

Chapter 3

How and What Do Videogames Teach?

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The pervasiveness of videogames in modern society, especially among children, suggests that it is important to understand how and what these videogames are teaching the individuals who play them. Although playing videogames can produce positive outcomes, such as increased persistence at difficult tasks, there are also potential negative outcomes, such as increased aggression. The General Learning Model illustrates how these positive and negative outcomes are produced, both in the form of immediate short term effects and through cumulative long term effects. In this chapter, we will explore the effects of videogames as explained by the General Learning Model. Some important public policy issues relating to the teaching effects of videogames will also be addressed.

The General Learning Model

The General Learning Model (GLM) is based on both early aggression theories and violent-media research as well as social-cognitive models and developmental approaches to learning. The GLM is general enough to explain many ways in which videogames teach and influence behavior (Buckley & Anderson, 2006). This model is also useful for its ability to integrate the short term and long term learning effects that videogames can produce.

Input variables

A person's behavior is a product of two types of input variables: personal and situational (see Figure 3.1). Person variables include all of the characteristics of a person as they exist before the learning encounter: personality traits, previous experience, behavioral tendencies, beliefs, attitudes, and mood state. These internal variables tend to be consistent over time and

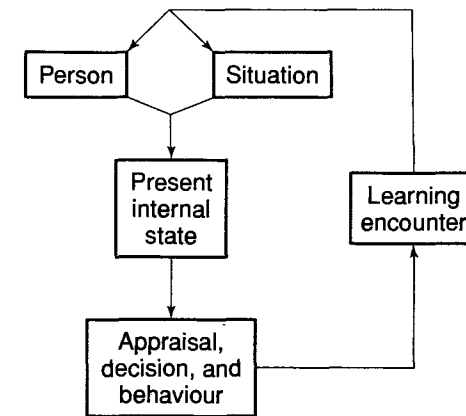


Figure 3.1. The General Learning Model: simplified view.

across situations as a result of people consistently using the same knowledge structures (e.g., scripts, beliefs, and schemata) in shaping their behavior (Anderson & Bushman, 2002; Anderson & Huesmann, 2003; Mischel & Shoda, 1995). Situational variables are the characteristics of the context in which the individual is currently placed ("situated"). This includes media, objects, settings, and other people that make up the learning environment. Although situational variables can and do vary quite a bit over time, they also show some consistency over time, as individuals are often in the same or similar situations repeatedly.

As with learning in general, the ability to learn from videogames is related to many variables, including age, grade level, ability level (this includes learning disabilities and low school performance), income level, and self-esteem (Lieberman, 1998). Some factors that influence learning from videogames are more specific to this form of learning. These variables include individual media-exposure history and the degree to which an individual's comprehension of information is affected by surrounding information (e.g., field-dependence vs. field-independence) (Ghinea & Chen, 2003). Some variables may affect learning through their connection with the specific content that is being learned. For example, learning from violent videogames may be affected by the player's sex, age, experiences with bullying, social problem-solving skills, emotional regulation ability, hostile personality, history of aggressive behavior, level of parental supervision and restriction of videogame play, and aggressive attitudes, beliefs, goals, and scripts (Anderson & Bushman, 2002).

Situational variables also have an impact on an individual's ability to learn from a videogame. The most important situational variables related

to learning are probably aspects of the games themselves. For example, variables such as the level of interest and involvement a game creates, game content (violent, nonviolent, educational), and amount of current game exposure (duration per exposure, number of exposures per week, number of weeks) all affect the amount of learning and what is learned. Videogames may also produce different types and amounts of learning depending on whether they focus on drill-and-practice of factual information (e.g., *Reader Rabbit* or *Knowledge Munchers*), or simulations that model reality (e.g., *The Sims* or *MS Flight Simulator*) (Murphy, Penuel, Means, Korbak, Whaley, & Allen, 2002; Squire, 2003). Some situational variables may enhance the learning effect of violent videogames. Aggressive cues (weapons and aggressive words), provocation, frustration, pain, drugs, and other incentives can have such an effect (Anderson & Bushman, 2002).

Person variables and situational variables can combine in additive and interactive ways to increase or inhibit learning. An example of such an interaction between person and situational variables is that children with low self-esteem (a person variable) who play a game in which they control a character that is similar to themselves, and which is challenging but not too difficult (a situational variable), tend to show increased self-esteem (Lieberman, 1998). Many researchers view learning as a process through which a person's predispositions are modified through situational influences, as self-esteem was modified in Lieberman's (1998) study (Huesmann, 1997; Tremblay, 2000). This is similar to the way that social-cognitive models of aggression describe the interaction of person and situational variables in influencing an individual's present internal state. For example, pain and trait hostility interact in influencing aggressive cognitions such that a person who is high in trait hostility will have a disproportionately strong reaction to pain (Anderson, Anderson, Dill, & Deuser, 1998).

Present internal state

Personal and situational input variables exert their influence on behavior through an individual's present internal state. This state is made up of three major components: cognition, affect, and arousal. These components are all interrelated, such that each one exerts influence on the other two, and all of these components play a role in the process of learning.

