PLAYING VIDEO GAMES

Motives, Responses, and Consequences

EDITED BY

Peter Vorderer · Jennings Bryant

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Contents

III Reception and Reaction Processes

IV Effects and Consequences

Foreword

When Palladas, the Greek poet who flourished in the 4th century A.C.E., said that life is but a game, he hardly could have imagined how pervasive games would become in every aspect of our modern lives. From security training simulations to war games and role-playing games, from sports games to gambling, playing video games has become a social phenomena and the increasing number of players that cross gender, culture, and age is on a dramatic trajectory.

Game play—and by that I mean simply computer-based game play—has become a driving economic force that is now giving shape to the technology landscape that supports it. With game play producing revenues in excess of $30 billion worldwide, it is not hard to imagine that a cutting-edge 3-D game can push the lagging revenues of a graphic chip manufacturer into soaring profitability. And so it goes that the fantastic developments in low-cost graphics capability feed the demand for more realism, simulation, and complex game play, which in turn require an even more sophisticated graphics capability in order to play the more demanding game.

This market thrust of pushing development by interweaving content and technology is the dominant feature of today's game play. The latest releases of popular games such as *DOOM 3, HALO 2,* and *World of Warcraft* outperform the commercial success of Hollywood movies and have an extraordinary level of realism that often can not be fully experienced without players upgrading their graphics hardware to the latest specifications. Game experience drives development even in the dedicated high-end game platforms that are another competitive solution for gamer players. Each of the majors—Sony, Microsoft, and Nintendo—regularly releases proprietary hardware that support new levels of graphic capability, but each release is short-lived only to be replaced by yet another, newer technology innovation.

Four years ago E3, the world's largest trade show for game players, distributors, and developers, featured a panel on massively multiplayer online games (MMOGs). The panel was made up of badly bruised and battered developers of these games, each of whom had lost money in the realization of their product and now faced another tough sentence: The audience was unrepentant and vocal in their belief that there would never be a market for people playing together in networked game environments.

In only a few short years, the world for online gamers has shifted completely. Online game play is now considered one of the highest growth opportunities for the commercial future of games. In North America we recently saw the U.S. military host a game developers' conference called "Serious Games" that focused on game-based team training, while the entertainment industry released the hugely popular MMOG called World of Warcraft. These uniquely distinct events share a common thread: They firmly establish the growth of social computing.

With all this frenzied development, what has not been rapidly upgraded or easily replaced is the thinking and academic research about game play itself. This anthology, providing an in-depth review and analysis of playing video games based on study of motives, responses and consequences, is long overdue. By deconstructing the topic into products, motivation and selection, reception and reaction processes, and effects and consequences, the editors have established a foundation in the understanding of what playing video games is all about.

Editors Vorderer and Bryant establish the playing field, focusing their extensive knowledge in entertainment theory to tackle challenging question and putting them into a context of academic research on entertainment. Unlike movies, however, games by their very nature set up the player as the director, with the action taking place in real time. Games, therefore, seem to be the real entertainment of our times, but playing them at the same time is so much different from traditional entertainment.

A total of 27 chapters, written by authors from all around the world, deal with every issue that is most pressing and urgent for our understanding of the more specific nature of playing these games. Overall, this seminal text arrives at a pivotal time in the history of video game development. The relevance of these writings will be equally meaningful to teachers, academics, and parents as to the established commercial game industry and experimental new indie producers.

—Stacey Spiegel, President and CEO
Immersion Studios, Inc., Toronto

Preface

This book has two ancestors: One of them is another book; the other one is a misfit. The other book is currently in press with Lawrence Erlbaum Associates under the title *Psychology of Entertainment.* Here is the backstory: When Jennings Bryant tired of never having adequate materials to teach a doctoral seminar on entertainment theory and research, he asked Peter Vorderer to join him in editing a scholarly volume that would have the advanced content and perspectives needed for such a course. While they were contemplating potential chapters and contributors for such a book, it became obvious that video games have become one of the—if not *the*—most important means of entertainment, at least for the younger generation. Moreover, when they taught entertainment at their various schools or presented papers on entertainment at conferences in the United States and abroad, it became equally obvious that the greatest interest in entertainment theory and research often came from junior faculty and from graduate students who were particularly intrigued by the newest and latest ways of becoming entertained. Often their preferred sources of entertainment were not traditional media, such as television, movies, or music. The delivery format for such contemporary entertainment was something that has been called digital or interactive entertainment. Although such media seemed to have lots of similarities with traditional entertainment, significant and substantial differences were also abundantly present. Many of these young scholars frequently complained that, despite the emerging status of entertainment theory in psychology and communication, there have been few attempts to apply the theory to the playing of video games and to thereby systematize this new field of research. After being hit over the head with such persuasive arguments several times, your responsive editors finally realized that a book that would bring together all these young (typically, but not always) scholars from around the world could enlighten our understanding of what happens when people play video and computer games.

At about the same time, the two editors also submitted a panel to the annual conference of the International Communication Association (ICA). This panel also was supposed to bring together scholars from around the world who would demonstrate and share their findings and insights on electronic games with their peers. The panel proposal, however, was rejected by the Mass Comm division of ICA on the grounds that the reviewers did not think it would fit into this particular branch of the discipline. So here is the misfit—one that puzzled and irritated your editors to such an extent that it finally motivated them to pull together a book that would be able to reach across divisions of a discipline. But, there was a hitch. This other book on the *Psychology of Entertainment* was already in the works, and who would be crazy enough to do two books at the same time?

Sure, our spouses dissuaded us from doing it, and our students and friends suggested we do one after the other, but we could not help developing both projects at the same time. One reason for our unwillingness to defer either idea was because we thought each project was so timely that if either were deferred, the discipline would suffer from the delay. Personally, neither of us has seen another topic within our discipline that has received more attention, more concern, and a greater need for understanding and explanation in such a short period of time as this burgeoning research area of entertainment theory. In particular, the video game industry is growing faster than any other entertainment industry, and electronic games have infiltrated and already changed our lives as much if not more than any other medium. Moreover, public opinion is highly alert to several facets of video game uses and effects, and universities around the world have started to put together programs, curricula, and research teams to better understand what playing electronic games may do to us. We simply cannot afford to postpone a more systematic and empirical study of playing video games.

We also found that most of the university programs that have been put together so far have focused on the creative side of video games, that is, on the art of storytelling and on the production of games. While this aesthetic and engineering perspective is crucial for developing and producing games, equally important are programs that take the perspective of examining their uses and effects. Such perspectives ask how people play games, why they play, and which games they play under what conditions and reasons, and what these games do to users as well as what gamers do with their games, both in the short term and in the longer term. Naturally, these are the questions scholars in media psychology and communication are interested in and are capable of answering, which is why we thought it was essential to put together this volume—if we could only obtain the commitment of these extremely busy scholars. Fortunately, our contributors were able and willing to meet the challenge.

No doubt, such a project with 51 contributors from the United States, Europe, Asia, and Australia would not have been possible without a publishing company that has supported us from the very beginning, and one that is as reliable and competent as we have always found them to be. We are extremely thankful to Linda Bathgate and to her team at Erlbaum for all their advice and for the patience they have had with us. We are also grateful to our contributors, who not only came from different places around the globe but also from different disciplines within the academic world and various gaming industries. We offer special thanks to Stacey Spiegel, who not only penned the foreword to the volume, but who also had his company's best designers create a cover for it.

The book is aimed at students, young and old, who would like to understand how, why, and with which consequences people play video games. It may be used inside and outside of classrooms for communication and media studies, in psychology, in human development, and in education both as an introductory reference resource as well as a textbook. It brings together an extremely talented group of international scholars who recognize—indeed, insist on—the relevance of video games in our lives.

—Peter Vorderer
—Jennings Bryant

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PLAYING VIDEO GAMES
Motives, Responses, and Consequences

CHAPTER 1
Playing Video Games as Entertainment

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Video games have surpassed the designation of "fad" or "new technology" to become a staple of contemporary entertainment. In 2003, computer and video game software sales totaled $7 billion in the United States—more than 239 million units—which is nearly enough for every American household to have purchased two games (Entertainment Software Association, 2004a). In the year 2000, "the demand for computer and video games created a $10.5 billion market" for the game industry, including such subsets as transporting and wholesaling (IDSA, 2001, p. 4). Clearly, entertainment needs that can be satisfied by game playing can generate quite a bit of revenue.

Increasing game sales are not the only indication that gaming has found a place in American—and international—homes. The Entertainment Software Association (ESA), which represents the computer and video game industry in the United States, tracks the demographics of game players. According to the ESA, 50% of all Americans play games, and the average age of a game player is 29 years old (ESA, 2004b). Interestingly, the ESA states that 39% of all gamers are female, dispelling the popular notion that games are a totally male-dominated pastime. Perhaps most importantly, the increases in players and revenue show no signs of stopping or even slowing; according to the ESA, more than 50% of gamers predict that in 10 years they will play as much or more than they currently play (ESA, 2004a).

