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Video Games as a Multifaceted Medium: A Review of Quantitative Social Science Research on Video Games and a Typology of Video Game Research Approaches

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Highlights

- Much quantitative social science research has explored video games' social impact using widely varied methods and approaches.
- As light is sometimes studied as a wave and sometimes as a particle, video game research has used many perspectives.
- It is difficult to compare some game research because studies often examine one social dimension of games while ignoring others.
- Researchers exploring different video game dimensions are sometimes like the Indian parable of the blind men and the elephant.
- A typology of social science research approaches to video games will aid comparison, synthesis, and expansion of research.
- This review of video game research approaches identifies four distinct perspectives used in much video game research.
- The "video games as stimulus" perspective includes research focused on effects of game content and features on users.
- The "video games as avocation" perspective includes research focused on users of video games and their commitment to the medium.
- The "video games as skill" perspective includes research focused on video games as a tool for developing skills and abilities.
- The "video games as social environment" perspective includes research focused on social interaction between game users.

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Abstract

Although there is a vast and useful body of quantitative social science research dealing with the social role and impact of video games, it is difficult to compare studies dealing with various dimensions of video games because they are informed by different perspectives and assumptions, employ different methodologies, and address different problems. Studies focusing on different social dimensions of video games can produce varied findings about games' social function that are often difficult to reconcile—or even contradictory. Research is also often categorized by topic area, rendering a comprehensive view of video games' social role across topic areas difficult. This interpretive review presents a novel typology of four identified approaches that categorize much of the quantitative social science video game research conducted to date: "video games as stimulus," "video games as avocation," "video games as skill," and "video games as social environment." This typology is useful because it provides an organizational structure within which the large and growing number of studies on video games can be categorized, guiding comparisons between studies on different research topics and aiding a more comprehensive understanding of video games' social role. Categorizing the different approaches to video game research provides a useful heuristic for those critiquing and expanding that research, as well as an understandable entry point for scholars new to video game research. Further, and perhaps more importantly, the typology indicates when topics should be explored using different approaches than usual to shed new light on the topic areas. Lastly, the typology exposes the conceptual disconnects between the different approaches to video game research, allowing researchers to consider new ways to bridge gaps between the different approaches' strengths and limitations with novel methods.

Content

Introduction

The advent of video games as a commercial phenomenon has been accompanied by a surge of research on video games' social impact. Beginning in the 1980s and continuing ever since, many hundreds of studies by researchers specializing in communication, psychology, medicine, and related fields have explored the role video games have in their users' lives and in society. This vast body of research has been enlightening, but not always conclusive. For example, commonly-researched areas such as the effects of video game violence remain disputed, and bodies of literature exploring potential negative effects and concerns about video games often remain unreconciled with other scholarship exploring opportunities and positive outcomes of game use. Also obfuscating a clear overview of the state of communication research dealing with video games is the fact that video games have many different dimensions and functions, which limits the extent to which video games' impact can be described in simple and uniform terms.

Given that video games serve many functions, researchers studying them have employed a variety of different methods, theoretical perspectives, and measurement instruments in research on video games. This is appropriate, as different dimensions of video games call for different research approaches. Much as light is sometimes treated as a particle and sometimes as a wave in research depending on the focus and goals of that research, video games can be treated as a message, as a time commitment, as a simulation activity, or as a community depending on what games are being studied and how. Unfortunately, though, the many

ways in which video games can be studied often lead researchers to look past each other's work or fail to understand its contributions. Much as the characters in the classic Indian parable of the blind men and the elephant all gave incomplete and discrepant accounts of the animal they were grasping depending on what part they touched, researchers examining video games from different perspectives may poorly understand the ways in which their various perspectives and findings can inform and complement each other.

It is difficult to review, compare, synthesize, and build upon research that is so varied in nature, so much of the research on video games remains isolated by topic area in reviews and meta-analyses. As a result, social science research on video games often progresses in increasingly fragmented and insular streams that examine separate video game dimensions without informing a more comprehensive understanding of the overall role of video games in society. For example, while a group of meta-analyses of video game research examines the negative and positive effects of their content on users (e.g., Anderson & Bushman, 2001; Anderson, Shibuya, Ihori, Bushman, Sakamoto, Rothstein, & Saleem, 2010; Ferguson, 2007a; 2007b; Sherry, 2001), others meta-analyses focus on games' function as everything from a learning tool (Vogel, Vogel, Cannon-Bowers, Bowers, Muse, & Wright, 2006), to an exercise enhancing visuospatial cognition (Ferguson, 2007b), to a pastime encouraging a sedentary lifestyle (Marshall, Biddle, Gorely, Cameron, & Murdey, 2004), to an active physical activity (Peng, Lin, & Crouse, 2011).

Such different foci, categorized primarily by research topic, produce seemingly contradictory findings across topics about the social role of video games. From one perspective, a finding may indicate that video games discourage physical activity (e.g., Marshall et al., 2004), while from another perspective, a study may observe that some video games are themselves a healthy physical activity (e.g., Peng et al., 2011). From one perspective, research may indicate that video games are a potentially harmful stimulus promoting antisocial behavior (e.g., Anderson et al., 2010), while from another perspective, a study may find that video games are a normal and healthy part of an individual's social life and development (Ferguson & Garza, 2011). These contradictions in findings about the social role of video games are sometimes the result of studies employing different methods and measures to produce different findings, but methodological differences are not all that separates discrepant research on video games. Differences between findings in different studies of video games are also the product of different assumptions about the fundamental nature of video games and their social role. Regardless of method employed or topic examined, different studies view video games as a stimulus users are exposed to, an avocation users spend time with, a task for users to practice and accomplish, or a medium for users to interact with each other. These approaches transcend method and topic in research, but selecting one of these approaches to a topic limits the way a topic can be conceptualized and researched.

While it is valuable that all of these bodies of research exist, it is important that we recognize the relative strengths and limitations of these approaches, consider how they contribute together to a comprehensive understanding of the social role of video games, explore ways to address popular research topics with different research approaches than previous research on those topics has employed, and plan new research on

video games that will bridge different approaches instead of proceeding in insular "siloes" within one approach or another. In many cases, particular topics in video game research have been primarily addressed from only one approach, perhaps sometimes because the approach has been particularly useful in informing the topic and perhaps sometimes because researchers have simply been accustomed to approaching the topic from that approach. Reliance on one approach in examining a dimension of video games may be effective when the approach is well-suited to the topic (e.g., examining video games as a stimulus in research dealing with the effects of games' violent content), but such steadfast application of the same approach to a topic over time may neglect key relevant elements of the video game experience (e.g., failing to account for the increasing proportion of violent video game play that occurs between players online rather than by a player interacting with game content as a stimulus). Therefore, identifying approaches commonly used in different areas of research on video games can indicate not only what approaches have been consistently used to examine different topics, but also where some topics should be examined from different approaches to generate new insights (e.g., examining violent video game play as an online social behavior rather than only as a player's exposure to a violent media stimulus).