Cognition. Personal and situational input variables can influence behavior by making thoughts and scripts related to various constructs more accessible. According to script theory, situational variables can bias a person's response to a situation by activating scripts that make certain responses more likely to occur (Huesmann, 1986). The activation of knowledge structures such as behavioral scripts can occur outside of conscious awareness or control

(Schneider & Shiffrin, 1977; Todorov & Bargh, 2002). Although many cognitive processes such as the activation of these scripts are unconscious, others begin as conscious processes but become automatized over time and with repetition.

A variety of cognitive variables, such as attributions, beliefs, thoughts, attitudes, perceptual schemata, expectation schemata, and behavioral scripts are influenced by input variables. For example, Anderson and Bushman (2001) found that playing a violent videogame increased aggressive thoughts. In this case, a situational input variable (the violent content of the videogame) was affecting people's cognitive state. Similar effects can result from personological input variables. An individual who has an aggressive personality would be more likely to demonstrate a hostile attribution bias. The effects of these input variables can also be more positive. Playing a videogame with prosocial elements could increase the accessibility of prosocial thoughts and constructs.

Affect. Mood and emotion provide another route by which input variables can influence behavior. Two of the ways that affect can influence learning and behavior are through mood-congruent cognition and mood-dependent memory. In the case of mood-congruent cognition, individuals are better able to process information that is consistent with their current mood. One good example of this is the tendency for depressed people to recall more negative information than they do positive information (Berry, 1997). Similarly, aversive stimuli like heat, which can create negative affect, can activate cognitive structures that lead to aggressive cognitions and behavior (Anderson, 1989; Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000; Berkowitz, 1990). Mood-dependent memory, on the other hand, is the phenomenon in which the retrieval of information is best when a person is in the same mood they were in when they learned that information (regardless of the affect of the information itself). In other words, people tend to pay more attention to information that is consistent with their mood, think about this mood-consistent information longer, and recall this information better when they are in the same mood.

The mere-exposure effect is another way by which affect influences learning and behavior: repeated exposure to an object increases the object's attractiveness. This can occur even when the individual is not aware of their exposure to it (Kunst-Wilson & Zajonc, 1980). This may occur in videogames as players are repeatedly exposed to particular characters and stories. The emotional responses to these recurring elements can keep players engaged in a game and motivated to continue playing (Lieberman, 2006). The mere-exposure effect can occur with a stimulus that is initially either neutral or positive. But in some cases the stimulus initially induces fear or other aversive affect. In these cases it is possible for repeated exposure to produce

systematic desensitization; that is, a reduction in the initially aversive emotions. Systematic desensitization is maximized if the initially aversive or feared stimulus is presented in a positive context. In relation to videogames, this means that although the violence contained in a videogame may be initially aversive, repeated exposure within the context of a fun game can reduce negative reactions to the violence (e.g., Carnagey, Anderson, & Bushman, 2006).

Arousal. Most videogames, whether they are designed for education or entertainment, tend to be arousing. The level of arousal produced by a game influences how much learning it can produce. If a videogame does not produce a sufficient amount of arousal, the player may be too bored to pay attention and learn from it. However, too much arousal can actually inhibit the learning of new information (Deshpande & Kawane, 1982; Yerkes & Dodson, 1908). For well learned material, this inhibition in the retrieval and use of information is less likely (Berkowitz, 1990). With less familiar information, arousal is more likely to inhibit the learning and use of the information.

Interrelationships of internal states

Although input variables influence cognition, affect, and arousal, these internal states also can exert substantial influence on each other; cognition and arousal have been shown to influence affect (Schachter & Singer, 1962) and affect can influence cognition and arousal (Bower, 1978). When arousal is too high, the learning of new information may be inhibited. When it is too low, the lack of motivation can also reduce the ability to learn. Furthermore, hostile cognitions or angry affect can determine the scripts and knowledge structures that guide a person's behavior.

Learning encounters

The factors that constitute the present internal state lead to appraisal and decision-making processes that result in some kind of action. This action can be either thoughtful or impulsive, depending on factors such as the valence of the appraisal and the presence of sufficient attentional resources to give the action more careful consideration. In an educational context, an example of such an action is trying to recall the answer to a test question. The entire episode, from input variables to the action that eventually results may be described as a learning encounter (see Figure 3.2). Playing a videogame may be thought of as a series of learning encounters. A single learning encounter within a videogame may last only a few seconds, or it can even last hours.