A 2003 report by the Kaiser Family Foundation shows that even the youngest children have experience with video games; nearly half of all children (49%) ages 0–6 have a video game player in their home, and 10% have a video game console in their bedroom. Thirty percent of young children have played video games, including 3% of children younger than 2. Although game playing is less common among children this age than using other media, 50% of children ages 4–6 play video games, and on a typical day, 16% play for a little more than an hour (1:04). Among boys this age, 9% play games every day, but only 2% of girls ages 4–6 play games this often (Kaiser Family Foundation, 2003). Clearly, video games are popular with younger members of society.

Industry members and nonprofit organizations are not the only groups interested in the pervasiveness of video game play. Academicians who study computer and video games have formed research groups, such as the Center for Computer Games Research Copenhagen, MIT's Comparative Media Studies program, and other similar groups across the globe. One such group at the University of Southern California, the Annenberg

Studies on Computer Games Group (ASC Games), recently conducted an exploratory survey to determine the prevalence of game play and other factors associated with play. A total of 314 individuals completed the online survey; of these, 94% (*n*=297) responded that they play video games, and 75% of respondents said that they played video games every day.

Players' favorite genres were shooter (57.5%), role-playing (54.8%), adventure (48.6%), and strategy/puzzle (48.3%) games. Examples of these games include the popular *Max Payne* and *Lara Croft: Tomb Raider* series, and even PC-based games such as solitaire. Game players expect these genres to remain their favorite for some time as well. Ninety-four percent responded that they expect to be playing games in 10 years, with little variation expected in their favorite genres: role-playing (55.8%), shooter (53.8%), strategy/puzzle (49.8%), and adventure (45%). These findings are similar to the ESA's list of top-selling game genres. In 2003, the best selling console genres were action (27.1%), sports (17.6%), racing (15.7%), and role-playing (8.7%), and for computer games were strategy (27.1%), children's (14.5%), shooter (13.5%) and family entertainment (9.5%) games (ESA, 2004b).

Video and computer games are quite obviously *entertaining* to those people who play them. Respondents overwhelmingly indicated that when forced to choose between video games and other media, they would rather give up television (73.6%) or movies (69.3%). However, does this qualify them as *entertainment*? Is it possible to use theories that explain "traditional" entertainment products (i.e., television, films) to describe what happens when people play games?

THE BOUNDARIES OF TRADITIONAL ENTERTAINMENT THEORY

Vorderer (2000) has pointed out that interactive entertainment poses special challenges to theories of entertainment, which rely on the assumption that users are receptive to content and process what is given to them. Interactivity, however, assumes that content evolves as the user participates with the medium. Computer and video games, unlike television or films in general, contain content that is modified by the user and may change as play develops.

Interactivity poses a unique question for individuals seeking to understand what it is that drives players to use a particular game or even games in general. Respondents to the ASC Games Group survey stated that "competition" was the most important factor (31%), followed by "challenge" (21.4%), for their enjoyment of game play. Respondents also said that they are most likely to purchase a game "because the game will be challenging" (55%). Despite these results, very few tests determine what factors of "competition" or "challenge" are particularly stimulating to players. Other studies (Sherry, de Souza, Greenberg, & Lachlan, n.d.) also demonstrate that the rewarding nature of a challenge or competition drives individuals to use games. These gratifications hold among children, adolescents, and college students (Sherry et al., n.d.). The most intricate process of establishing new gratifications of video game play, however, comes in defining what it is about "challenge" that is motivating. Researchers have already contemplated the defining characteristics of such gratifications as "information," "diversion," or even "entertainment," but have yet to clearly delineate what "challenge" and "competition" mean for video game players and why they are so appealing.

Continually evolving content requires special approaches to the narrative structure of video games. Grodal (2000) discussed three dimensions of entertainment that are experienced fundamentally differently in video games than in more traditional entertainment genres. In a situation in which the viewer or player takes an active role in constructing content, our academic understanding of the role or structure of curiosity, surprise, and suspense needs adjustment. These three aspects of narrative create arousal in viewers and players that will govern their emotional experience while using a film or video game. Interactivity allows for multiple unique interactions with a given entertainment product, which changes the function of curiosity, surprise, and suspense. According to Grodal, especially in video games, "the experience of given situations will change over time, due to learning processes that will change arousal and will change the cognitive labeling of the arousal" (2000, p. 207). Instead of experiencing surprise only one time throughout the game, users experience continual surprises as they encounter new challenges, battles, or characters in a game (Grodal, 2000). Suspense, an important storytelling tool in film (Vorderer, Wulff, & Friedrichsen, 1996), changes drastically when applied to games. A user's experience with a game revolves around the use of the avatar, which they must guide through a series of increasingly difficult tasks. Thus, although players may feel suspense about outcomes of the games, they are at the same time in control of those outcomes (to some extent). This fusion of narrative and interactivity results in a much different emotional experience than that of traditional entertainment (Grodal, 2000; Vorderer, 2000).

CONVERGENCE AND DIVERGENCE: VIDEO GAMES AND TRADITIONAL ENTERTAINMENT THEORY

Video games have altered the public conception of entertainment, but it follows that they must also transform the way that academics research entertainment. The differences between video games and traditional entertainment should force researchers to question an established base of research and demand not only assimilation into older theoretical traditions, but also the construction of new theories in the discipline.

There is a clear convention in entertainment research to investigate several different elements of the viewing experience, namely motivation, selection, experience, and effects (Vorderer, Klimmt, & Ritterfeld, 2004). These different phases of viewing capture the unique and variable emotional states that may guide or result from the use of entertainment. This practice in entertainment research has spawned numerous studies and research projects; so many, in fact, that it is impossible to cover them all in the space of this chapter. Instead, two of these theories will be discussed, alongside the problems that arise when video games become the object of investigation.

Mood Management Theory

One way to explain the motivation of individuals to use entertainment products is given by mood management theory (Zillmann, 1988a, 1988b; Zillmann & Bryant, 1985). The theory considers individuals as hedonically motivated to place themselves in situations in which they amplify pleasure while ameliorating pain. Although the underlying conception of humans as beings who enjoy pleasurable experiences translates to situations other than entertainment, mass media situations represent a common practice individuals may employ to regulate mood states that are noxious and to maintain those that are satisfying (Oliver, 2003). Mood management theory asserts that one of the fundamental states that requires modification is physiological arousal. Overly stimulated or bored individuals may seek to use entertainment to reduce their arousal or stimulate their interest. Highly absorbing entertainment fare that is unrelated to an individual's current affective state can reduce stressful arousal levels because it is "likely to disrupt rehearsal processes that would perpetuate states of elevated arousal associated with negative affective experiences" (Zillmann, 1991, p. 109). Similarly, when faced with a choice, understimulated individuals turn to entertainment options that will increase their level of arousal to a "normal" degree (Bryant & Zillmann, 1984; Zillmann, 1991). Additionally, affective states can be regulated by media exposure. Individuals experiencing a negative mood turn to entertainment stimuli that will alleviate these feelings of sadness or upset, and instead provide feelings of joy or cheer (Oliver, 2003).

Video games, however, come as a challenge to mood management theory, because they provide a much different form of entertainment than traditional film or television. Games are very arousing, highly involving, and require the user to participate in the action instead of providing a distraction. Research on exactly which games are more stimulating to individuals and why is certainly needed. Also, perhaps certain other attributes of games—challenge, interpersonal activity while playing, or fast-paced action—have implications for how individuals can regulate their positive or negative affective states. Correspondingly, users may be forced to not only choose which content best suits their needs, but also which media will best modify their arousal level. Individuals seeking a reduction or increase in arousal have a host of options, and some might forego film or television in favor of games, or eschew their favorite games in favor of less stimulating material.

Affective Disposition Theory

Affective disposition theory (Zillmann, 1980, 1983, 1996; Raney, 2003; Raney & Bryant, 2002) represents a second element of the entertainment discipline, which is focused on the experience a viewer has as he or she is entertained. As a narrative unfolds, its central characters (are forced to) make choices. Disposition theory regards each of these choices as an opportunity for viewers to assess the moral valence of the characters—whether or not the characters' judgments are in line with an individual's own attitudes and beliefs. When characters act in a manner that is in line with a viewer's own opinions, the viewer hopes for positive outcomes and fears negative events for this character. Characters whose actions oppose the viewpoints of the individual are resented or disliked, and the viewer hopes for negative outcomes but fears that these characters will experience positive ends. At the end of the presentation, the resolution will be enjoyable if the desired outcomes are achieved (Zillmann, 2000).