This literature review attempts to summarize much of the quantitative social science research on video games using a novel typology of video game research approaches often used to explore popular research topics. In addition to providing an up-to-date summary of a large number of studies from several areas of video game research, the review's typology of approaches will help organize criticism, comparison, and extension of research on video games. This typology will allow us to identify what video game research topics tend to employ different approaches, which bodies of research can be compared because they share a common approach, and what limitations bodies of research have due to their reliance on a given approach. Using this typology to categorize existing approaches to video game research, we can also identify when research should further investigate topics using a novel approach, and we can address disconnects between approaches with new research that will bridge those disconnects to add new understanding about video games' social role. Below is an attempt at a comprehensive review of some major areas in quantitative social science research on video games, organized within a novel typology of four research approaches: "video games as stimulus," "video games as avocation," "video games as skill," and "video games as social environment." (See Table 1 & Figure 1.)

Video Games as Stimulus

Definition and Characteristics

The "video games as stimulus" approach is by far the most prominent approach in social science research dealing with video games over the last three decades. This approach includes research that examines the effects of video game content and format features on users' psychological and behavior responses. In some

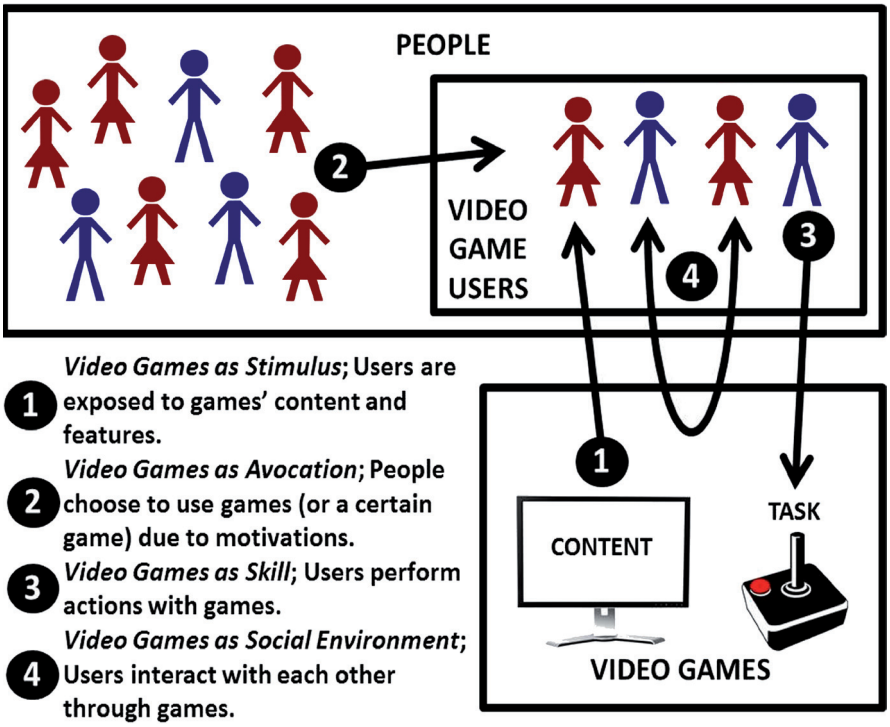

Figure 1. Conceptual Model of Social Dimensions of Video Games Examined by Different Video Game Research Approaches.

cases, a single, very simple characteristic of video games, such as the presence of violence, is examined as a unidimensional and monolithic stimulus variable. In other cases, the effects of a more nuanced stimulus message with more semantically complex symbols and constructs, such as in-game persuasive advertising appeals, are examined (though these nuanced message characteristics can still be regarded as stimuli; see Simons, Detenber, Roedema, & Reiss, 1999; Wright, 1974). Whether viewing video games as one-dimensional stimuli or more complicated mass media messages, though, research from the "video games as stimulus" approach focuses on the effects of one or more dimensions of game content or format on users' responses in a manner consistent with the "media effects" tradition (see Eveland, 2003; McLeod, Kosicki, & Pan,1991). Characteristics of the "video games as stimulus" approach therefore include (a) isolation of one or more game content or form elements as treatments to examine effects on users, (b) a presumption that treatment variables will have similar effects across games in which they are present, and (c) a presumption that treatment variables' effects are produced more or less independently of any effects that other game dimensions might have. Research using this approach may acknowledge that video games are an interactive medium whose users can influence their experiences with the games, but is still concerned primarily with identifying generalizable effects of individual game dimensions in isolation.

Table 1. Overview of Quantitative Social Science Video Game Research Approaches.

Approach	Characteristics	Examples	Trends and Status	Advantages	Limitations
Video Games as Stimulus	Concerned with the content and features of video games and their effects on us ers' psychological states and behavior	Violence; Technological advancement; Game controls; Portrayals of gender, race, and age; Advertising and product placement	Consistently prominent through history of games research	Well-suited to research isolating effects of one or more game factors	Maintains a one-way focus in examining games' impact; Poorly suited to understanding of nuances in game content, interactive and social game dimensions, and active role of users
Video Games as Avocation	Concerned with video game players, their motivations, and their game use	Video game use; Problematic use and "addiction"	Consistently prominent through history of games research	Focus on users provides a better understanding of video game audience and active decisions involved in game use	May not always accurately measure use, motivations, and outcomes; Often reliant on self-reports
Video Games as Skill	Concerned with influence of video games as a simulation exercise for development of skills and abilities.	Perception, cognition, and motor skills; Physical activity	Present in some early studies of video games; Now returning with advent of new interfaces and research findings	Maintains a focus on the unique game-based aspects of medium	May ignore social information and narratives present in game content.
Video Games as Social Environment	Concerned with the way individuals and groups interact within online game settings	Social interaction and relationships; Online behavioral observation	Neglected in early research; Very prominent in recent years after growth of large commercial graphical online games	Recognizes the growing importance of social interaction as part of many video game experiences	Not relevant to all video games as some are still individual experiences; Difficult to determine when events in games correspond to real-life phenomena

Examples

Violence.

Content analyses have consistently demonstrated that the majority of popular video games contain at least some form of violence (e.g., Dietz, 1998; Smith, Lachlan, & Tamborini, 2003), though the nature and extent of that violence varies widely across games (e.g., Thompson & Haninger, 2001). The most visible research employing the "video games as stimulus" approach over the medium's history has been research examining the effects of violent content in video games. Consistent with the characteristics of the "video games as stimulus" approach, this research has typically involved laboratory experiments comparing the effects of a violent and nonviolent video game on an outcome variable, usually one associated with aggression, while often also attempting to hold as many other game elements as constant as possible across the compared games (but cf. Adachi & Willoughby, 2010; 2011). Alternatively, research in this area has also employed cross-sectional or longitudinal surveys asking participants to report their levels of exposure to video games to examine correlations with reports of problematic behavior, again with the intent of identifying video game violence as a universal treatment that can be measured as a level of exposure across numerous hours playing many different video games.