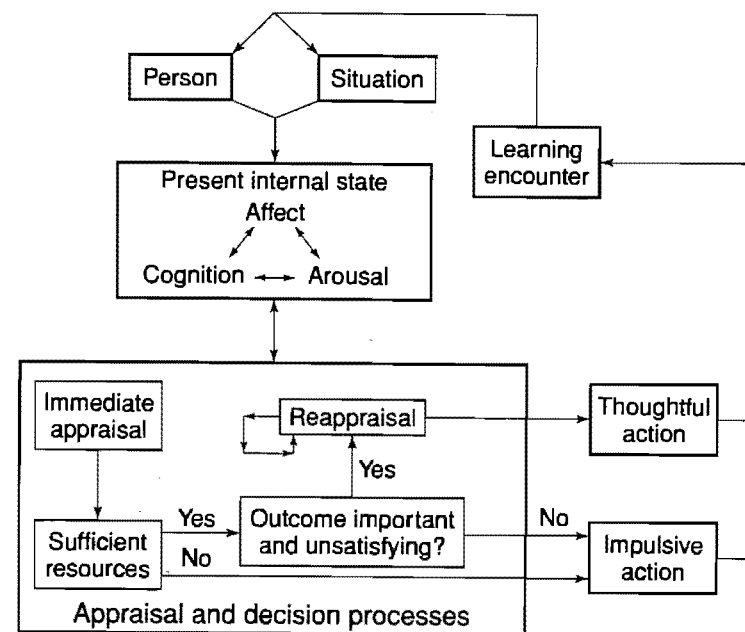


Figure 3.2. The General Learning Model: expanded causes and processes.

According to the General Learning Model, learning encounters have both short term and long term effects on an individual. A learning encounter may exert short term effects on an individual through both person variables and situation variables that make up the inputs of subsequent learning encounters. Of more interest is the potential of these episodes to produce long term effects, through repeated episodes of a similar type. Such repeated episodes can result in changes in personality processes, long term affective changes, and changes to a variety of types of knowledge structures (e.g., content information, procedures, beliefs, attitudes, perceptual schemata for both basic and social patterns, behavioral scripts, and expectation schemata). To relate this back to learning from videogames, an example of such a long term change is that repeatedly playing a videogame that includes a specific form of violence (e.g., gang warfare) could lead to the development of behavioral scripts for that type of violence. Similarly, repeated exposure to videogames that simulate the operations of a business (e.g., *Sim Theme Park*) could lead to the development of knowledge structures (including scripts) for such business operations.

Learning encounters can also exert long term effects by influencing the situational variables that make up the input of future episodes. This may

happen when changes in knowledge structures affect an individual's relationship with teachers, parents, or peers. The development of different knowledge structures may also produce changes by influencing the types of social and non-social situations an individual is likely to encounter. As an example of how such a change in personality might occur, a series of learning encounters that led a person to expect hostile reactions from their peers could lead the person to seek out or create situations in which aggression and confrontation are more likely. Similarly, improvements in school performance brought about by repeated exposure to educational videogames could lead to improved relationships with teachers and parents, and to seeking out additional situational contexts that have academic possibilities.

Videogame Effects

As with any type of media, videogames have the potential to have positive or negative effects on the people who play them. However, videogames are of particular interest because they are very effective teaching tools. Before examining the reasons videogames are effective at teaching, it is worth covering some of the important distinctions concerning videogame effects.

Important distinctions

Short term effects vs. long term effects. When researchers describe short term effects of a videogame, they are referring to effects that are immediate; that is, while playing the game or shortly after playing. Such effects could persist for as long as a half-hour or so after playing, but will tend to diminish rapidly over time. Long term effects may be thought of as delayed effects. These effects tend to accumulate with repeated practice and rehearsal of the videogame content. It is worth noting that while it may often be the case that a videogame will produce similar short term and long term effects, this is not necessarily the case. A videogame could potentially lead to an increase in prosocial behavior as a short term effect, but still increase aggression in the long term. For example, a videogame that increased hostility towards an outgroup might produce such opposite short term and long term effects if the player is playing the videogame in an in-group setting but later has repeated interactions with the outgroup.

Learning vs. performance. Although people often view performance as a necessary indicator that learning has occurred, this approach can be misleading. It is possible to learn skills, beliefs, attitudes, or other knowledge structures even if a person does not have an immediate opportunity to demonstrate such learning outcomes. It makes sense to look for performance as

an indication of learning because the performance of a behavior or the use of a knowledge structure obviously indicates learning. However, the absence of such performance does not indicate that no learning has occurred. It may be that the situation in which the learned knowledge structures or behavior is evoked occurs years later, or it may not ever occur at all.

Manifest effects vs. latent effects. With respect to videogames, manifest effects can be described as the effects of the game that are intended, while latent effects are those effects that are unintended. Although a game may be designed for one purpose, it may produce other unintended effects as well. For example, just because a videogame was designed to be entertaining does not mean that it cannot produce an unintended increase in aggression. Also, note that the latent effects of a videogame are not necessarily negative. Videogames can produce positive effects (e.g., improved perceptual-motor skills) even if there was never any intention of producing such an effect.

Effectiveness of videogames as teaching tools

There are several reasons why videogames are very effective teaching tools (Gentile & Gentile, 2005). Some of the major reasons are outlined in Table 3.1. One such reason is the ability of videogames to capture and hold a person's attention. Videogames do this in part through the use of perceptual cues, such as rapid changes in scene or interesting auditory stimuli that naturally capture attention. Videogames can also offer clear objectives, which are especially appealing because these goals can be adapted to the skills and knowledge of the player. Even the pace of learning can be adapted to the abilities of the individual player. The use of naturally attention-grabbing stimuli and adaptable goals can help ensure that a videogame has a person's attention, which increases the potential to learn from it.