Disposition theories, like mood management theory, are difficult to apply to video and computer games. According to Klimmt and Vorderer (2003), disposition theory considers the audience "to be passive witnesses of the ongoing events" (p. 351). However, as stated earlier, the active audience is an essential component of video and computer games—which require not only action, but also *interaction* with the medium for successful results. Additionally, the lynchpin of disposition theory is the moral judgments individuals form about the actions of the characters. The avatars in nearly all computer games may be evaluated much differently than traditional characters, as the player controls them, rather than viewing their progress as a "moral monitor" (Zillmann, 2000, p. 38). Moral judgments about these characters may not apply because they are behaving in user-controlled patterns. Although these characters may invite users to empathize with their situations and form affective connections, thereby improving the sense of presence an individual feels (Klimmt & Vorderer, 2003), avatars are a problematic application of the basic tenets of disposition theory. Disposition theory, in its current state, is challenged when it is expected to explain the process of enjoyment that users feel as they play a game because it does not account for the unscripted nature of the medium (see, however, Bryant & Davies, chap. 13 in this volume).

Overall, from an academic point of view, the situation has become most interesting: Although there has been an established body of research on traditional entertainment, including well-supported theories and a pallet of empirical findings, many questions involving "new media" such as video and computer games remain open. How will entertainment theory deal with issues of interactivity? How do video games regulate mood states or arousal levels? What kinds of judgments or dispositions do game players form with their avatars, and what impact does this have not only on enjoyment of the game, but also on feelings, cognitions, attitudes, and behaviors? These are just a few of the many questions that will need to be dealt with as video games continue to infiltrate our lives.

IN THIS VOLUME

This book brings together scholars from various disciplines and from different countries around the globe to provide answers to questions like those just mentioned. It is structured into four segments that deal with the games themselves, that is, their content and their history, users' motivation and selection processes, their responses to these games, and the consequences that playing them may have on the users.

Before dealing with these aspects in detail, we first approach computer games twice from a business perspective: In his foreword, Stacey Spiegel contemplates the scope of this volume from his background as a CEO and president of Immersion Studios, Inc., a company that develops games and other multimedia products. Michael Sellers, straddling the typically separate worlds of academia and game design, looks at the process of designing a game from an industry standpoint.

With respect to the games themselves, four chapters introduce and describe their most important features: Henry Lowood traces the history of computer games by providing a brief, but nevertheless most comprehensive, biography of computer games. The following two chapters content-analyze the most popular current games, that is, systematically describe what may be found in these. Barry Smith does this with a rather broad scope that serves very well as a general introduction. Stacy Smith is particularly interested in negative content patterns and character portrayals, such as perps, pimps, and provocative clothing. By analyzing their "weight," she addresses the eligibility of many public concerns expressed in recent years. The final chapter in this section deals with so-called massively multiplayer online games, which Elaine Chan and Peter Vorderer introduce as a new and quite different spin on computer games.

Following a rather established allocation of different phases of the entertainment process, section 2 of this book deals with the processes of motivation and selection, essentially asking, "Why do people play games?" Again, a number of very different perspectives, academic disciplines, theories, and paradigms are put together to illuminate these topics in all their complexity: Jesse Schell and Chris Klug lead off this section by providing answers that are dominant within the game industry. Very much in contrast to this approach, Peter Ohler and Gerhild Nieding take an evolutionary perspective on game play and selection, a stance that has become prominent in contemporary psychology. The following two chapters then use personality theory, motivational psychology, and communication theory to address the question of selection: In the first chapter by Tilo Hartmann and Christoph Klimmt, the role that personality factors play in the selection of computer games is addressed. In the subsequent chapter by Christoph Klimmt and Tilo Hartmann, effectance motivation and self-efficacy, in particular, account for the motivation and selection of specific games. Two further chapters in this section examine players of different ages: Maria von Salisch, Caroline Oppl, and Astrid Kristen explore why children, arguably the most vulnerable group of players, are attracted to games. And Arthur Raney, Jason Smith, and Kaysee Baker focus on adolescents, for whom games have become such an important factor in life. Jennings Bryant and John Davies unite these age variables and others to integrate them in their explanation of selective exposure to computer games.

While the preceding section deals with motivation and selection—that is, processes that occur before the actual entertainment experience—section 3 of this book focuses on reception and reaction processes, such that develop in a phase when somebody is in fact engaged in play and, hopefully, entertained. The section opens with a chapter by Dmitri Williams, who provides a social history of game play, asking, "How has the way we have played computer games changed over the years?" John Sherry, Kristen Lucas, Bradley Greenberg, and Ken Lachlan then take on a very popular research paradigm in communication to summarize what we know about the uses and gratifications of computer games. The four following chapters deal with specific aspects (i.e., features) of the entertainment experience that occur as a particular response to playing computer games: Ron Tamborini and Paul Skalski examine the role of presence (as a "sense of being there") in playing. Sean Zehnder and Scott Lipscomb do this in respect to the role of music in games. Kwan Min Lee, Namkee Park, and Seung-A Jin discuss the importance of narrative and of interactivity in games, and Michael Shapiro, Jorge Peña-Herborn, and Jeff Hancock summarize what is known about the relevance of realism and imagination in computer games. The final two chapters in this section address the playing of online games: Ann-Sofie Axelsson and Tim Regan discuss what it means to play online by examining *Asheron's Call,* and Francis Steen, Patricia Greenfield, Mari Siân Davies, and Brendesha Tynes pick another game, *The Sims Online,* to examine why, in contrast to its offline version *(The Sims),* the online version has failed so dramatically.

The final section of the book is devoted to the various effects and consequences playing computer games can have on their users. Again, the section starts with an overview of what is known in respect to the topic: Kwan Min Lee and Wei Peng summarize the social and psychological effects of computer games. Their chapter is followed by René Weber, Ute Ritterfeld, and Anna Kostygina, who introduce current theoretical positions on the effects of violent games, discuss various methodologies to investigate the short-term and long-term impacts of game playing, and report empirical findings. Katherine Buckley and Craig Anderson then elaborate and expand the most prominent theoretical model about the effects of violent games, namely the general aggression model (GAM), in their chapter. Whereas these chapters primarily focus on negative effects, the final chapters turn the question around and ask what can be and what is actually learned by playing games: Debra Lieberman gives an overview of various studies that show the educational potential of playing. Ute Ritterfeld and René Weber look particularly at the potential of interactivity for enjoyment and the enhancement of developmental processes while elaborating paradigms of entertainment-education. Finally, Kevin Durkin claims that adolescent users are "at risk" if they do not grow up with games.

This sheer quantity of ideas, assumptions, perspectives, theses, and research results is admittedly quite a reading load for anyone who is interested in the study of this new medium. Up to now, there have been no canonized research programs, undisputed theories, or conclusive findings concerning the uses, enjoyment, and consequences of playing electronic games. The field grows rapidly and diversely, driven primarily by the energy of junior scholars who try to come to terms with the entertainment medium that still persists from their childhood. No doubt, this field is still very much work in progress. The only thing that may already be stated is that computer games have become extremely important for people of different ages and cultures, and gender alike. Games are just about to become the most important entertainment product that people use for leisure. This book solicits, examines, and further encourages systematic research on playing computer games by approaching it from different disciplines and research paradigms, and from scholars around the globe, in order to account for the great complexity of this new phenomenon.

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CHAPTER 2
Designing the Experience of Interactive Play

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Games occupy a unique place in human society. They are almost infinite in form and yet possess a singular quality that makes them immediately recognizable. They serve no clear practical purpose and yet are found in every culture and era. As computers have developed in our technological society, games have evolved right along with them—first reiterating classical games (chess, checkers, etc.) and then enabling new games that could not be played in any other form (from *Hunt the Wumpus* [1972] to *The Sims* [2000] and *Grand Theft Auto* [1997]). Computer games have changed as technology has advanced, but the game developer's essential task of designing the game play experience has remained fundamentally the same.

HOW GAMES ARE DIFFERENT FROM OTHER SOFTWARE

Unlike almost all other kinds of software such as enterprise or office products, presentation or tax software, games are peculiar in two important ways. The first of these is that no one has to play a game. An office worker faced with learning a new database program typically has little choice in the matter; but if a game fails to grab a person's attention, it fails as a product. Games are not *required* for anyone, and must therefore succeed on their own engaging qualities to attract and retain a person's interest.