This research examining violence in video games as a treatment influencing users' responses dates back to the mid-1980s (e.g., Dominick, 1984; Anderson & Ford, 1986), when empirical research first began to investigate potential relationships between violence in game content and aggression in users. Since then, some prominent and widely-cited studies have pointed toward a relationship between exposure to violence in video game content and aggressive thoughts, feelings, and behavior in users (e.g., Anderson & Dill, 2000; Bushman & Anderson, 2002; Carnagey, Anderson, & Bushman, 2007). The emergence and promotion of these studies initially led to a dominant viewpoint in fields from psychology to medicine that violent video games represented a substantial cause of aggression in users. However, a number of published studies have not observed such a relationship between violence in video games and aggression, and some studies have even found that exposure to video game violence reduced aggressive responses (see Ferguson, 2010; Ferguson & Rueda, 2010) or increased prosocial behaviors (e.g., Ferguson & Garza, 2011). Further, measures and interpretations in research on effects of video game violence are increasingly disputed, with many arguing that the measures of aggression used in most research finding negative effects of violent video games does not measure responses that are relevant to meaningful antisocial behavior in a real-life setting (Ferguson & Rueda, 2009; Ritter & Eslea, 2005; Tedeschi & Quigley, 1996; 2000) and that measures are used selectively in some cases to increase the likelihood of significant findings (Ferguson & Heene, 2012).

The mixed results across studies dealing with video game violence are exemplified by meta-analyses synthesizing scores of these studies examining the effects of video games on measures of aggression; these meta-analyses have been similarly mixed in their findings regarding a relationship between exposure to

violence in video game content and measures of aggressive thoughts, feelings, and behaviors. Some meta-analyses observe such a relationship (e.g., Anderson & Bushman, 2001; Anderson, et al., 2010), though sometimes suggesting effects on aggression may be weaker than violence in other media such as television and film (Sherry, 2001). Other meta-analysis do not indicate such a relationship (Ferguson, 2007a; 2007b; Sherry, 2007). Further, the results of meta-analyses finding a relationship between violent video games and aggression have been challenged on the grounds that the relationship exists because studies finding no such relationship are unlikely to be published (Ferguson, 2007a; 2007b; Ferguson & Kilburn, 2009) and because meta-analysis authors may have been biased in their selection of studies included in analyses (Ferguson & Heene, 2012).

In addition, recent research has identified another key video game characteristic that may actually be the cause of the aggressive responses to violent games: competition (Adachi & Willoughby 2010; 2011). Most violent video games include a competitive element to produce the conflict that leads to their violent content (e.g., antagonists engaging a character in a fight), and a pair of recent studies comparing effects of competition and violence on aggressive responses suggest that this competition is a clearer influence on aggressive outcomes than violence (Adachi & Willoughby, 2011). Such results suggest that effects of violent games on aggression that were previously attributed to violence in the games may actually be an effect of competition that is also typical in violent games.

These and other concerns have provoked calls for researchers investigating effects of video game violence to be more cautious and back away from earlier claims that violent video games present a substantial risk of harming their users while re-examining the research that produced such claims (e.g., Ferguson; 2011; Hall, Day, & Hall, 2011a; 2011b). Meanwhile, other researchers hold steadfastly to the claims that a conclusive link between violence in video games and meaningful aggression in users has been sufficiently evidenced (e.g., Murray, Biggins, Donnerstein, Menninger, Rich, & Strasburger, 2011). Therefore, the state of research regarding the negative effects of violent video games on aggression is very much in flux, with the longstanding dominant opinion that violence in video games is harmful under siege from new interpretations and data suggesting that the effects of video game violence may have been overstated and may also result from other game factors. In any case, arguments on all sides have been based largely in the "video games as stimulus" approach, and are likely to continue to be.

In addition to research focusing only on the presence or absence of violence, some research on violence in video games examines specific portrayals of violence and the effects of those messages. For example, a content analysis (Smith et al., 2003) raised concerns about not only the high prevalence of violence in video games, but also the nature of its portrayal, claiming that most aggressive exchanges in the games sampled were portrayed as justified, depicted as rewarded or unpunished, and shown with unrealistically low consequences for victims. Some research on effects of video game violence has also investigated specific elements of the way in which violence is portrayed. For example, Carnagey and Anderson (2005)

conducted three studies exploring whether a game that rewarded violence would have greater effects on aggression than a game that punished violence or a nonviolent game. The studies found that playing either type of violent game had similar effects on hostility compared to a nonviolent game, but that playing the game that rewarded violence tended to elicit more aggressive thoughts and behaviors compared to the game where violence was punished or the nonviolent game. That study, however, has been subject to recent criticism that observed effects were actually due to different levels of competitiveness across game conditions (Adachi & Willoughby, 2011).

A group of studies has also explored the effects of bloodshed as a specific element of video games' portrayals of violence, with mixed results (Ballard & Lineberger, 1999; Ballard & Wiest, 1996; Barlett, Harris, & Bruey, 2008). One study (Ballard & Wiest, 1996) found that playing a fighting game portraying bloodshed led to increased blood pressure and hostility compared to playing the same game without blood depicted or playing a nonviolent game. Another study varying levels of blood (Barlett, Harris, & Bruey, 2008) found that playing a fighting game set to display higher levels of blood led to more arousal than playing the game set to display lower levels of blood or none at all. A third study (Ballard & Lineberger, 1999) found that playing a violent game led to less reward behavior and more punishment behavior from players in a subsequent task compared to playing a nonviolent game, but that varying the amount of blood depicted in the violent game did not influence either types of behavior.

In another study, Konijn, Nije Bijvank, and Bushman (2007) found that children assigned to play a violent video game exhibited more aggressive behavior in a laboratory than children assigned to play a nonviolent game, but also found that children who played the violent game exhibited more aggression if they identified more with the characters. They also compared effects of realistic and fantasy games that were violent and nonviolent, finding that games' realism increased identification, but not aggression. As with many studies finding negative effects of video game violence on aggression, though, the aggressive behavior measure used in the study has been criticized as potentially invalid (Ferguson & Rueda, 2009), and the appropriateness of the games used in the study's nonviolent and violent conditions has also been questioned (Ferguson, 2010; Ferguson & Kilburn, 2010).

Lastly, an experiment involving users of an online game (Williams, 2006b) examined effects of game violence on perceptions of social reality rather than on aggression. That study found that participants assigned to play a violent online game for a month were more likely than participants not assigned to play the game to overestimate rates of assault with weapons, a specific type of crime portrayed in the game, but that there were no substantial differences between participants who played and did not play the game in terms of their estimates of types of crime not portrayed in the game.

Portrayals of gender, race, and age.

Another prominent example of research from the "video games as stimulus" perspective is research deal-

ing with portrayals of character gender. Research dealing with portrayals of video game characters' gender deals not only with the presence or absence of different genders among video game portrayals, but messages about gender that games send through prevalence, roles, and context of characters. Content analyses of video game character gender have consistently found not only that female characters are present less frequently in video games, but that they are less likely to be important characters in a game's narrative, less likely to be characters that the user can take the role of in the game, more likely to be passive characters, and more likely to be portrayed in sexualized ways (e.g., Dietz, 1998; Beasley & Standley, 2002; Dill & Thill, 2007; Downs & Smith, 2010; Ivory, 2006; Williams, Martins, Consalvo, & Ivory, 2009). Perhaps the largest such study (Williams, Martins, et al., 2009), which analyzed 4,966 characters appearing in the 150 top-selling games from one year, found that female characters represented only 14.77% of all characters and only 10.45% of primary characters. Data from that study also indicated that female video game characters tended to be thinner than the average American woman in highly photorealistic games, though female video game characters were larger than the average American woman in less graphically realistic games (Martins, Williams, Harrison, & Ratan, 2009). Another recent study (Downs & Smith, 2010) observed that female characters in video games were proportionately more likely than male characters to be portrayed as partially nude or in revealing clothing and more likely to have an unrealistic body shape typically unattainable "without the aid of augmentation, plastic surgery, or chemical injections" (p. 725).