Videogames also are effective because of the active role of the player

Table 3.1. Videogames: great teaching tools.

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- Can capture and hold attention (e.g., orienting response)
 - Offer clear objectives which can be adaptable to prior knowledge and skill
 - Match objectives and pace to the abilities of the learner
 - Active learning, including feedback and the ability to practice until mastery
 - Overlearning
 - Include both extrinsic (e.g., points) and intrinsic rewards (e.g., competence)
 - Subsequent rewards require knowledge and skills learned at earlier points in the game
 - Massed and distributed practice
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Adapted from Gentile & Gentile (2005)

in the learning encounters. Players receive rapid feedback on their performance, and can repeatedly practice a skill or carry out a script until it is mastered. In many cases, skills are overlearned, which improves the long term retention of the learning produced by the game. The same skills mastered early in a game are often required later on in the game as well, which contributes to this process of overlearning. It is common in educational situations for information or skills to be taught without this sort of overlearning that occurs in videogames. Unfortunately, this often means that students do not have the sort of chances to apply or rehearse the knowledge in ways that would lead to long term retention. For many videogame players, their playing time constitutes both massed practice (in that they play for long duration in each sitting) and distributed practice (by playing the game frequently), which is also ideal for increasing learning.

The level of attention players give to videogames and the amount of time spent playing are both due in part to the effective systems of rewards that most videogames utilize. These rewards include both extrinsic and intrinsic rewards. Extrinsic rewards tend to be relatively obvious, as these are often an intentional part of the game, such as "points." Extrinsic rewards can also include entertaining visual and sound effects. Intrinsic rewards occur outside of the videogame itself, but are a result of playing it. For example, videogames can give players a sense of accomplishment and competence, or improve their self-esteem (Lieberman, 1998). These rewards are intrinsic to the experience of playing the game itself, rather than being overt in the sense that game points are. Several features, such as adaptability and multiple forms of rewards, are responsible for giving videogames the ability to attract and hold players' attention, and the gameplay allows players to thoroughly learn the knowledge structures presented in the videogame.

Positive videogame effects

Videogames have the potential to be powerful educational tools. These games can teach both specific content and skills that are beneficial, and also exert more general positive effects on those who play them. Schools, the military, and other industries and organizations have already successfully utilized videogames as teaching tools, but there is the potential for much greater benefit to be derived from videogames.

Unintended effects. Playing videogames can have various positive effects on an individual. These effects are, in many cases, unintended by those who design and those who play these videogames. One such general skill that videogames have proven effective in teaching is hand-eye coordination. People who play videogames are better able to pay attention to cues across the visual field and can attend to a greater number of cues, compared to

those who do not play videogames (Green & Bavelier, 2003). Although such advantages in coordination may not be important in most real-world contexts, one study recently found that surgeons who had experience in playing videogames were faster at performing laparoscopic surgeries and also made fewer mistakes (Rosser, Lynch, Haskamp, Yalif, Gentile, & Giammaria, 2004). Laparoscopic surgery is a less invasive method of operation, in which surgical devices are controlled by keypads and joysticks while progress is viewed on a monitor. The finding that videogames experience is related to better performance at specific skills, such as surgical techniques, suggests that deliberate efforts to improve performance in these areas through videogames could prove successful.

Another positive effect that videogames have is increasing children's positive attitudes towards computers and computer use. Given the importance of computers in many occupational fields in the modern world, such attitudes are likely to benefit an individual to the extent that it increases computer familiarity and use. In some videogames, basic aspects of computer programming are incorporated into the game, giving players an opportunity to develop skills which are potentially beneficial in other computer-related contexts.

Videogames can also teach players task persistence, a useful ability in many contexts. It is common in many videogames for players to fail in their initial attempts at a particular task. In fact, many games are designed so that immediate success is nearly impossible, but by developing skills and persisting in their efforts, they gradually perform better at the challenge and are eventually rewarded with success. The fact that success is contingent on repeated efforts rather than natural ability or task difficulty could transfer into other areas of their life, showing the player that difficult tasks can be achieved through persistence.

Intended effects. Many videogames have been created to teach players specific content and skills. There are many computer games that have been designed to teach traditional school content, and such games have proven effective in teaching subjects such as algebra, geometry (Corbett, Koedinger, & Hadley, 2001), biology (Ybarrondo, 1984), photography (Abrams, 1986), and computer programming (Kahn, 1999). For example, the Pennsylvania Department of Migrant Education was able to successfully teach math, reading, English fluency, and critical thinking skills to migrant children through a videogame (Winograd, 2001). Research indicates that educational software programs are effective at improving early reading and math development (Murphy et al., 2002).

