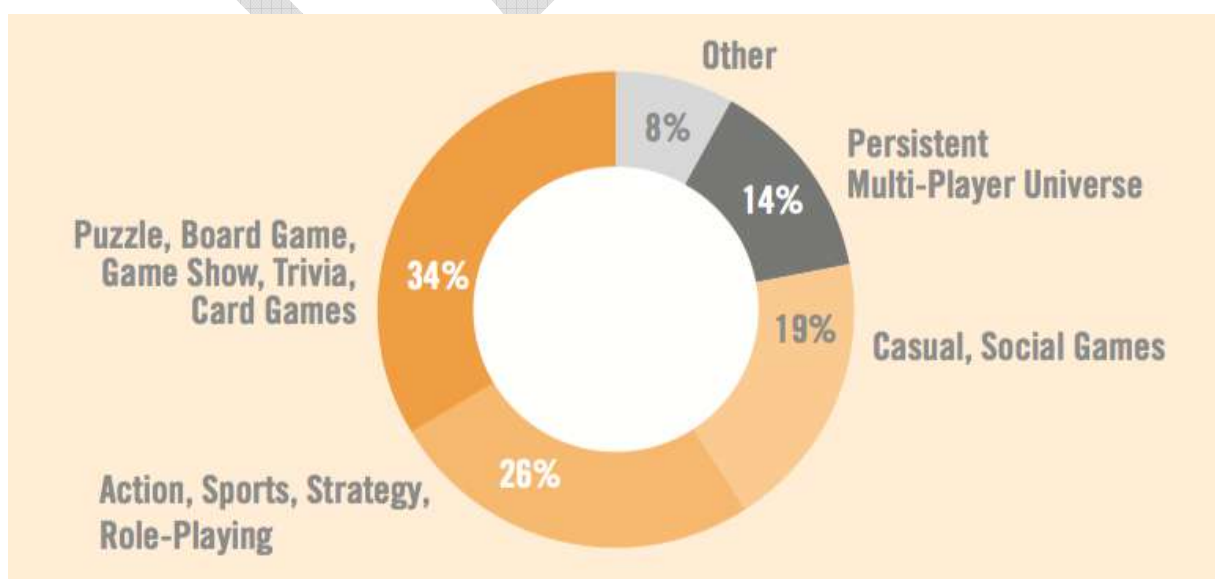
5. Essential Facts about Video Games [as in 23]

58% of Americans play video games. There is an average of TWO gamers in each game-playing U.S. Household. The average age of game players is: 30 Year.



In this ratio 55% of gender is Male and 45% is Female.

Types of online games played most often:



A majority of gamers play games with their friends and family members:

- a) 16% play with parents.
- b) 32% play with other family members.
- c) 42% play with friends.
- d) 16% play with their spouse or significant other.

Do parents control what their kids play?

86% of parents believe that the parental controls available on all new video game consoles are useful.

Further, parents impose time usage limits on video games more than any other form of entertainment:

79% of parents place time limits on video game playing.

78% of parents place time limits on Internet usage

72% of parents place time limits on television viewing

69% of parents place time limits on movie viewing.

Top 5 reasons parents play with their kids:

- 1) It's fun for the entire family: 85%
- 2) Because they're asked to: 82%
- 3) It's good opportunity to socialize with their child: 78%
- 4) It's good opportunity to monitor game content: 57%
- 5) They enjoy playing video games as much as their child does: 49%

U.S. Household. The average age of game players is: 30 Year.

52% of parents say video games are a positive part of their child's life

Parents with Children Under 18 See Positive Impact of Playing Computer and Video Games:



6. Recommendation for Video Games

Monitor video game play the same way you need to monitor television and other media. Be a loving, attentive parent who disciplines your child well. An aggressive child is more a product of dysfunctional parenting than anything else, including violent games and TV. According to Los Angeles-based psychotherapist Robert Butterworth, dysfunctional parenting, children with little guilt, and accessibility to firearms with little parental supervision can create violent children. "Most children who commit violent crime show an early combination of personality and family factors that include having trouble getting along with playmates in preschool," Butterworth says. "By second or third grade they're doing poorly in school, and have few friends. By the age of 10 they're picking fights and getting labeled by their peers as social outcasts." What's more "they typically come from families where parents are poor at disciplining because they are indifferent, neglectful, too coercive or they use harsh physical punishment with little love."