These portrayals may have a negative influence on both male and female users' perceptions of women in the real world, as is evidenced by an experiment finding that male and female users who played a video game with a sexualized female main character tended to exhibit more unfavorable perceptions of women on some questionnaire measures compared to users who played the same game with a female main character who was not sexualized or did not play a game at all (Behm-Morawitz & Mastro, 2009). These results, which are consistent with research on the effects of gender portrayals in other media (see Bessenoff, 2006; Signorielli, 1989, but c.f. Muñoz & Ferguson, 2012), suggest that video games' portrayals of gender roles in society may have negative implications for users' perceptions of gender roles.

There is also some research on other demographic portrayals in video games and the potential effects of those portrayals. A content analysis examining portrayals of race in video games found that White characters were overrepresented in top-selling video games relative to the race's prevalence in the U. S. population, with Black, Hispanic, biracial, and Native American characters underrepresented and Asian/Pacific Islander characters slightly overrepresented (Williams, Martins, et al., 2009). The same content analysis examined age of video game characters as well, finding that adult characters were overrepresented relative to the U. S. population, as were teens to a lesser extent, while children and the elderly were underrepresented (Williams, Martins, et al., 2009). While there has been limited research about the effects of such disproportionate portrayals of race and age in video games on games' users, the messages these portrayals send also exemplify the "video games as stimulus" perspective.

Advertising and product placement.

Another growing body of research within the "video games as stimulus" approach is research dealing with advertising and product placement within video games. This emerging research area has generally tended to find that commercial messages within video games are effective, both in terms of how well they are remembered and the favorable impressions they create. Yang, Roskos-Ewoldsen, Dinu, and Arpan (2006) found that advertising in soccer and racing games elicited better implicit memory for advertised brands than for brands not advertised in the games. Another study by Glass (2007) found that brands advertised within a boxing video game elicited quicker positive responses than negative responses in subsequent implicit association tests, and also elicited quicker positive responses than brands not advertised in the game. An experiment by Lee and Faber (2007) found that users remembered product placement advertising in a driving video game better when ads were centrally-placed in the game than when ads were placed in peripheral locations, and also that users remembered ads for products that were not closely related to the game's topic better than ads for products that were congruent with the game's topic. These effects, though, varied considerably depending on users' experience with video games and their level of involvement with the game.

Although research on advertising in video games has a shorter history than research on some other game messages such as portrayals of character demographics, it is likely that this line of research will continue to be active and vital given that advertising is not only present in some video games, but often the entire purpose of the common and increasingly prevalent "advergames" made available online by companies selling fast food, soft drinks, candy, and various other products (Lee, Choi, Quilliam, & Cole, 2009; Lee & Youn, 2008).

Technological advancement.

While research dealing with video game content such as violence, character portrayals, and advertising messages are the most prominent examples of the "video games as stimulus" approach, content elements are not the only dimensions of video games that are examined with the "video games as stimulus" perspective. Characteristics of video games' technology and form have also been frequently investigated as game characteristics with simple and generalizable effects on users. For example, Ivory and Kalyanaraman (2007) conducted an experiment comparing the effects of technological advancement on game users' experience, finding that newer (and consequently more advanced) games elicited greater feelings of presence and involvement in the games, higher levels of physiological arousal as measured by skin conductance, and more self-reported excitement compared to older games. In a similar vein, Tamborini, Eastin, Skalski, Lachlan, Fediuk, and Brady (2004) compared the effects of a virtual reality video game interface and a traditional console video game interface on users' feelings of telepresence, finding that the difference in technological sophistication between the two game interface conditions did not influence users' feelings of telepresence.

The "video games as stimulus" studies investigating effects of game technology have also exemplified how this approach is well-suited to studying two game variables in concert by exploring whether technological advancement moderated effects of violence on aggression. The aforementioned studies conducted by both Ivory and Kalyanaraman (2007) and Tamborini and colleagues (2004) also looked at whether games' technological advancement exacerbated any possible effects of violent content on aggression, failing to find that more advanced violent games had stronger effects on aggression. A pair of studies by Barlett, Rodeheffer, Baldassaro, Hinkin, & Harris (2008) similarly examined whether technological advancement in video games moderated effects of video game violence on aggression, generally finding that effects of violence on aggression did not tend to vary across video game consoles differing in technological advancement. Finally, a more recent study (Krcmar, Farrar, & McGloin, 2011) compared responses to a violent video game from 1993 and a sequel released in 2004, finding that the newer game version elicited more attention, feelings of presence, and physically aggressive intentions, but not feelings of identification, verbally aggressive intentions, or retaliatory aggression.

Game controls.

Another notable example of research examining effects of video game elements from the "video games as stimulus" perspective is the majority of the growing body of research investigating responses to game control formats. While a control interface might in principle be considered a way to interact with game content and features rather than a game stimulus dimension, much research dealing with effects of game controls has examined uniform effects of control interfaces rather than the way an interface is used or an interface's efficacy as a mode of interaction. Therefore, such research can also be categorized as falling within the "video games as stimulus" perspective because of its focus on uniform effects of game controls on user responses. Studies on effects of control schemes, though, are very mixed. For example, a study by Barlett, Harris, and Baldassaro (2007) found that playing a shooting video game with a "light gun" controller elicited higher levels of heart rate, aggression, and hostility than playing the same game with a traditional controller. Conversely, though, a study by Markey and Scherer (2009) found that using motion-based controllers did not enhance effects of a violent video game on hostility or aggressive thoughts (though the violent games were found to generate more hostility and aggressive thoughts than the nonviolent games regardless of control format). A pair of studies by Skalski, Tamborini, Shelton, Buncher, and Lindmark (2011) comparing effects of controls varying in "naturalness" on feelings of presence and enjoyment generally found that more natural controllers increased both responses. More recently, Schmierbach, Limperos, and Woolley (2012) found that a steering wheel controller increased enjoyment of a driving video game compared to a traditional game controller. On the other hand, a study by Limperos, Schmierbach, Kegerise, and Dardis (2011) found that playing a game with a traditional controller elicited more feelings of control and enjoyment than a more advanced and "natural" controller.

Trends in Popularity over Time

In the early years of video game research, studies using the "video games as stimulus" perspective may have been common because the content and features of video games were relatively simple due to limitations in graphical processing, computer memory, interface hardware, and game development budgets. In many cases, the content of these early games might have been easy to break down into a few defining characteristics to explore their effects. More recently, technological advances in game hardware and software, along with growth in game development budgets, have engendered massive increases in the complexity and depth of video games' content and made games' messages much more nuanced than a few identifiable stimulus characteristics. Even as video games become more complex and multidimensional, though, the "games as stimulus" approach remains popular, most likely because the approach is very conducive to experimental designs and variable-focused theoretical models of media effects (see Eveland, 2003; McLeod et al., 1991). Therefore, the "games as stimulus" approach has not only been popular across the history of social science research involving video games' effects, but will also likely be a dominant approach through which video games will be investigated by researchers for the foreseeable future.