This condition leads to a highly competitive landscape, where games compete in a Darwinian fashion for the attention of potential players—a scarce resource, especially as the number of games expands faster than the pool of likely players. Game developers today are driven by risk-averse financial necessity to design games that are similar to games that have been successful in the recent past, and by creative necessity to throw in innovations along the way. This creates a highly mutative, highly competitive environment where game developers are constantly trying out new ideas (but not *too* new) to get people to buy and play their games. There is intense pressure in game development to create products that have more usable user interfaces, better graphics and sound, and overall provide a more appealing and satisfying game play experience than their competitors. This pressure exceeds that found in any other field of software development, because the feedback loop (revenue) is so directly linked to these attributes.

The second key difference between games and other forms of software is that in games, there is no set of user goals and tasks to model. In contrast, other forms of software exist to streamline, expand on, or augment a preexisting external set of these goals. In user-centered design (a prominent methodology for software development), identifying and understanding the users' goals and tasks is the central aspect around which all the rest of the product's development revolves. In game development, however, there is no such set of predefined goals or tasks. Instead, game developers are faced with coming up with a set of goals and tasks that is comprehensible, novel, appealing, and—most elusively of all—fun. The developers must create goals that the players understand and find sufficiently meaningful, and provide them the ability to navigate a conceptual landscape with appropriate controls that lead to some goal-state.

As predicted by the classic "inverted-U" Yerkes-Dodson arousal curve (Yerkes & Dodson, 1908; explored more fully in Silverman, 2001), this must be done in a way that maintains the user's psychological arousal in the area between boredom and overstimulation, between mechanistic tedium and the paralyzing anxiety and frustration of having too many options. As discussed below, creating the player's tasks effectively to maintain this level of arousal and engagement is the heart of designing the interactive play experience.

GAMES LEAD OTHER FORMS OF SOFTWARE DEVELOPMENT

The combination of these factors—the nature of games as discretionary items, having no external task to design to, and the highly competitive design environment—results in games emerging at the forefront of consumer product development. Games often lead the way in user interface design, artificial intelligence, asset and database organization, and the use of consumer computer hardware (e.g., graphics cards). New developments in industrial and other consumer software are often first seen in games several years earlier.

Despite (or perhaps because of) this leading position in many aspects of consumer product development, the actual game design process—by which the developers decide what the game play experience will be—remains intuitive and ad hoc, with little agreement between designers or teams on necessary and sufficient methods. This has begun to change in the past few years as developers have begun to gather a corpus of knowledge about what works in games, but still remains highly fragmented and idiosyncratic. In the remainder of this chapter, I review common aspects of game design and the development process and explore possible unifying abstractions that focus on defining interactivity from a psychosocial point of view.

COMMONALITIES IN COMPUTER GAME DESIGN

Despite the lack of a de facto accepted methodology for designing game play experiences, there are important commonalities that can be found across the computer games industry. These include distinct genres that have evolved and that now both inform and constrain game development, as well as high-level abstractions concerning the development of interactive play. Understanding computer game genres will help to frame the discussion of design principles and the game development process.

Computer game genres are styles of game play and are important to understand as part of the design process. Each of these genres is fluid but has identifiable hallmarks. Much as with movie genres like "comedy" or "buddy picture," these classifications form useful abstractions for everyone from the initial designers to the product distributors and consumers. As a result, each genre also has its typical dynamics and design constraints. These inform and often limit everything from user interface conventions (e.g., key bindings in first-person shooters) to game play dynamics and aesthetics (e.g., the feeling of heroic accomplishment in role-playing games). The following discussion of genre types is not exclusive, but represents the majority of computer games developed over the past 20 years.

Puzzle games are typically the simplest games to pick up and play, and are aimed at the most casual players. These games present the player with one or more puzzles to be solved, often under time pressure or increasing complexity. These are often visually attractive, easy to learn, and require little time commitment. At their best, these games enable players to "surf" in a psychologically aroused state, often described as being "in the zone" or as the experience of *flow* (Csikszentmihalyi, 1990), a highly attractive state to which people will return again and again. Examples include *Tetris, Myst,* and *Bejeweled.*

Shooters (also known as "first-person shooters" or FPS games) have emerged in the last decade as one of the most exciting if violent types of games; examples include *Doom, Quake,* and *Unreal.* The typical interaction is to shoot at and kill multiple enemies in pursuit of some goal. The quality of the graphics in FPS games is of paramount importance, as the game play experience is primarily perceptually driven.

Role-playing games (RPGs) allow the player to take on the role of a hero on a quest to right a wrong or achieve a great destiny. These games are typically played from a graphical thirdperson perspective, as if looking down on the people represented in the game. The player's character fights monsters, retrieves treasure, and from time to time talks with computer-run characters (typically through predefined menus onscreen). Graphical quality is important in these games from an atmospheric point of view (as shown in *Diablo II* and *Dungeon Siege,* among many others), but does not trump story and game play in importance to the players.

An important but nearly vanished subgenre of the RPG is that of *interactive fiction.* In contrast to the other types of games described here, these games use only text as a display, often using sophisticated language parsers to make sense of the user's typed input. These games first became popular on college mainframe computers in the late 1970s and moved to personal computers in the 1980s. There is still a small but persistent community of players and developers devoted to this area, but it is no longer a major presence in the computer game industry. This type of game does illustrate the primacy of game play over graphics in this genre, however.

Sports games simulate known activities ranging from realistic professional baseball to car racing, fly-fishing, or snowboarding taken to the point of fantasy. These games are known for their attention to detail, scrupulous following of the rules (as set down in the sport itself), and faithful real-world physics.

Simulation games also attempt to faithfully simulate some real-world activity or an extension of some activity. Some, such as fighting flight simulators (e.g., *Crimson Skies*), are hybrids of this and other genres. Others such as the popular city-building game *SimCity,* the Tycoon games (*Rollercoaster Tycoon, Zoo Tycoon,* etc.), and Sim games *(SimTown, SimGolf, The Sims)* enable players to do something they could not do otherwise through the simulation of a familiar series of events in a compressed time and physical context. These games, while brightly graphical, succeed primarily on the cognitive engagement provided by the game play rather than on the perceptual elements of the graphics themselves.

Strategy games fall into two categories—turn-based and real-time strategy games. The latter now dominates the market and these games are often referred to simply as RTS games. The *Heroes of Might and Magic* series are some of the best-selling turn-based strategy games, while the *WarCraft* and *StarCraft* games represent some of the most financially successful real-time strategy games. The game play most often consists of using many units to explore the landscape, expand a controlled area, exploit resources to create new units, and exterminate enemies (for this reason, they are often called "4X" games—eXplore, eXpand, eXploit, exterminate). As with simulation games, the primary game play elements here are cognitive and sometimes social; the graphics are important, but some of the most celebrated games in this genre (e.g., *Civilization*) have had minimal graphics and animation when compared to other games.

The last major genre of games today are *massively multiplayer games,* often abbreviated MMP games (or even with the unwieldy MMORPG—massively multiplayer online roleplaying game). Examples include *Lineage, World of Warcraft,* and *Dark Age of Camelot,* which range from having about two hundred thousand to several million players each. These games are discussed in greater detail in chapter 6.

MMP games present the player with a persistent world that remains in place (and in play) after any individual player has ended his or her play session. Thousands of individual players may be found in this online world at any given time. The game play typically focuses on killing monsters, gathering treasures, completing (often formulaic) quests, and gaining power within the game. However, players also spend a great deal of time socializing with each other, crafting in-game items, creating communities within and outside the game, and exploring the game landscape.

The presence of many players in a persistent world sets the stage for social dynamics not seen in any other type of game or online community. This results in an entirely different experience for the developers and the players; developing an MMP game poses a series of design and production challenges that differ greatly from those found in other genres. These games more than any others combine the perceptual elements of FPS games, the cognitive aspects of strategy and simulation games, and provide a greater social component than do games in other genres.

Genres of computer games are not static, but do represent fundamental abstractions of forms of game play. It is significant that these genres have evolved empirically rather than from design principles: They exist because they have been shown to create games that people will play. As a result, while existing game genres are not a canon, they nevertheless drive and constrain game development from the beginning of conceptual design to the game's final polishing and testing. Additional information on game genres can be found in chapter 3 of this book.

COMMON DESIGN ABSTRACTIONS

Beyond aspects such as genre, point of view, and game play style, there are design abstractions that increasingly act as touchstones during the design and development process. While game developers differ in the formality or intuitiveness of their approach to game play design, a common vocabulary is beginning to emerge centered on these abstractions.

Among those gaining acceptance at a fundamental level is LeBlanc's "MechanicsDynamics-Aesthetics" or MDA framework (LeBlanc, 2004; Hunicke, 2004).

In brief, this is a method for conceptualizing the different components of any game design into three different but interrelated parts.