Although playing video games can be a learning experience, give your kid a variety of entertaining things to learn from, so your kid will not be addicted to just one thing. Be sure to make him read books, play sports, interact with other kids, and watch good TV. Everything should be taken in moderation. The American Academy of Pediatrics recommends that children not spend more than

one to two hours per day in front of all electronic screens, including TV, DVDs, videos, video games (handheld, console, or computer), and computers (for non-academic use). This means seven to fourteen hours per week total. Limit the amount of time they could play and also used the video game ratings to limit the content of the games have children who do better in school and also get into fewer fights. Monitor the effect of video games on your child. Observe his behaviour. If it appears that he is becoming more aggressive with his siblings or friends during the period that he is playing violent games, stop him from playing the games. If he becomes interested in history after playing historical games, then the game is beneficial to him. Limit your child's video game playing when you see him spending less time doing homework and that he is getting lower grades. Limit your child's video game playing when you observe him having a sedentary lifestyle, and not engaging in sports and exercise.

Limit your child's video game playing if he displays sign of addiction and experience "video game withdrawal". Instead of letting your child indulge in watch TV, let him play a good video game instead on the console or the tablet. For young children, playing video games is better than watching TV, according to Queensland University of Technology Games Research and Interaction Design Lab. Some games encourage kids to be moderately active, and some also exercise kids' cognitive skills. According to Dr. Penny Sweetser, such games "can improve academic performance, social skills and self esteem". He recommends, though, letting your kid play with parental interaction and supervision.

What to look for in choosing a video game Decide what is acceptable in your home and if you think violent games are not acceptable, explain to your kid the reason why it might be bad for him. Check the Ratings of the game before you buy it or allow your kid to play it. Check its rating which is indicated in the box. Note the title and cover picture. If they have themes of sex and/or violence, then these themes are in the game. If possible, be familiar with the game or read its reviews in the internet. Sometimes, the "bad" part of the game is hidden in the higher levels. Do not neglect supervising your kid as a parent.

Consider your child's maturity level to determine which games are suitable for him. Chronological age is not necessarily a measure of maturity. Pick games that require the player to come up with strategies, and make decisions in a game environment that is more complex than punching, stealing, and killing. Look for games involving multiple players to encourage group play. According to Los Angeles-based psychotherapist Robert Butterworth, you should "evaluate the shows and games not just in terms of violence or obscenity, but in terms of the mental engagement that they require. Boys need to slay dragons and play games with action figures of cowboys and Indians," he says. "They need to be in a fantasy where they are conquering heroes; suppressing this may have long-term effects that may not be good."

7. Conclusion

Results from the current analysis supported the conclusion that violent video game exposure is associated with increased visuospatial cognition. However, results of the current meta-analysis did not support a relationship between violent video game exposure and aggressive behaviour. Taken together these results suggest that violent video game exposure is associated with some positive effects, but does not appear to be associated with negative effects in relation to aggressive behaviour. These results have some important implications for the way in which the debate on violent video game effects have been framed. Arguably the larger part of the discussion on violent video games has focused on their effects on aggressive behaviour, with some researchers suggesting that the relationship between violent games and aggressive behaviour is well demonstrated [11]. Results from the current analysis, however, suggest that such claims are unfounded. Video games may, however, be associated with increased visuo- spatial cognition. However, this body of literature is still fairly new and small and further research is necessary before true causal inferences are warranted. Although video game violence appears to be of relatively little concern for most individuals, it still may be worth examining whether there are special populations for whom video game violence may pose a particular risk. Specifically, individuals already at risk for violent behaviour may respond more

negatively to violent games than the majority of individuals. Although violent games are not likely a cause of violent behaviour in such individuals, it may be possible that violent games may moderate existing violence predilections. Given that the negative effects of violent video games on aggressive behaviour may be overstated, and that such games are popular, it may be worth considering ways in which such games may be adopted for positive goals. For instance, research examining the utility of such games for educational purposes would be welcome. It may be that these games may prove valuable as learning tools, at minimum in areas related to visuospatial skills. For example, one game with violent content called Re-Mission, has been demonstrated to lead to greater treatment adherence, quality of life, cancer knowledge and self-efficacy in youths with cancer who were randomized to play the game in comparison to youths who did not play the game.