The educational effects of videogames have extended beyond traditional educational subjects to include the teaching of various life skills. Videogames have used virtual reality environments to help teach basic life skills

such as grocery shopping to students with severe learning disabilities (Standen, & Cromby, 1996). Lieberman (1997) found that a videogame was able to successfully teach diabetic children to practice better health behaviors to take care of their disease. NASA research on attentional abilities of fighter pilots led indirectly to the creation of a videogame designed to teach children diagnosed with Attention-Deficit Hyperactivity Disorder how to better control their attention. Various types of simulators (e.g., flight simulators) have demonstrated effectiveness in teaching some of the skills required to perform the task being simulated.

One of the organizations that relies most heavily upon videogames to teach is the U.S. military. The U.S. Army has a unit called the Program Executive Office for Simulation, Training, and Instrumentation (PEO STRI) with an annual budget of one billion dollars. This unit is responsible for implementing training through videogames that are designed to simulate military operations (Buckley & Anderson, 2006). The military simulators teach a variety of skills, such as how to fire different weapons, operate vehicles, interpret computer interfaces, military strategy, and teamwork. Various private organizations also use videogames for training purposes.

Although these videogame effects illustrate that videogames can exert a positive influence in many areas, both intentionally and unintentionally, there remain many other ways in which videogames could be applied in beneficial ways. Games could be designed to teach social skills to children experiencing social difficulties. It may also be possible to design videogames with psychotherapeutic applications. The benefits of videogames can apply to a broad range of skills, abilities, and general life practices, and can even occur in unintentional ways.

Negative videogame effects

Unfortunately, not all of the effects of videogames are positive. Videogames also have the potential to change behavior in undesirable ways. One of these ways that has received the most research attention is the potential for violent videogames to increase aggression. It is not particularly surprising, given the effectiveness of educational games in teaching various skills and information, that videogames with violent content can also teach their content to players.

Nature of the effects. Different research methods have yielded converging evidence that short term exposure to violent entertainment media produces immediate increases in aggression, and that repeated, long term exposure increases aggression across the lifespan (Anderson et al., 2003). Similar findings now exist in the videogame research literature (Anderson, Gentile, & Buckley, 2007). These research findings can be clearly and effectively explained by the General Aggression Model (GAM). This model is

similar to the General Learning Model, and it likewise explains short term and long term effects of videogames. GAM more specifically addresses the processes that lead to aggression. According to GAM, when aggressive scripts, cognitions, or other knowledge structures become activated (either through short term situational priming or due to aggression-related personological factors) and a person is mildly provoked, they are more likely to act aggressively. This action will often be interpreted as excessive by the target of their aggression, which can lead to an aggression-escalation cycle. Thus violent videogames can increase aggression either through the short term activation (i.e., priming) of aggression related knowledge structures or through long term increases in the accessibility of such knowledge structures (i.e., the development of an aggressive personality). Even then, it will take some form of provocation for violent behavior to be evoked, but such provocations are common in the day-to-day experiences of most people, and violent videogames increase the likelihood of an aggressive response.

A common question about violent videogame effects is whether they are stronger than the effects that have been found for violent television and films. There are several reasons, based on social psychological theory, to believe this to be the case (see Table 3.2). First, theory suggests that identification with an aggressor makes an individual more likely to behave aggressively in the future. Videogames force a player to identify with the aggressor because the player is controlling them. This is similar to the active-passive distinction from the general learning model, in that the active role of a videogame player leads to better learning of the violent content. This increased identification with the aggressor is likely to make the rewards for the portrayed violence more direct and salient as well.

Violent videogames may also have a stronger effect on aggressive behavior than films or television because these games often allow the player to rehearse the entire aggression sequence. A player may be required to look for threats, identify them, make a decision, and take aggressive action in a game, whereas television or film observer may not rehearse all of these steps in watching a film or television show. By developing more complete aggressive scripts, future aggressive behavior becomes more likely.

Table 3.2. Are violent videogames worse than violent television/films?

Reasons they might be:

- Identification with the aggressor
- Active participation
- Rehearsal of the entire aggression sequence
- Violence is directly rewarded
- Rate of violence is much higher

The overall rate of violence tends to be higher in violent videogames than violent films and television shows. Even films and television shows with generally violent themes often spend a decent amount of time in non-violent plot development. Many videogames, on the other hand, contain non-stop violence. This difference in the quantity of violence is likely to make the effect of videogame violence stronger than that of television and film.

Strength of the evidence. Despite the consistent finding in the research literature that violent videogames increase aggression, many people outside the research field have not accepted this conclusion. The scientific knowledge of the relationship between media violence and aggression is most accurately reflected in meta-analyses. Meta-analysis is a statistical technique for combining the results of many studies that test the same general hypothesis (e.g., violent videogames increase aggression). Meta-analyses quantify the overall findings of the literature, leaving less potential for reviewer bias than narrative literature reviews. A recent review of the literature, including review of relevant meta-analyses, found “unequivocal evidence that media violence increases the likelihood of aggressive and violent behavior in both immediate and long-term contexts” (Anderson, Berkowitz, Donnerstein, Huesmann, Johnson, Linz, Malamuth, & Wartella, 2003, p. 81). This same conclusion now applies specifically to violent videogame effects (Anderson, Gentile, & Buckley, 2007).