The first of these, *mechanics,* refers to the specifics of what can happen in a game—what the pieces or actors in a game do. For example, the mechanics of chess defines how each piece can move: Rooks move only in straight lines, bishops only diagonally on their color, and so forth. In a computer game, the mechanics define the rate of a vehicle's acceleration or the damage done by a sword.

A game's *dynamics* describes how the specific mechanics interact. In chess, two knights can form a pincer to trap another piece; and in *Tetris* the player can create higher-scoring combinations of pieces by placing the individual blocks carefully. The mechanics of a game are always defined explicitly and are thus entirely predictable. The dynamics rely on the effects of multiple pieces acting together, and so often result in unpredictable systemic behavior. When the dynamics are unforeseeable at first but obvious in retrospect; when the player can learn and manipulate them easily via the game's mechanics; and when they create perceptually pleasing, cognitively nonlinear, or socially valuable results, then the game play tends to be describable as engaging and fun. The tentative "tends to" disclaimer is necessary as even these factors may not always describe a sufficient set for creating enjoyment; there is still a large element of unexplored and unarticulated art in designing game play dynamics.

Finally, the *aesthetics* describe the reactions in the player evoked by the unpredictability arising from the dynamic interactions of specific objects in the game. A particularly subtle set of moves in chess can create a sense of wonder (or dismay for the opponent); pulling off a difficult trick and winning first place in a snowboard race in *SSX* can create the feeling of *fiero,* or personal triumph. Ultimately, game developers are concerned with the aesthetics their game creates, the psychological arousal and emotions it evokes in the player. But, just as movie directors work with scripts, actors, lights, camera angles, and so on to engender the reactions in the audience they are after, game developers must work through their game's mechanics and dynamics to create the desired aesthetic. For example, in the highly successful game *Prince of Persia: The Sands of Time,* a key mechanic is that the Prince can rewind time using his magical dagger. This creates the dynamic of enabling the player to avoid mistakes by seeing what does not work—albeit at a cost, since the dagger has limited uses. This and other dynamics (including how objects in the world can be used) help set up in the player a sense of excitement, wonder, foreboding, exploration, and even regret when he or she is unable to use the Prince's dagger in a difficult situation.

LINEARITY, INTERACTIVITY, AND EMERGENCE

Along with the MDA conceptual framework, the qualities of interactivity, linearity, and emergence must also be considered. These can be thought of as types of dynamics often considered by developers during the design process.

One common definition of interactivity used in game development states that a computer program (or any other device) can be said to be interactive if it:

- presents state information to the user,
- enables the user to take actions indirectly related to that state,

- changes state based on the user's action, and
- displays that new state.

Together the human user(s) and the device or program form an interactive system, each altering the others' behavior. For example, a thermostat, furnace, and person in combination can be considered to have rudimentary interactivity: The thermostat displays state (temperature), enables the user to change its setting, which indirectly turns on or off the furnace, which then in turn eventually changes the thermostat's displayed state. Setting a thermostat is not a game, however, as it lacks the enjoyment that comes from effective dynamics. Different types of interactivity and their accompanying aesthetics will be considered later in this chapter.

In a game, the user can typically view various aspects of the game state, make decisions about what to do next to achieve some goal, take actions via the user interface (mouse, keyboard, console controller, etc.) to enact those decisions, and, after the game processes this input, view the new state. Whether this is more enjoyable than adjusting a thermostat moves back into the realm of dynamics and aesthetics, and is what sets successful game designs apart from unsuccessful ones. In general, a game needs to provide the players with not just the ability to make and act on decisions but must provide *meaningful* decisions. Meaningfulness occurs in several contexts (described below), but in games is always tied to the player's perceived ability to interact with the game, to change an outcome by making decisions within the context of the game.

Interactivity can take many forms. In many games, the most basic of kind of interactivity is an almost completely linear experience: As in a book or movie, the game proceeds from A to B to C and the player is powerless to change this. Game developers speak of a game being "on rails" (like a train) to describe the fact that the game mechanics do not allow the player to deviate from a predefined path. While making a game completely linear in some aspects can work well (for example, in *Medal of Honor: Allied Assault,* the missions are presented in a predetermined order), too much linearity eliminates interactivity. Whenever an experience is linear, the player is robbed of any ability to make decisions; all the player can do is view the game's state. This leaves the player with mechanics (e.g., this gun shoots 10 rounds per second), but without any dynamics from which the desired aesthetics can be derived.

This highlights the essential difference between games and books or movies. Games are often compared to books or (especially) movies as parallel forms of popular entertainment, but they differ at a fundamental level: Books and movies are noninteractive in their content—nothing the reader or viewer does will change how the story ends. These are still compelling to us psychologically and socially, and our knowledge that the end has been predetermined does not reduce our enjoyment along the way. Games, on the other hand, are necessarily interactive experiences; those in which the outcome is perceived to be predetermined and in which the player's decisions have no effect quickly lose their appeal, no matter how strong the writing or the narrative arcs within them. This difference affects every aspect of the design of the interactive experience.

As a way to maintain some semblance of traditional story and to straddle the line between linearity and interactivity, many games have branching-linear plotlines. In these, the player is given a few opportunities to make meaningful decisions that affect the overall game, but the possible choices and their consequences have all been mapped out during design and development. The advantage of this design method is that it enables the developer to enforce a narrative arc on the game (albeit at the price of to some degree reducing the player to the status of passive viewer) and does not require subtlety in automated characters in the game; their responses can be entirely predetermined. Branching linearity can be successful if the game is sufficiently interactive at some level within the plot structure, so that the player maintains the feeling of having been able to make sufficiently meaningful decisions between forced branch-points.

The difficulties of linearity, even branching linearity where a number of branch points are presented to the player, make classical narrative storytelling difficult in games. This has set up an enduring conundrum for game developers: People enjoy stories, but stories are linear; linearity destroys game dynamics, and people typically do not enjoy linear games or interactive stories. Creating meaningful narrative structures with increasing tension, climax, and resolution within a satisfyingly interactive context—in which the player retains the ability to truly alter the course of events—remains an unsolved problem.

Beyond linearity (branching or otherwise) lies emergent game play. Emergence is to games what narrative is to fiction. Rather than propelling the game forward on a single track via artificial or prescripted structures, the developer provides the building blocks—the game mechanics—that the player can use to create meaningful dynamics with compelling and unexpected-but-welcome aesthetic effects. When such effects arise because of indirect mechanic or dynamic connections, this is called emergent game play. Emergence requires locally specified conditions and consequences, but not an overall plot or narrative direction (though in the best cases, the individual mechanics and dynamics combine to create an emergent directional flow, similar to the narrative flow in a story). Thus, persons playing *SimCity* will make decisions that, acting on the game mechanics and dynamics, determine the growth of their city. Each time they play, the city that emerges will be different. Similarly, players of *Grand Theft Auto* may have entirely different experiences based on their decisions and interactions each time they play the game. In either case, the game developers can predict only how individual pieces of the game will act and interact (the mechanics and dynamics), but not ultimately what the players will make of this (the aesthetics). The sequence of events that emerges becomes the narrative for that particular game within the player's mind, though it may not follow the path of a traditional linear plotline.

It is important to understand that these emergent narratives are often as satisfying for the individual as is a well-crafted, predetermined linear story. This suggests that the more we can embed nascent narrative structures within the mechanics and dynamics of a game without destroying its interactive and emergent properties, the more satisfying the aesthetic experience will be for the player.

It is worth noting that in massively multiplayer games the presence of hundreds or thousands of people in the same game space adds a new element to emergence—that of the other people and the social context. In effect, the players become part of the dynamics of the game for each other. This means that the degree of unexpected emergent consequence in MMP games far exceeds than in any other type of game; it is common for two or more innocuous mechanics to combine to create a dynamic with unforeseeable —sometimes undesirable—aesthetic experience for the players.

For example, in *Ultima Online* it was at one time possible to learn a skill simply by standing near someone who was using the skill: If you watched someone cook, you would become a better cook, too. And in this game, characters had a limited pool of skill they could attain: At some point their skill-gain became zero-sum, and they could not gain a skill without losing from one someplace else. The unfortunate consequence of these two mechanics is that a player, via his or her character, could *harm* another character by reducing their highest skill. That is, character A comes up near character B and begins cooking. Character B's cooking skill begins to rise due to the observation effect. But, because of the zero-sum nature of the skill cap, another skill—character B's highest and thus most desired skill—was reduced. So by the simple act of cooking near someone, you could reduce their ability to fight or work with magic in the game. This is only one of many similar dynamics based on underlying mechanics that did not result in the desired aesthetics within the players.