Advantages and Limitations

The popularity of the "video games as stimulus" approach has advantages in its suitability to studies conducted in a controlled environment aiming to isolate specific variable relationships in video games' effects, but widespread adherence to the approach may delay a fuller understanding of how many contexts and characteristics of video game play beyond the games themselves may impact game users. For example, while a great deal of video game play now takes place between friends and strangers in an online setting (see Williams, 2006c), the bulk of research from the "games as message stimulus" perspective continues to employ experiments where a single research participant plays a video game in a controlled setting so that effects of the games' characteristics alone can be isolated and analyzed, or surveys isolating relationships between game exposure and dimensions of users' perceptions and behavior that expected to be influenced by games.

The "video games as stimulus" approach also treats the game experience largely as a one-way communication process wherein users absorb and interpret game messages. While this approach may be well-suited to video games that provide similar content to all users, viewing video games as a one-way message may be poorly suited to the study of increasingly common video games that provide users with an active role in determining their content and games that allow users to engage one another online and therefore create novel content and experiences for each other. One might consider, for example, whether traditional "video games as stimulus" research on responses to video game violence are relevant to an understanding of whether or how users of popular "massively multiplayer online role-playing games" such as World of Warcraft or Lord of the Rings Online are influenced by the violent content that is present in these games,

but often almost tangential to the completion of "quests" and social interaction that takes place in their online virtual environments. The one-way focus of the "video games as stimulus" approach also provides little understanding about why people use video games and what makes them choose one game over another.

Video Games as Avocation

Definition and Characteristics

The "video games as stimulus" perspective may have tended to dominate research dealing with various video game content, forms, and effects, but a second perspective has also been highly prominent in research on video games. The "video games as avocation" approach has been concerned not with the nature or effects of video games, but with those who use video games. In some ways, the "video games as avocation" perspective's focus on video game users and use behaviors complements the popular "video games as stimulus" perspective in a manner analogous to the way that the uses and gratifications perspective of communication theory (see Blumler, 1979; Ruggiero, 2000) complements other media effects perspectives. Research based in this approach is characterized by a focus on the characteristics of video game users, why they play video games, the amount of time they spend with video games, and potential problems associated with their commitment to playing video games.

Examples

Video game use.

Some of the most long-standing research on video game users has been surveys measuring video game use, both in general and across gender and age groups. Numerous studies of youth, adolescents, and adults have consistently observed that males are more likely to play video games than females and play them more frequently. Surveys of 900 fourth- through eighth-grade students in the United States conducted in the early 1990s (e.g., Buchman and Funk, 1996; Funk, 1993; Funk & Buchman, 1996) found that typical video game use among the surveyed youth ranged from about two hours a day to two hours a week. In those surveys, 63.4% of female respondents played video games weekly at home, but 87.7% of male respondents played video games at home at least that often. The surveys also found that video game use decreases with age, with 90% of respondents playing video games weekly at home in the fourth grade, but only 75% of respondents playing weekly at home by seventh and eighth grade. Of the age and gender groups in the study, fourth-grade boys averaged the most hours of playing time with 9.44 hours spent per week, while eighth-grade girls spent an average of only 2.52 hours per week playing video games.

A national telephone survey of 1,102 12- to 17-year-olds (Lenhart, Kahne, Middaugh, Macgill, Evans, & Vitak, 2008) found that 97% of U.S. teenagers reported playing video games, with 31% playing every day and 21% more playing between three and five days per week. Male respondents tended to play more than female respondents, with 39% of males reporting daily video game use compared to 22% of female respondents. In a more recent national online survey of 1,178 8- to 18-year olds in the United States (Gentile, 2009), 88% of respondents reported playing video games at least once a month, and 23% played at least once a day. There was an average time spent player per week of 13.2 hours across the sample. Male respondents spent an average of 16.4 hours playing per week, while female respondents spent an average of 9.2 hours per week playing. Frequency of video game play decreased as respondents' age increased, though length of play time session increased with age.

Similar results have been observed in the United Kingdom. A survey of 387 12- to 16- year olds conducted in the early 1990s (Griffiths & Hunt, 1995) found that 31% of respondents played video games daily and 73% played at least once a month, with males more likely to play frequently than females. In a survey of 147 11-year-olds in the United Kingdom, 25.8% of respondents played video games daily and 80.8% played at least once per week, with males playing more than females.

A survey of 572 18 to 24-year-old university students in the United States (Lucas & Sherry, 2004) found video games to be a popular pastime with that age group as well, with 68.9% of respondents playing video games and the average time spent playing for all survey respondents being 8.54 hours per week. The survey found a similar gender gap in play tendencies, with 88.3% of males in the survey playing games compared to 54.6% of females.

In addition to data about video game use in general, extensive data have been collected in the last decade or so about the users of online video games specifically. These studies of online game players have indicated that the genre is popular with adults, though a gender gap persists in the games' popularity. A groundbreaking survey conducted in 2000 and 2001 with users of the "massively multiplayer online role playing game" (MMORPG) Everquest (Yee, 2001) found that about 84% of the game's players in the survey were male and 16% were female, and that players in the survey had an average age of 25.6 years. In another survey of EverQuest players from the same year (Castronova, 2001) only 7.8% of respondents were female and players had an average age of 24.3 years. A third survey of EverQuest users (Griffiths, Davies, & Chappell, 2003; Griffiths, Davies, & Chappell, 2004a; 2004b) found that the average age of participating players was 27.9 years and 81% or respondents were male, but differences in the gender makeup of the player population varied by age. Of adolescent players in the survey, 93.2% were male, but of adult players in the survey, 79.6 were male. Subsequent surveys of MMORPG players have observed similar trends in age and gender makeup of players (e.g., Charlton & Danforth, 2007; Cole & Griffiths, 2007; Ng & Wiemer-Hastings, 2005; Smahel, Blinka, & Ledabyl, 2008; Yee; 2006b; 2006c). Most recently, one survey of online game players using the MMORPG EverQuest II (Williams, Consalvo, Caplan, & Yee, 2009; Williams, Yee,

& Caplan, 2008) has been able to more precisely identify trends in online game user characteristics by examining game server data in conjunction with surveys. This study's findings were generally consistent with data from other studies of online game players, observing that players were 31.16 years old on average and that 80.8% of players were male. However, the user log data also indicated that female players spent more time on average playing EverQuest II than males, and that female players tended to underestimate how much time they spent playing per week than males.

In addition to tracking video game play and comparing play tendencies across genders, studies of video game use have also observed gender differences in game type preferences and motivations for play. These studies have tended to find that as with total amount of play, game preferences and motivations for play have also varied across genders (e.g., Buchman & Funk 1996; Griffiths & Hunt, 1995; Lucas & Sherry, 2004; Williams, Consalvo, et al., 2009; Yee, 2006a).

Problematic use and "addiction."