Of course, in any research domain studies typically find somewhat varying results. The media violence domain is no different in this regard. To a great extent, differing outcomes are merely the result of chance factors. Other factors include use of different measures and different methodologies. Recent reviews of the violent videogame literature have revealed that the relative quality of the research methodology also explains some of the differences in results. Some studies of videogame violence have had serious methodological flaws, such as the use of “violent” videogames that are not actually violent, the use of “non-violent” videogames that contain a substantial amount of violence, the use of violent and non-violent games that differed in other important ways, or studies that used an inappropriate measure of aggression (e.g., trait aggression as the primary dependent measure in a short term experimental study). Meta-analysis has demonstrated that studies with such methodological flaws yield smaller effect sizes for the relationship between videogame violence and aggression than studies without such flaws. This finding remains true regardless of whether the studies were using aggressive behavior, hostile affect, physiological arousal, or prosocial behavior (which is inversely related to videogame violence) as the dependent measure (Anderson, Carnagey, Flanagan, Benjamin, Eubanks, & Valentine, 2004). In other words, poor methodology leads to underestimates of the effect of videogame violence on aggression (see Figure 3.3).

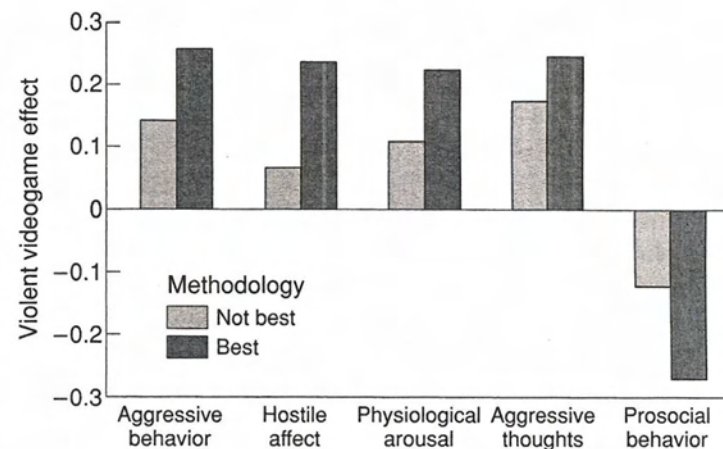


Figure 3.3. Meta-analysis of videogame violence effects on five outcome variables: Effects of Best versus Not Best methodology.

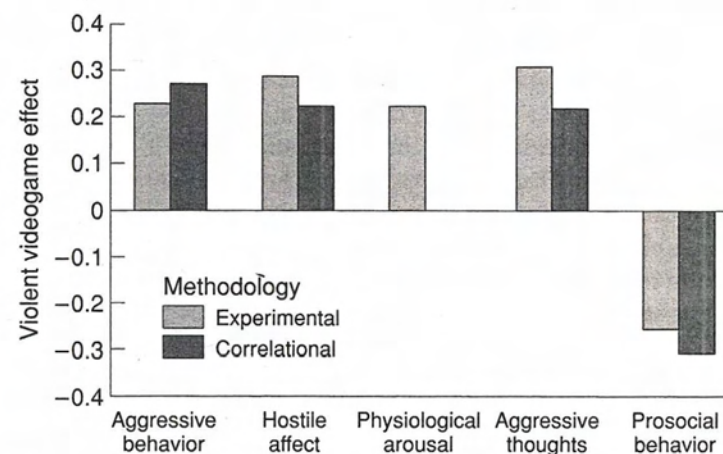


Figure 3.4. Meta-analysis of videogame violence effects on five outcome variables: Best studies by experimental versus correlational method.

Not only is there a clear link between videogame violence and aggression, there is also strong evidence that this relationship is causal (i.e., playing violent videogames causes aggression). Many of the studies which have tested this hypothesis have used experimental methodology, which allows for stronger conclusions of causality to be made than correlational research, though correlational and experimental research on media violence yields similar effect sizes (Anderson et al., 2004; see Figure 3.4). There is also some

evidence based on longitudinal studies that repeated exposure to violent videogames increases aggression over time (Anderson et al., 2007).

Despite such evidence of the causal nature of the relationship between violent videogames and aggression, there is a particularly large amount of resistance by many people to accept this relationship. This is due, in large part, to the differences in the usage of the concept of causality between media violence researchers and the general public. Scientific researchers in many disciplines use the concept of causality in a probabilistic fashion. That is, if a particular variable influences the likelihood that some specific outcome will occur, it can be said to cause that outcome. Another commonly used form of causality is necessary and sufficient causality. Necessary causality means that a given outcome can only occur if a particular level of a specific variable is present. Sufficient causality means that if that particular level of the variable is present, the outcome will always be produced.

People generally do not have trouble accepting probabilistic causality in medical contexts. For example, it is widely accepted that smoking cigarettes *causes* cancer, despite the fact that this relationship clearly does not match the necessary and sufficient form of causality. Not everyone who smokes cigarettes gets cancer (indicating that smoking is not a sufficient cause of cancer) and not everyone who gets cancer has smoked cigarettes (indicating that smoking is not a necessary cause of cancer).