THE INTERACTIVE PLAY DESIGN PROCESS

To create new games, developers may take existing experiences and turn them into games (e.g., table tennis in *Pong* or developing a city in *SimCity*), or they may come up with entirely novel experiences that have no direct analog outside of the game (e.g., "dropping blocks" games such as *Tetris*). In either case, they must devise ways to make a set of tasks immediately attractive and appealing enough to hold the player's attention. Moreover, developers of online subscription-based games face an additional challenge: Along with creating a play experience that is novel and appealing, it must be one that retains its attractive quality over a period of months or years rather than the tens of hours typically considered for a game experience. This extension for online games adds an entirely new layer to game play design.

Idea and Concept

Game development typically starts with a specific idea. This may be a setting, a visual style, a particular game event the designer sees in his or her mind's eye, or an emotion or reaction the developer hopes to instill in the player. Alternatively, the design process may start with a licensed property to be developed as a game, or with various technological or business constraints that drive the developers in a particular design direction. However it begins, the idea of the game is only a seed. Although people become attached to their ideas, experienced designers know that great ideas are to be found everywhere; coming up with the core idea for a game is by far the easiest part of the development process.

Once the developers believe they have a viable seed for the game, they—typically a single designer or a small group working together—develop the high-level game concept. This often takes the form of a design treatment or overview, sometimes accompanied by early graphical mockups of what the designer envisions for the final product. This brief document outlines the type or genre (RTS, FPS, etc.) of the game, which specifies the overall style of play; the market opportunity (such commercial constraints are never far from the surface in professional game development); a few sketches of the user interface or conceptual graphics, including the player's visual perspective on the game (whether it is viewed from above or from a first-person perspective); and often a brief vignette or two outlining the kind of experience the player will have within the game. Ultimately it is the player's internal psychological experience that determines the success of a game: If this experience is satisfying, people will continue playing and will tell their friends about the game; if not, they will stop playing and tell their friends that, too. No matter the marketing budget or the strength of the license, a game that is simply not enjoyable is quickly lost under the tide of new games ready to wash over it.

From Concept to Design

After the overall concept is designed and approved by a publisher or studio executives, the developers begin work on the mechanics and dynamics of the game—the objects and actions in the game that will support the aesthetic outlined in the high-level concept document (note that many developers do not think explicitly in terms of mechanics, dynamics, and aesthetics, though this is still indicative of the thought process). Some game developers spend a great deal of time in the early macro/concept phase searching for the right aesthetic, the right experience that they want to communicate via the game. This is often considered in terms of the player's experience, phrased as the question, "What is the game?" or "What's fun about that?" Other developers rush right to the detailed micro design of the mechanics and use this as a way to determine the eventual aesthetic, trusting in their ability to create sufficiently interesting pieces that the aggregate will also be interesting to players. Still other developers take their intuitive feeling for how the pieces should interact—the game's dynamics—and use this to create both the mechanics and the aesthetics in the eventual game. No single path is accepted overall in the game industry, and none can be said to have a greater success rate than another. Depending on the strengths of the developers (as individuals and as teams), one of these approaches will be more likely to lead to an optimal set of mechanics and dynamics that create a satisfying, engaging, fun aesthetic for the player.

The risk inherent in this process, no matter how it is approached, is that the developer will not be able to converge on a viable game, but will instead cycle interminably, searching for the right combination of mechanics, dynamics, and aesthetics without ever finding it. This is an unfortunate but common fate for many game projects. At the present stage of evolution of the game development process, there are few tools for evaluating actual progress in the design process. The necessary but difficult evaluations of progress in a game's development typically still reduce to intuitive gut-checks by management or publishers who have to weigh the game developer's creativity and vision against their concomitant optimism.

From Design to Production and Deployment

Development of the game proceeds from the early idea and concept stage through preproduction and production. The first of these typically involves completing the specifics of the game mechanics and testing out a few crucial dynamics. Ideally in preproduction the team comes to understand what they are going to build, and in production they actually build it. The reality is typically far from this ideal, however, as the building of the game exposes previously unknown problems and design insufficiencies and may lead to better ideas than were conceived early on. Currently there is no single accepted game development process, though phases such as concept, preproduction, and production are used as general heuristics throughout the industry (Sellers, 2002).

Once a game has been developed to the point that most of its internal objects —including programmed mechanics and graphical representations—are in place, and when the developers are confident that most of the dynamics are behaving as they intend, the game is made available to a limited audience for beta testing. During this phase, nondeveloper players get their first chance to try out the game and the developers react as best they can to fill in holes, balance out-of-kilter mechanics, and generally hone the game so that it provides the desired aesthetic experience. Once the game is sufficiently playable (it provides the desired aesthetic experience)—or, alternatively, when the schedule or financing demands it—the game is released to the public.

EXISTING PRINCIPLES FOR INTERACTIVE GAME DESIGN

The current game development process does not rely on any theory of game play or game aesthetics. However, while there are few overarching principles of the design of the interactive game play experience, there are hints and outlines that have emerged from many different developers and researchers. Placing these in a psychosocial context leads to a deeper, more explanatory framework for understanding and developing games.

Caillois (1967) defined four categories or types of games: *alea,* games of chance; *agôn,* games of competition; *ilinx,* games of physical or sensory pleasure; and *mimicry,* games of fantasy and make-believe. In terms of the mechanics-dynamics-aesthetics framework discussed earlier, the first two of these relate to the game's mechanics and dynamics, while the latter two refer more significantly to the game's aesthetics. Caillois also included another dimension of *paidia,* or informal play, to *ludus,* or formal game. Again, these refer to both the mechanics—the formalisms involved in a particular game—and the aesthetic created in the player. For example, Frasca (1991) noted that *SimCity* is an example of *paidia* in that it is a game without a goal. While it has formal rules, it has no "victory condition" typically made explicit in *ludic* games. Costikyan (1994) echoed this in differentiating between software toys (Caillois' *paidia*) like *SimCity* and games *(ludus)* that have stated goals. The heart of Costikyan's definition of game play is that it consists of players making meaningful decisions in pursuit of a goal. If the game is trivial or linear or if there is no opposition, there are no decisions; and if there are no goals, the decisions are meaningless. This is a strongly cognitive (and, as Yee, 2002 pointed out, strongly male) view of game play, but it provides a necessary piece of the game play puzzle. In a complementary vein, Huizinga (1968) offered an extensive definition of games, a key part of which is the aesthetic view that a game involves "a feeling of tension, joy, and the consciousness that it is different from ordinary life."

In reference to online games, Bartle (1996) posited that there are four broad types of players in MUDs (Multi-User Dungeons), the text-based predecessors of current massively multiplayer online games: *killers, achievers, socializers,* and *explorers.* While these four types are broad, they provide explanatory archetypes that have helped drive and clarify the design of many online game designs. However, Yee (2002) found in a survey of over 6,700 players of several popular MMP games that Bartle's typology was insufficient to entirely explain actual player motivations. Yee added *leadership* as a prime motivation along with a more qualitative desire for *immersion* in the game world.

Two other contributors to a psychosocial view of game design have already been discussed: the Yerkes-Dodson concept of rising and then falling performance (and interest) as psychological arousal increases, and LeBlanc's mechanics-dynamics-aesthetics framework. In his framework, LeBlanc (2004) also posited "eight kinds of fun" as specific types of aesthetics: sensory pleasure; make-believe or fantasy; drama or narrative; challenges to be overcome; fellowship with others; exploration and discovery; self-discovery and expression; and submission, or a way to pass the time. These types of fun are not exclusive; for example, a competitive game (Caillois' *agôn*) offers a combination of challenge and fellowship experiences.

It is significant that the MDA framework enables game descriptions in terms of the player's experience. It is ultimately not the game mechanics or dynamics—the formality or informality, for example—that determine whether a game is enjoyable (and, from a commercial perspective, successful). These are the tools the game developer uses, but the players' enjoyment depends entirely on their internal psychological and emotional experience created or evoked by the game. At the same time, a range of psychological aspects beyond emotions or aesthetics—such as cognitive problem solving and goal orientation—must be included in any complete description of game play.

A PSYCHOSOCIAL DESCRIPTION OF INTERACTIVITY FOR GAME DESIGN

By returning to the view discussed earlier of the player and game as complementary parts of a whole system, with interactivity describing the communication between them, we can place the game play descriptors used above into a single psychosocial context. Considering game play as the combination of physical/perceptual, cognitive, social, and cultural experiences, each with its own aesthetic and emotional components, provides a psychosocial framework that illuminates an understanding of game play and supports the game play design process.