Just as research has tracked video game use for decades, concern about the harmful overuse of video games has explored the potentially dangerous side of the "video games as avocation" perspective for just as long. Almost as soon as video games became a popular commercial pastime, arguments sprouted about their risk for addiction and overuse (e.g., Anderson & Ford, 1986; Klein, 1984). Numerous studies have shown evidence that some users are at risk for problematic use and overuse of video games (e.g., Griffiths, 1991; 1997; Griffiths & Hunt, 1995; Griffiths & Meredith, 2009; Grüsser, Thalemann, & Griffiths, 2007; Lemmens, Valkenburg, & Peter, 2009). A survey of 387 12- to 16-year-olds in the United Kingdom (Griffiths & Hunt, 1998) produced estimates that one in five adolescents was "dependent" on video games, while a more recent estimate from Gentile's (2009) survey of 1,178 8- to 18-years olds in the United States placed the rate of "pathological" video game use at 8%. Similarly, a two-year survey of 3,034 students in the third, fourth, seventh, and eighth grades in Singapore (Gentile, Choo, Liau, Sim, Li, Fung, & Khoo, 2011) found that about 8% could be classified as "pathological" video game users. Most studies, though, tend to find much lower rates of problematic game use, in part because they use less liberal measures of problematic use than Gentile's surveys. A survey of 4,208 adolescents by Desai, Krishnan-Sarin, Cavallo, & Potenza (2010) placed the prevalence of problematic gaming at 4.9%, and a pair of surveys of Dutch 13- to 16-year olds (Van Rooij, Schoenmakers, Vermulst, Van Den Eijnden, & Van De Mheen, 2011) found that 3% were addicted to online games. Another Dutch survey (Haagsma, Pieterse, & Peters, 2012) found the prevalence of problematic gaming to be 1.3% among all of the survey's 902 respondents and 3.3% among adolescents and young adults taking the survey. A meta-analysis of research on pathological gaming by Ferguson, Coulson, & Barnett (2011) found the overall prevalence of pathological gaming across included studies to be 3.1%.

Given that the Internet has been generally identified as a medium that is prone to overuse (e.g., Caplan, 2002; 2003; McKenna & Bargh, 2000; Young, 1998), it is no surprise that online games have been singled

out in particular as a threat for problematic use. In Yee's (2001) seminal survey of online game players, a majority of respondents reported being "probably" or "definitely" addicted to EverQuest, while Castronova's (2001) survey of EverQuest users observed that 38.1% of respondents spent more time playing the game than at their jobs. A third survey of EverQuest users (Griffiths et al., 2004a; 2004b) found that some respondents spent as much at 70 hours per week playing the game, and that substantial minorities of respondents reported neglecting other activities such as hobbies, sleep, time with friends and family, work, and school to play EverQuest. A series of surveys of MMORPG users by Yee (2006b; 2006c) found that a majority of players have spent at least 10 continuous hours in one play session and that 18% of players believed that their MMORPG play had negatively affected their schoolwork, health, finances, or personal relationships. When asked if they were "addicted" to an MMORPG, about half of those respondents said yes. Other surveys of MMORPG users have produced similar results with regard to players reporting long play sessions (Ng & Wiemer-Hastings, 2005) and negative effects of MMORPG use on their lives (Charlton & Danforth, 2007; Cole & Griffiths, 2007). A final survey of MMORPG users (Hussain & Griffiths, 2009) estimated that 7% of players may be at risk for problematic game use behaviors.

Complicating research on unhealthy video game use is an absence of a consensus regarding the appropriateness of the term "addiction" to describe video game overuse (Griffiths, 2008; Griffiths & Meredith, 2009; Wood, 2008); the term "problematic use" is often substituted to sidestep the difficult questions surrounding whether compulsive use of media constitutes an addiction per se (Caplan, 2002). Also, some have claimed that problematic use of video games has been overestimated because some measures of problematic use actually only assess high engagement with games, which is not necessarily problematic (Charlton, 2002; Charlton & Danforth, 2007). Still others argue that video game "addiction" is often used inaccurately to describe cases where people are simply poor time managers or using video games excessively due to other underlying problems (Wood, 2008).

Trends in Popularity over Time

As with research from the "video games stimulus" perspective, research in the "video games as avocation" tradition has been consistently prominent for decades. The approach's utility in determining the medium's prominence in our society, as well as in identifying potential harms of overuse, ensure that "video games as avocation" research is a robust part of the video game research landscape. If anything, research in this tradition appears to be increasing in prevalence with the growing presence of online video games. This increase is likely in part because of their popularity, in part because of concerns about their unique potential for harm compared to other video games, and in part because of unique opportunities for collection of user data through partnerships between researchers and the video games industry.

Advantages and Limitations

By focusing on who plays video games, as well as patterns of their use and reasons they choose to play games, the "video games as avocation" approach recognizes the active role that video game users have in the medium's social impact. By the same token, though, much research from the "video games as avocation" perspective is burdened by the same weaknesses as research focused on media uses and gratifications in that it is reliant on self-reports that may not be accurate. Therefore, "video games as avocation" research may not always accurately uncover patterns of video game use and user characteristics as well as research from the behavioral tradition. That concern is mollified, though, by novel methods of data collection that allow researchers to access video game use data directly from game servers rather than from self-reports alone (e.g., Williams et al., 2008).

Video Games as Skill

Definition and Characteristics

Although the "video games as stimulus," and "video games as avocation" approaches are arguably dominant in the history of research on video games' social role, there is also a smaller but important body of research that examines a different set of outcomes from video game use. A long tradition of research confirms that casual play of all kinds serves a meaningful role for both humans and animals in the development of important life skills (see Frederickson, 1998). Similarly, the "video games as skill" approach includes studies that explore the practical outcomes of the video game medium by investigating physical and cognitive skills developed through video game play. Generally speaking, then, research in the "video games as skill" approach is characterized by research linking video game play to general development of any of a range of physical and cognitive abilities. Like the "video games as stimulus" perspective, the "video games as skill" perspective deals largely with how playing video games changes aspects of the user, but the direction of the interaction between the game user and game differs between the two perspectives; while the "video games as stimulus" approach views video games as something that users are exposed to and influenced by, the "video games as skill" perspective views video games as a tool that users employ to develop abilities and practice and perform skills.

Examples

Perception, cognition, and motor skills.

In the very early years of video game research, several studies observed that video game users performed

better than non-users on some tasks measuring performance related to perception and coordination. Such tasks included performance on a pursuit rotor exercise (tracking a rotating dot on a turntable with a metal wand) (Griffith, Voloschin, Gibb, & Bailey, 1983), a Bassin timer exercise (pressing a button in time with the arrival of a moving light on a runway) (Kuhlman & Beitel, 1991), and a spatial representation task (a mental paper-folding exercise) (Greenfield, Brannon, & Lohr, 1994), among others. While these studies simply correlated video game experience with perceptual, spatial, and motor performance, other studies went further by isolating causal effects of a video game session on performance in similar tasks (e.g., Dorval & Pépin, 1986; Okagaki & Frensch, 1994; Subrahmanyam & Greenfield, 1994).