But many non-scientists (and many scientists as well) have difficulty applying probabilistic causality to social psychological contexts, especially when the causal relationship is one which they find unfavorable. Many cigarette smokers and the tobacco industry once used the necessary and sufficient form of causality to argue against the effects of cigarette smoking on cancer. The same type of argument is now used by some videogame players and the videogame industry to discount the causal effect of videogame violence on aggression. Thus, we hear obviously invalid arguments of the form: "I've played violent videogames [smoked cigarettes] for many years, and have never killed anyone [have not gotten lung cancer]. Therefore, playing violent videogames [smoking cigarettes] cannot cause aggression [lung cancer]."

Research has shown the effect of videogame violence on aggression to be moderately strong (see Figure 3.5). The effect size of this relationship is sufficient to warrant public concern. To put this effect size into perspective, note that it is larger than effect sizes found for the impact of asbestos exposure on cancer, the effect of homework on grades, calcium intake on bone mass, nicotine patch use on smoking cessation, lead exposure on reductions in children's IQ, secondhand smoke on cancer, and condom use on susceptibility to HIV (Anderson et al., 2004). These effects serve as useful comparisons for the videogame violence effects, in that all of these effects are of general public concern (see Figure 3.6). The relationship between

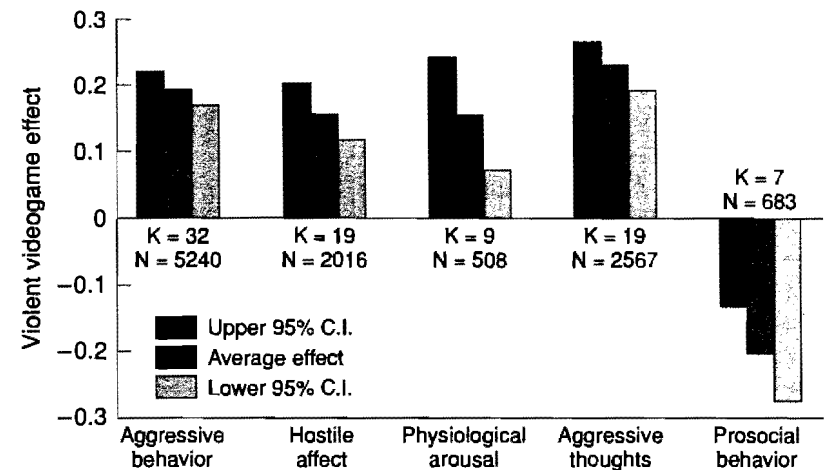


Figure 3.5. Meta-analysis of videogame violence effects on five outcome variables: Overall.

K = number of independent samples.

N = total number of participants.

C.I. = the upper and lower 95% confidence intervals.

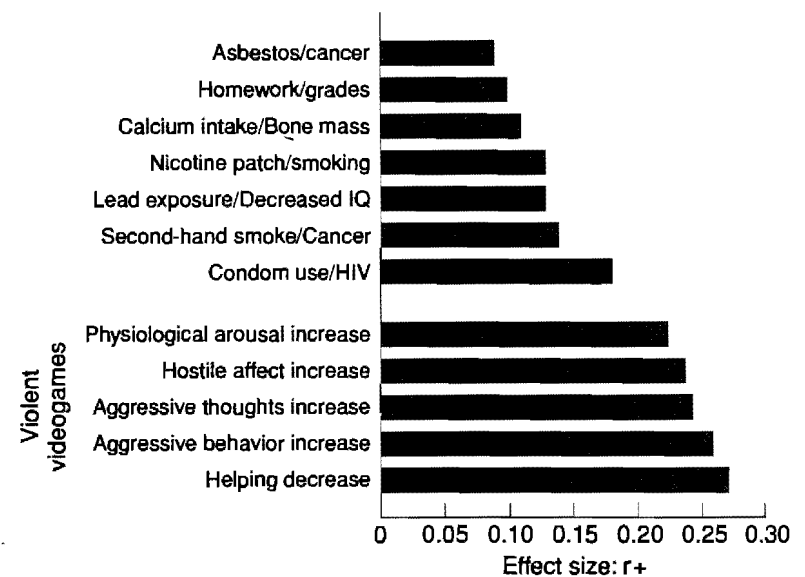


Figure 3.6. How big are violent videogame effects?

variables such as violent videogame use and aggression does not have to be large in order to be deserving of public concern, because so many people are exposed to it and because the outcome (aggression) is of sufficient societal importance that even moderate effects are worthy of attention and concern.

Aggression is an important variable in part because factors that increase aggression, such as violent videogames, can increase extreme forms of aggression (i.e., violent behavior). Although it is unethical to use severe violence as a dependent measure in experimental research, correlational data suggests that playing such games is predictive of violent behavior. Taken together with the findings of experimental research (which relies on other forms of aggression such as setting punishment levels), this suggests that playing violent videogames causes an increase in the probability that someone will behave violently.