Perceptual and Physical Interactivity

As humans, we are evolutionarily built to react to physical stimuli and action, especially visual and aural perceptions. We are attracted to bright colors, flashes, moving images, rhythmic or explosive sounds, and to specific proportions in form and color. We are also predisposed to memorize and perform rhythmic or sequential physical actions such as dance steps or songs—the behavioral counterpart to rhythmic perceptions. These predilections are not a matter of conscious choice but of psychophysics; in this we are like cats with string or dogs with thrown balls: We cannot help but be attracted to stimuli or actions deemed relevant by our evolution. Each of these stimuli thus represents a perceptual hook that can be used as part of the game play experience. Repetitive or rhythmic actions create a similar action-oriented hook as seen in everything from rhythmic clapping games to specific memorized keyboard or mouse click sequences in many computer games.

It should be no surprise that many games make use of bright flashing colors, explosions and the like, as these are, in the right proportions and doses, almost irresistible to the human perceptual system (consider too noninteractive applications of these principles we tend to find enjoyable, such as the bright flashes of fireworks, often accompanied by music). Other games such as the popular *Myst* series offer a quieter experience of visual form and sound design that are pleasing to the eye and the ear. Finally, many games rely on repetitive or rhythmic action—usually in the hands in the case of computer games, though some such as *Dance Dance Revolution* involve the whole body.

The common aspect to all perceptual and physical-level interactivity is that of a short time horizon: These are pleasing only in the psychological present tense. This immediacy is related to the nature of perception and physical action itself. Cognitive interaction includes planning for the future and memories of the past, but perceptual and physical enjoyment lasts only so long as the bright color, musical tone, or proportional form is perceived or as long as the dance or song lasts. This is nevertheless one of the most accessible—and thus the most often used—forms of interactivity in computer games. The entire first-person shooter genre depends on players finding enjoyment in the fast-changing graphics, bright colors and explosions, and fast-beat musical soundtracks. In LeBlanc's (2004) terms, perceptually oriented game play creates the aesthetic of sense-pleasure; this also refers to Caillois' (1967) *ilinx* type of game play.

Short-Term Cognitive Interactivity

Adjacent in time to perceptual and physical interactivity is short-term cognitive activity. This incorporates attentional aspects such as short-term memory and accomplishment of a proximate task. In game terms, this includes solving puzzles and (in game-military terms) the shortterm tactics that combine to form longer-term strategies. The common aspect here is that of attentional focus: The player must be able to comprehend and consider the entire puzzle or task at once in his or her mind, or must be able to follow a known sequence that exceeds the short-term store (as, for example, in completing a known series of dance steps or musical notes). The link to perceptual and physical interactivity can be seen in this dual aspect of short-term cognition: The player must be able to cognitively perceive the entire puzzle or task at once or must be able to follow the cognitive dance steps (literal or metaphorical) through a known sequence. As with the sensory and perceptual pleasure found in bright colors, finding enjoyment in such activities is not so much a matter of choice as cognitive ability fused with arousal and emotion. If a puzzle is not too tedious (too low arousal) or frustrating (requiring too high arousal or more cognitive resources than are available), it is almost certain to be perceived with aesthetic descriptors like challenging, dynamic, or compelling—each a type of enjoyment or, more simply, fun.

Long-Term Cognitive Interactivity

Beyond task-oriented short-term cognition lies goal-oriented longer-term cognition. This is where planning, strategy, considered decisions, and memory all come into play; for many this is the true *ludic* form of play. Achieving a goal may require stringing together many shortterm tasks, each the product of a cognitively intensive decision. As with short-term cognitive interaction, if the planning and decision making for long-term cognitive interactivity is not too simple or repetitive (that is, too low arousal) or too complex and taxing of the user's cognitive resources (too high arousal), and in particular if the goals themselves are meaningful to the player in an emotional sense, then the player will likely find enjoyment in both the pursuit and accomplishment of the goals. In LeBlanc's (2004) terms, this enjoyment typically takes the form of satisfaction in goal accomplishment, overcoming a challenge, discovery, and self-expression.

Prior to this level of interactivity, a game may be seen as enjoyable in itself without reference to any external context; at the perceptual and short-term cognitive levels emotional attachment (the sense of enjoyment) does not require a significant cognitive or reflective component. Once the player's long-term cognition and goal selection is part of the game, meaningfulness (as determined by the player) is more important. Once significant planning, balancing, and strategizing are involved, the question of "why am I doing this" becomes more germane. This desire for a meaningful context may be created in many ways, such as with an elaborate background fiction, characters the player cares about, or by making reference to a real-world situation that is important to the player. This lattermost context may include the player's own capabilities; thus, games of skill, especially intellectual or cognitive skill, become ends in themselves. The cognitive nature of the game enables the player to increase his or her own cognitive abilities.

Most computer games draw on a combination of perceptual, short-term, and long-term cognitive interactivity for their game play. For example, *Myst* is perceptually beautiful and uses a linear series of linked task-puzzles to lead the player toward the accomplishment of the game's goal. In contrast, chess depends heavily on short- and long-term cognition, but typically does not rely on the perceptual component of the shape of the pieces or board to increase the player's enjoyment. Real-time strategy games such as *Age of Empires* and *Starcraft* present the player with a lush visual and aural landscape onto which is built a set a series of shortand long-term cognitive decisions. While there is one overall goal to such games (eliminate all competitors), there are innumerable approaches to this goal, making for a cognitively diverse—and thus more enjoyable—game play landscape than is found in a linear sequence. Finally, sandbox games such as *SimCity* that do not direct the player to any particular goal also provide rich perceptual and cognitive landscapes. Some players complain that the undirected nature of these games detracts from their enjoyment, as they do not provide a sufficiently goal-oriented framework. This may be viewed as the result of individual differences in preferred arousal level: It may be that players who require less cognitive arousal may be happier with an open, undirected experience, while those who thrive in higher-arousal environments may find greater enjoyment in contending with externally imposed challenges.

Social Interactivity

Historically, most computer games have been created for a single player interacting with the computer or game console, but an increasing number also include a social component. This enables a new form of interactivity that leads from the purely internal and psychological to the interpersonal and psychosocial, as players are now able to interact not only with the game but also with each other around and as part of the game. The social componentshort-term cognitive becomes especially important in games where the players have a persistent identity and the ability to affect the game state together, as in massively multiplayer games. The persistence of identity enables longterm relationships to form, greatly enhancing social enjoyment ("fellowship" in LeBlanc's terms). Social game play often acts as a form of meta-game, surrounding and enhancing other perceptual and cognitive game play elements. It also creates new game dynamics and aesthetics as the other players become both part of the game play landscape (e.g., as competitors) and allies with complementary goals.

By providing "social scaffolding" (Kim, 1998) such as persistent identity, the ability for players to communicate easily with each other (both synchronously and asynchronously—via chat and message boards, for example), and the ability to form their own ad hoc and permanent groups, game developers greatly increase the players' potential for fellowship and building social enjoyment (Sellers, 2002). This is a particularly strong form of game-related enjoyment for many people, especially women (Yee, 2002).

Unlike perceptual or cognitive interactivity, social interactivity takes place on a time scale of hours, days, weeks, or even years. The short-term interactivity may involve cooperation or competition in a goal-context, but the longer baseline interactivity involves relationships built over longer periods of time. Games that adequately support these longer-term relationships are both more commercially successful and provide greater social enjoyment (fellowship, self-expression, and new forms of group-related narrative) than do those that limit socialization to the in-the-moment social interactions.

Cultural Interactivity

On the far end of the spectrum of interactivity is the largely unexplored area of cultural interactivity. This form of game play involves giving the player a new historical or cultural perspective or articulating previously tacit cultural knowledge. Cultural interactivity has the longest baseline in terms of time, typically occurring over the course of many hours of play. It leads to subtler forms of enjoyment than the other types of interactivity—self-discovery, discovery of the world, and a combined reconsideration of one's place in history and culture. In many ways this can be the most powerful form of enjoyment, the kind of fun that does not fade as quickly as perceptual or short-term puzzle-based interactivity. The aesthetics associated with cultural interactivity might be achieved via combinations of the other types of game play that provide a previously unknown perspective, such as in the life of a family in *The Sims,* a city in *SimCity,* a group of pioneers in *Oregon Trail,* or an ancient civilization in *Age of Empires.* Our knowledge of how to enable the aesthetics of wonder and discovery in the player is still rudimentary. As our understanding of these grows we should see more games evoking these emotions and the sense of fulfilling enjoyment that goes with them.

CONCLUSION

The heart and soul of interactive play is the human experience while playing. Games fill no practical need, but we play them anyway. As discussed in this chapter, the enjoyment from a game may be the ephemeral but visceral perceptual enjoyment of bright colors or fast movement; the cognitive thrill of overcoming obstacles and being victorious over a challenge (or challenger); the sense of community and fellowship derived from sharing experiences with others; or the sense of wonder and discovery at learning more about one's place in the larger scheme of things.