The current meta-analysis was designed to help elucidate the impact of violent video games on aggressive behaviour and visuospatial cognition. It is believed that the current results will prove valuable in further discussion and debate on this topic. Specifically, it is hoped that this paper will stimulate a more balanced discussion of violent video games that focuses less on heightened concerns and more on practical outcomes.

REFERENCES

1. Lawrence R, Birkland T: Guns, hollywood and school safety: Defining the school-shooting problem across multiple arenas. *Social Science Quarterly* 85:1193–1207, 2004
2. Kotaku: WaPost removes Counterstrike reference from story. Available at: <http://kotaku.com/gaming/washington-post/wapost-removes-counterstrike-from-story-253356.php>. April 25, 2007
3. Griffiths M, Hunt N: Computer game playing in adolescence: Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology* 5:189–193, 1995
4. Bartholow B, Anderson C: Effects of violent video games on aggressive behaviour: Potential sex differences. *Journal of Experimental Social Psychology* 38:283–290, 2002
5. Bartholow B, Bushman B, Sestir M: Chronic violent video game exposure and desensitization to violence: Behavioural and event related brain potential. *Journal of Experimental Social Psychology* 42:532–539, 2006
6. Anderson C, Dill K: Video games and aggressive thoughts, feelings and behaviour in the laboratory and in life. *Journal of Personality and Social Psychology* 78:772–790, 2000
7. Ferguson CJ, Rueda S, Cruz A, Ferguson D, Fritz S, Smith S: Violent video games and aggression: Causal relationship of family violence and intrinsic violence motivation? *Criminal Justice and Behaviour* (in press)
8. Weigman O, Van Schie E: Video game playing and its relations with aggressive and prosocial behaviour. *British Journal of Social Psychology* 37:367–378, 1998
9. Williams D, Skoric M: Internet fantasy violence: A test of aggression in an online game. *Communication Monographs* 72:217–233, 2005
10. Anderson C, Bushman B: Effects of violent video games on aggressive behaviour, aggressive cognition, aggressive affect, physiological arousal and prosocial behaviour: A meta-analysis. *Psychology and Science* 12:353–359, 2001
11. Anderson C: An update on the effects of playing violent video games. *Journal of Adolescence* 27:113–122, 2004
12. Sherry J: The effects of violent video games on aggression: A meta-analysis. *Human Communication Research* 27:409–431, 2001
13. Sherry J: Violent video games and aggression: Why can't we find links? In Preiss R, Gayle B, Burrell N, Allen M, Bryant J, Eds *Mass Media Effects Research: Advances Through Meta-analysis*. Mahwah, NJ, L. Erlbaum, 2007, pp 231–248
14. Ferguson CJ: Evidence for publication bias in video game violence effects literature: A meta-analytic review. *Aggression Violent Behaviour* 12:470–482, 2007
15. Ryan R, Rigby S, Przybylski A: The motivational pull of video games: A self determination theory approach. *Motivation and Emotion* 30:347–363, 2006
16. Green CS, Bavelier D: Action video game experience alters the spatial resolution of vision. *Psychology and Science*

18:88–94, 2007

17. Rosser J, Lynch P, Caddihy L, Gentile D, Klonsky J, Merrell R: The impact of video games on training surgeons in the 21st century. *Archives of Surgery* 142:181–186, 2007

18. Castel A, Pratt J, Drummond E: The effect of action video game experience on the time course of inhibition of return and the efficiency of visual search. *Acta Psychologica* 119:217–230, 2005

19. Green CS, Bavelier D: Action video game modifies visual selective attention. *Nature* 423:534–537, 2003 20. Sims V, Mayer R: Domain specificity of spatial expertise: The case of video game players. *Applied Cognitive Psychology* 16:95–115, 2002

21. Carnagey N, Anderson C: The effects of reward and punishment in violent video games on aggressive affect, cognition and behaviour. *Psychology Science* 16:882–889, 2004

22. Hunter J, Schmidt F: *Methods of meta-analysis: Correcting error and bias in research findings*. Thousand Oaks, CA, Sage, 2004

23. Kato P, Cole S, Marin-Bowling V, Dahl G, Pollock B: Controlled trial of a video game to improve health-related outcomes among adolescents and young adults with cancer. Presented at the Society of

Behavioural Medicine 27th Annual Meeting, San Francisco CA, 2006 (April)

24. http://www.theesa.com/facts/pdfs/ESA_EF_2013.pdf