A particularly widely-cited series of studies (Green & Bavelier, 2003; 2006a; 2006b; 2007) identified a positive effect of action game play on multiple measures of visual selective attention. Likewise, a meta-analysis summarizing studies of effects of action games on visuospatial cognition (Ferguson, 2007b) found evidence that the body of research in the area indicated a positive relationship. Interestingly, the effects of video games on visuospatial cognition may be stronger for violent video games than nonviolent video games, largely because of the nature of the action in violent games (see Spence & Feng, 2010). Some research has also shown connections between video game experience and performance in specific vocational skills, such as some types of surgery (Lynch, Aughwane, & Hammond, 2010; Rosser, Lynch, Cuddihy, Gentile, Klonsky, & Merrell, 2007). While recent research has suggested that the bounds of positive effects of video games on visuospatial cognition may be limited (Valadez & Ferguson, 2012), and that methodological flaws may cause some research to exaggerate effects of video games on perception and cognition (Boot, Blakely, & Simons, 2011), there appears to be a general consensus that video games can have positive effects on some skills related to perception and cognition. It should be noted, though, that not all research based in the "video games as skill" perspective involves users developing skills that are necessarily healthy or prosocial; one experiment, for example (Whitaker & Bushman, in press), found that playing a shooting game with a pistol-like controller instead of a typical game controller led users to successfully make almost twice as many "headshots" and 33% more other shots on a mannequin in a subsequent target-shooting task.

Physical activity.

Video games have also been explored as a potential positive influence on general physical health and fitness, though primarily only in recent years. An early study (Segal & Dietz, 1991) found that playing a standing arcade game resulted in more energy expenditure than standing without playing a game, and that energy expenditure from playing the arcade game was comparable to a slow walk. Video game play was not associated with enough energy expenditure to be recommended as an acceptable form of cardiovascular exercise. Considering that many video games are played in a sedentary position rather than the standing position used for many arcade games, video game use has historically been associated with inadequate physical activity levels and a risk of unhealthy weight (Vandewater, Shim, & Caplovitz, 2004) rather than

positive physical health outcomes.

However, the potential for positive physical health outcomes from video game use has been revived by the recent development of several popular active video game control interfaces that require users to control games with movement, such as using a motion-sensing controller, standing and moving on a motion- and weight-sensing device, or moving their bodies in front of a camera interface. A number of "exergames" of "active video games" (AVGs) developed using these interfaces show promise for encouraging physical activity during game play rather than the sedentary states traditionally associated with video games (e.g., Graf, Pratt, Hester, & Short, 2009; Graves, Stratton, Ridgers, & Cable, 2007; 2008). Both an interpretive literature review (Peng, Crouse, & Lin, in press) and a meta-analysis (Peng et al., 2011) assessing recent research on AVGs indicate that these new game formats can encourage light- to moderate-physical activity, with a few studies suggesting that AVGs can substantially increase players' exercise rates. Although the extent of AVGs' positive health potential is still undetermined, it may be that these new video game formats may reverse video games' historical role as an often unhealthy sedentary activity.

Trends in Popularity over Time

As the brief review of research from the "video games as skill" indicates, the perspective was manifested in a number of studies during some of the early years of video game research—roughly the 1980s and early 1990s—but was somewhat quieter for more than a decade while research on effects of game content proliferated. The combination of a resurgence of research on games and visuospatial cognition and new developments in active video game technology, though, have spawned a resurgence in "video games as skill" research in recent years to complement the ongoing video game research dealing with use and social responses. Given the exciting potential implications of some research from this approach, though, it is likely that research based in the "video games as skill" approach will continue to be prevalent in the future.

Advantages and Limitations

While many of the other video game research approaches described here regard video games in much the same way as other communication media in their exploration of content, use, and effects, the "video games as skill" perspective is sensitive to the fact that video games are indeed games with unique characteristics and functions compared to other media. By keeping the game component of video games in focus, the "video games as skill" perspective is best suited to address the unique contributions of video games compared to other media. As the brief review above indicates, some of these unique contributions may be very promising. At the same time, though, video games do contain powerful stimuli and messages, so stripping their function down to only a task or exercise fails to take into account the amount of social information that video games convey as a rich and dynamic medium. Despite the approach's focus on games as a tool for developing skills of one type or another, research applying the approach is also often limited

in the extent to which it can truly show evidence for long-term casual effects of game play on skills because much of the research consists of either short-term experiments or correlational studies rather than prospective or longitudinal experiments.

Video Games as Social Environment

Definition and Characteristics

While all three approaches of video game research described so far deal with the way people use video games and respond to them, the increasing presence of video games that allow users to interact with each other online ushers in the final video game research perspective in this typology: "video games as social environment." Research from the "video games as social environment" perspective focuses not on how much people interact with video games or how they respond to video game content and technology, but rather on how people use video games to interact socially with other people online. Therefore, this research perspective addresses video games as an interpersonal and group social medium rather than as a one-way mass medium or interactive simulation.

Examples

Social interaction and relationships.

Although even the first prototypes of video games were designed for more than one person to play together (Consalvo, 2006; Kirriemuir, 2006; Lowood, 2006; Rockwell, 2002; Williams, 2006a), social interaction between video game players has tended to be understudied over the history of video games research in favor of the research more in line with the "video games as stimulus" tradition. There are some exceptions, of course, involving early video game research dealing with social interaction between game users. For example, Fisher's (1995) survey of young arcade game players found that socializing with others was a primary motivation for their arcade visits. For the most part, though, social interaction between game players was neglected in early research, a decision perhaps justified by surveys finding that most video game players used the games alone even when playing at public arcades (Selnow, 1984). Although online game environments allowing interaction between users date back as far as the early 1980s in the form of text-based MUDs (Multi User Dungeons) emulating the eponymous MUD prototype created between 1978 and 1980 (Bartle, 2010), research on interaction in MUDs was limited. The advent of popular graphical commercial online video games in the late 1990s and early 2000s, however, inspired an increase in research on users' online social interaction.

This research on social interaction between players was conducted primarily in the form of surveys,

many of them the same surveys of online game use described above in the review of research from the "video games as avocation" perspective. The surveys revealed not only that online video game users commit a lot of time to their games, but also that they enjoyed a rich virtual social landscape. For example, Yee's (2006b; 2006c) surveys of MMORPG players found that 39.4% of male respondents and 53.3% of female respondents considered their friendships with people in online games to be as good as or better than their friendships based outside of the games. Of the respondents, 32.0% of females and 22.9% of males also claimed they had told a personal secret to a friend in a MMORPG that they had not told a friend outside of an online game setting, and 15.7% of males and 5.1% of females in the survey had been involved in a physical dating relationship with someone they met in an MMORPG. Many MMORPG users in the surveys also claimed to have learned interpersonal, leadership, and social skills from playing the games.

A second survey of MMORPG users (Cole & Griffiths, 2007) found that about three-quarters of respondents reported making good friends in the games, with more than a third having discussed sensitive topics with their friends in an MMORPG. Other surveys of MMORPG users indicate that online games may offer a valuable alternative to other social opportunities (Ng & Wiemer-Hastings, 2005), that many MMORPG users' primary motivations for playing are social (Griffths et al., 2004a; 2004b; Williams et al., 2008) and that most MMORPG users prefer to take part groups that are primarily social in nature within the games (Williams, Ducheneaut, Xiong, Zhang, Lee, & Nickell, 2006). Such research indicates that for online game users, much of the play experience is not about the content and tasks of the game as much as it is about the social interactions that the games provide.