Public Policy and Videogames

Some resistance to the findings of violent videogame researchers is due to concern that acknowledging such effects means that it will be necessary to ban those videogames. This is a misconception of the meaning of the research findings. The question of whether or not such a policy is necessary is not a scientific one. In order to create public policies to deal with videogames in light of the findings on violent videogames, it is necessary to understand the role that science plays in public policy (Gentile & Anderson, 2006).

One of the primary roles of science in public policy is to provide factual answers (or as close to factual answers as the science is capable of providing) to key questions. In order to fulfill this role, science must have good theory. This theoretical basis must have an empirical basis in the form of scientific studies that provide data to support the theory. The scientific tests of a theory may lead to revisions of the theory. Based on the current scientific theories, scientists are able to answer some public policy questions. For example, scientists can comment on whether a specific public policy is or is not likely to prove successful at achieving a specific result. For example, the question of whether *Midnight Basketball* (an inner-city program for organizing basketball games among youth that are at risk for committing crimes) is likely to be effective at reducing inner-city crime can be addressed by scientists within the framework of established scientific theory.

Science cannot be the only factor determining public policies. Other factors including legal issues, personal values, and political realities, go into shaping public policies as well (see Figure 3.7). Personal values are a particularly important factor in shaping policy. For example, personal values

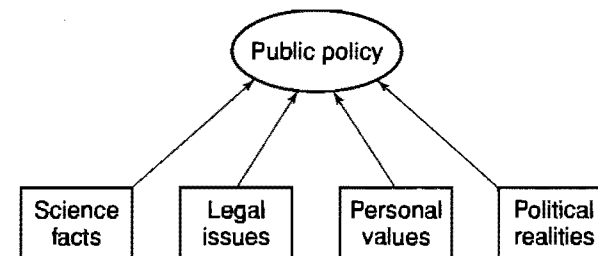


Figure 3.7. The role of science in public policy.

influence public policy decisions about gun control laws. Even if there were indisputable evidence that stricter gun control laws would reduce homicide rates, one could still argue against having such laws. If a person valued less-restricted access to guns more than they valued low homicide rates, such a position could be logical.

There are several ways that the effects of violent media on children can be reduced, primarily by reducing exposure. We have described three pillars of responsibility for such action (Gentile & Anderson, 2003). First, the television, film, and videogame industries need to accurately label their products to indicate the content. They must also educate parents about the meaning of this labelling system. These industries should also maintain ethical marketing practices, ensuring that their advertisements are not aimed at children for whom the games are inappropriate based on their age. The second pillar of responsibility lies with the retail and rental industry. Once media is accurately labelled regarding its content, these industries can enforce appropriate restrictions on the distribution of such media. Third, parents should educate themselves about the meanings of the ratings systems used to label television, films, and videogames. Parents also need to learn why both the content of videogames and the amount of play are important in determining the effects these games produce. Parents also need to act on this knowledge if they are to reduce the negative impact that videogames can have on their children.

Conclusion

It is clear that videogames can be very effective teaching tools. The General Learning Model explains how videogames exert their influence on players. Games can have a variety of positive effects on their players, both in general, unintended ways as well as in terms of deliberately teaching specific knowledge and skills. Unfortunately, along with these positive effects comes

the potential for videogames to exert a negative influence on their players. For example, research indicates that violent videogames produce both short term and long term increases in aggression. Science alone cannot resolve the question of how public policy should deal with such negative effects, though there are ways that videogame industries, retailers, and parents can work to reduce these harmful effects.

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Chapter 4

Videogame Addiction: Fact or Fiction?

Mark D. Griffiths

The popularity of videogames as a leisure phenomenon has become an ever-increasing part of many people's lives. Videogames are widely marketed to adults and children and are readily available in most countries around the world. This leisure activity, however, has recently become the target of criticism within the media. There have been a growing number of reports about excessive use of videogames by both children and adults (often referred to as "joystick junkies") to the extent that some users are being identified as videogame addicts. This concept of "videogame addiction" is a relatively new concept that is currently causing many to rethink more traditional views about what constitutes addiction. Although the concept of "videogame addiction" appears to have its supporters in the media, there is much skepticism within the academic community—especially among those working in the field of addiction research. For many in the academic environment, the concept of videogame addiction seems far-fetched, particularly if their concepts and definitions of addiction are based on the criteria typically associated with addictions to psychoactive drugs. Despite the predominance of drug-based definitions of addiction, there is now a growing movement which views a number of behaviors as potentially addictive. For example some have identified gambling, computer game playing, exercise, sex, and now the Internet as potentially addictive behaviors. Such diversity in addictive agents (drugs or behaviors) has led to new all-encompassing definitions of what constitutes addictive behavior.

The first step in expanding the definition of addiction to include videogaming requires a full examination of what we know and what we need to know about videogaming behavior. Specifically, research into the area of videogame addiction needs to be underpinned by three fundamental questions: (1) What is addiction? (2) Does videogame addiction exist? (3) If videogame addiction exists, what are people actually addicted to?