Online behavioral observation.

Given that online games provide users with a dynamic social environment, online games also provide researchers with an opportunity to observe some social behavior at a level of detail that is not possible in everyday life. Studies have observed that many of the social behaviors online game users exhibit in game environments mirror patterns and tendencies observed in studies of real-life social behavior, including subtle behaviors such as nonverbal communication and gestures (Williams; 2010; Yee, Bailenson, Urbanek, Chang, & Merget, 2007). This correspondence between behavior in games and in real life makes some researchers optimistic that social behavior in online games can be studied not only to understand games' social dynamics, but to understand how people may interact in the real world. Suggestions for topics that can be studied using online games to better inform an understanding of real-life phenomena have ranged from economic trends and behaviors (Castronova, Williams, Shen, Ratan, Xiong, Huang, & Keegan, 2009) to disease outbreaks and epidemics (Balicer, 2007; Lofgren & Fefferman, 2007). Such efforts are a testament to the richness of online games as a social environment.

Trends in Popularity over Time

As has been mentioned above, the study of social dynamics of video games has been very limited until relatively recently, even though video games have allowed users to play together since their inception and online game environments have existed for more than three decades. Therefore, the "video games as social environment" approach is the most recent of the four perspectives described here to see a high level of representation in research activity. As the populations of online games continue to grow, though, and their research potential becomes clearer, research on social dimensions on online games has flourished in recent years and can be expected to continue to do so. In fact, it is very possible that the "video games as social environment" approach may dominate the future research on video games, eclipsing previously common perspectives that have focused more on users' interactions with games than with each other in games.

Advantages and Limitations

As video games become increasingly more likely to include online components, either as a game feature or a central aspect, the value of the "video games as social environment" approach is clear. While other perspectives like the "video games as stimulus" approach have treated video games as a one-way influence, the "video games as social environment" approach focuses on the dynamic interpersonal interactions that are a key component of most online game users' experience. Considering the many millions of video game users who play games online, as well as the time many of them commit to the games, it is a grave error for researchers to continue to examine the social impact of video games based purely on games' content and potential effects of that content on users. An awareness of video games' social dimensions is critical to an understanding of today's video game landscape. On the other hand, though, research focused on video games' content, uses, and effects remains valuable. Online video games represent only part of the broad range of video games available, so individual uses and responses still require investigation. Further, researchers must take care to note that even though some online game behaviors will correspond closely with real-life behaviors, this will not always be the case. Therefore, research employing online games to examine social phenomena must proceed cautiously to ensure that online games are used as a model for social behavior only when appropriate (Williams, 2010).

Applying the Typology when Critiquing and Conducting Research

While some research topics and methods are better suited from one approach than another, the approaches to video game research outlined here transcend topic and method. Therefore, the four categories of this typology have some utility simply as organizational heuristics in critiques of existing research. Given that research from each of the four perspectives tends to share common advantages and limitations, identifying the approach that informs a study provides insight about a study's strengths and weaknesses.

Just as several advantages and limitations of a study can be known as soon as its method is revealed (e.g., a laboratory experiment is potentially useful in isolating causal relationships but limited by artificiality; a cross-sectional survey can identify correlations in a large group but frustrates attempts to eliminate alternative explanations for a relationship), several advantages and limitations of a study about video games can be known once its approach is recognized (e.g., a study from the "games as stimulus" perspective may inform potential psychological effects but neglect the role of social interactions with other players in game experiences; a study from the "games as social environment" perspective may address interpersonal and group dimensions of game use but may neglect how the game itself may influence users' perceptions and behavior).

In this manner, the limitations of assumptions behind a study or group of studies in a topic might be summarized by describing their adherence to one approach to the exclusion of other approaches, and the approach typology can be used to inform new directions in research on a topic. This typology may also provide a comprehensible entry point for scholars who are less familiar with video game research, demonstrating in quick and simple terms what approaches to video game research guide the broad range of research studies exploring the medium and where there may be opportunities to employ new approaches in exploring a video game research topic. As this review indicates, it is often the case that a body of research on a given topic related to video games is based largely or wholly in one research tradition; that does not mean that this should be the case, though.

For example, much of the research on popular "first-person shooter" games tends to examine their effects from the "video games as stimulus" perspective, which is valid for answering some questions but completely neglects the fact that much "first-person shooter" play now takes place in online multiplayer environments. Therefore, research examining first-person shooter games from the "video games as social environments" perspectives may be needed to supplement the body of research on the topic from the "video games as stimulus" perspective. Similarly, this review has noted that much of the literature on problematic video game use and "addiction" is based in the "video games as avocation" approach. This perspective has been useful in informing prevalence of video game use and overuse, and some relationships between individual difference variables and problematic game use. However, problematic video game use could also be studied effectively from other perspectives to better inform the broad picture of unhealthy game use, such as with research from the "video games as stimulus" perspective investigating video game features that produce effects conducive to problematic use, or research from the "video games as social environment" perspective exploring social dynamics of online game relationships that are associated with problematic use. Any number of video game research topics can be examined similarly using this typology to determine where the existing research has not been explored with multiple approaches.

Finally, research designs can work to address topics and questions comprehensively by employing designs based in multiple approaches from the typology. For example, we have extensive research on the effects of

video game violence from the "video games as stimulus" perspective, but more research examining effects of such game features for users with different play habits and motivations would hint at whether some players are more at risk for potential negative effects than others to synthesize the "video games as stimulus" and "video games as avocation" perspectives to better inform the media effects picture. In this way, mindfulness of the typology of approaches to video games might serve as a valuable structure for research designs seeking to take into account the full range of roles that video games serve rather than only addressing one facet of video games at a time.

Conclusions

In an attempt to synthesize the widely varying foci of the vast and growing corpus of literature dealing with video games, this article has presented a thorough review of quantitative social science research on video games and their social impact over the past few decades, as well as a novel typology of four different approaches within which much of that research can be categorized. While new research topics and findings will continue to emerge, this categorization of video game research perspectives will hopefully allow us to determine how new studies can be compared to existing work and how they can be placed in the vast context of the video game research landscape. Further, this categorization is also meant to guide development of new studies by delineating the characteristics, strengths, and limitations of each approach to help researchers make clear determinations as to how best to investigate new problems.

This typology is not without its limitations, most notable among them that it categorizes only quantitative social science research on video games. This means that the four game research approaches described here are positioned within the broader paradigm of empirical social science research. The existence of valuable research from other qualitative and critical research perspectives should also be acknowledged, and future scholarship may be able to position the approaches described here within a larger typology of video game research approaches that spans more methodological and conceptual approaches to video games. Finally, and most ambitiously, it is hoped that by describing and explicating each of these existing approaches in video game research, this typology can help scholars carefully consider what all of the approaches are missing and develop novel approaches that will guide future research probing new questions about video games. Every study of video game research has its strengths, weaknesses, limitations, and assumptions. Using the broad typology described here, perhaps we can better understand gaps and opportunities in the existing research, reconcile discrepancies in findings from different perspectives, and design new and better studies and approaches to draw ever closer to a comprehensive understanding of the social role of video games.

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