While many think of games primarily in terms of solving puzzles or reaching goals, the various forms of enjoyment inevitably touch us emotionally. Designing the interactive game play experience requires successfully evoking the desired psychosocial experiences through the careful application of game mechanics and dynamics. By creating a conceptual landscape of emotionally and aesthetically meaningful decisions rather than relying on an unchangeable predetermined narrative line, the game developer is able to create an enjoyable, psychologically satisfying experience unlike any other.

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PART I
THE PRODUCT

CHAPTER 3
A Brief Biography of Computer Games

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Biography provides an interesting metaphor for a survey of computer game history. After all, the computer game was born in the early 1960s, so it has only just entered middle age. Even if we located the origins of the computer game near the invention of electronic computing, its entire history would easily fit within a human life span.

This biography of the computer game is rooted in an observation made by Loftus and Loftus more than 20 years ago: "Video games are fundamentally different from all other games in history because of the computer technology that underlies them" (Loftus & Loftus, 1983, pp. ix-x). They referred to the nature of games as interactive software. In framing the history of the computer game as a history of technology, it is nevertheless crucial to consider the roles of game culture and design; game design is discussed in greater detail in chapter 2. The modifiability of game software provides a historical thread that encompasses these themes, leading from early games such as *Spacewar!* to "mods" such as *Half-Life: Counterstrike.*

THE DOOM REVOLUTION

> This is the first game to really exploit the power of LANs and modems to their full potential. In 1993, we fully expect to be the number one cause of decreased productivity in businesses around the world, (id Software, 1993)

Released in December 1993, *DOOM* immediately left its imprint on almost every aspect of computer gaming, from graphics and networking technology to styles of play, notions of authorship, and public scrutiny of content. The development team, led by John Romero and John Carmack, had designed games for *Softdisk* magazine and Apogee Software, notably the *Commander Keen* series. Carmack's first significant programming achievement, a demonstration of a smooth, side-scrolling platform game called "Dangerous Dave in Copyright Infringement," led to the formation of id Software in February 1991. Other than the protagonist, "Dangerous Dave" reproduced the first level of Nintendo's flagship game, *Super Mario Brothers 3*. More than homage, it demonstrated that personal computers could meet or possibly exceed the graphics produced by video game consoles.

Indeed, during the 1990s, personal computers, not proprietary game consoles, paced the progress of graphical game engines. Id's *Catacomb 3-D,* completed in 1991, provided another milestone as their first texture-mapped action game, and in 1992, *Wolfenstein 3-D,* another action title published by Apogee as shareware, showcased the improvement of id's graphics technology. (Origin's *Ultima Underworld* brought 3-D graphics technology to role-playing games at about the same time.) *Wolfenstein 3-D* set the stage for *DOOM* to define the game genre now known as the first-person shooter (FPS). *DOOM* added improvements such as a superior graphics engine, fast peer-to-peer networking for multiplayer gaming, a modular design that encouraged independent authors to create new levels, and a new mode of competitive play that Romero called “death match.” *DOOM* established competitive multiplayer gaming as the leading-edge category of PC games (Kushner, 2003; *Book of id,* 1996). Its subject matter (slaughtering demons in outer space), moody graphics and audio, and vocabulary (“shooters,” “death match”) also called public attention to the levels of violence depicted in computer games.

DOOM stimulated a new model of game development. According to its own corporate history:

> The team of innovators also made DOOM’S source code available to their fan base, encouraging would-be game designers to modify the game and create their own levels, or “mods.” Fans were free to distribute their mods of the game, as long as the updates were offered free of charge to other enthusiasts. The mod community took off, giving the game seemingly eternal life on the Internet, (id Software, n.d.)

Inspired by programming hacks that altered games, such as the “Barney patch” for Silas Warner’s original *Castle Wolfenstein* (Muse Software, 1981), Carmack had often altered games he played. He built modifiability into *DOOM* by simplifying the process. He did this by separating the core “game engine” from the code for specific “levels” of the game defined by maps, objects, monsters, graphics, sound, and so on. Level-specific information was captured in wad files, which were loaded separately into the game to play these levels; editing or creating wad files changed a game’s content without hacking at the game engine. This mechanism spawned independent and third-party level design, and encouraged the development of software tools to make this new content.[1] Manovich suggested that *DOOM* spawned a new “cultural economy” of game design, in which “hacking and adding to the game became its essential part” (Manovich, 1998). Games become design tools as much as finished designs, as independent level, scenario, and mod designers begin creating their own modified versions (“mods”) almost as soon as the original game ships. The popularity of *Counter-Strike,* a competitive, multiplayer modification of *Half-Life* (itself based on the *Quake* engine), shows how mainstream the mod-based economy of game design has become. Manovich contrasted modifiable games to the more traditional characteristics of a game like *Myst,* “more similar to a traditional artwork than to a piece of software: something to behold and admire, rather than take apart and modify” (Manovich, 1998). This “letting go of authorial control” (Packer, 1998) is a distinguishing characteristic of modern computer games, especially in comparison to other artistic or entertainment media.

It is tempting to date the birth of the modern computer game at *DOOM’s* release from id’s womb. It established modes of authorship, production, and distribution for computer games, at least on PC platforms. Certainly, id embraced this notion *of DOOM’s* historical impact, proclaiming “on December 10, 1993, id unleashed *DOOM* on the world. A technically stunning opus of heart-stopping action, unspeakable horror and pure gaming bliss, *DOOM* heralded a paradigm shift in video games” (id Software, n.d.). As developers of games defined by player actions rather than narrative content, the loss of authorial control hardly troubled Carmack and Co.; rather, *DOOM* established technology as id's foundation for game development; they encouraged the player community to modify their games. Romero viewed *DOOM* as necessarily an "open" game during its development, "because of Wolf3D *[Wolfenstein 3-D]*—people figured out how to make maps for it without our help, plus change all the graphics, etc. and we were so impressed that we knew that *DOOM* just 'had' to be modifyable [sic]. That is the real reason" (Romero, 1997). Scott Miller of Apogee (and 3D Realms) cited *Wolfenstein 3-D* and his own *Duke Nukem* (1991) as games that introduced the "hacking and proliferation of user levels," thus making it imperative that *DOOM* be "easy to modify at the start." For Miller, later mods such as *Counter-Strike* merely raised "the importance to a new level" (Miller, 2001). Carmack's position is even more pointed: "There is not a hell of a lot of difference between what the best designer in the world produces, and what quite a few reasonably clued in players would produce at this point" (Carmack, 2002a).

Id followed *Doom* with *Quake,* released in June 1996; it preserved *DOOM's* modes of competitive play, thus establishing the FPS as a genre. *Quake* was a technological tour-de-force. Its built-in client/server networking stimulated the popularity of Internet-based multiplayer games, and it offered Carmack's first genuinely 3-D graphics engine, optimized by Michael Abrash. The complexity of creating fully 3-dimensional game levels might have daunted many enthusiasts, but id provided information and tools to help them. During development of the game, Carmack described a new editing tool, QuakeEd, and disseminated some source code (Carmack, 1996). A Usenet discussion group, rec.games.computer.Quake.editing, was launched in January 1996, and the participants filled it with discussion of how *Quake's* levels could be edited and the game modified. The full retail version included the QuakeC script programming language, along with its source code. Access to QuakeC, QuakeEd, and other software tools created by *Quake* players and programmers made it easier to create new "skins" or textures, program "bots" (robot opponents controlled by computer AI), design new levels, and even develop new games (such as "team fortress" and "capture the flag" modes of play). *Quake,* though far more complex than *DOOM,* became even more accessible as an arena for demonstrating programming as well as playing skills.

DOOM and *Quake* introduced a new culture of computer game design. "Communities of networked gamers" competed online, influenced the development of games, and acquired a linked-up life as virtual communities. The impact of *DOOM* and *Quake* has been cast in various lights. King and Borland wrote, "the networked age of gamers had begun in earnest" (2003, p. 116). Miklaucic asserted that "*DOOM* redefined gaming, virtually overnight," by spawning "an entire subculture" (Miklaucic, 2002). According to Kushner, the independently developed *DOOM* Editor Utility was "a watershed in the evolution of the participatory culture of mod making." He added that the player community, by making tools like the DEU, transformed "game players into game makers" and this culture of community authorship, beginning with *DOOM,* offered a "radical idea not only for games but, really, for any type of media" (Kushner, 2002, pp. 71–72). Raymond, writing for the Open Source software community, concluded that, "*Doom's* life cycle… may be coming to typify that of applications software in today's code ecology" (Raymond, 1999, 10.3–10.4). Schleiner suggested that *DOOM* and *Quake* realized the "many to many" notions of cultural production that have influenced cable television and other media since the 1960s (Schleiner, 1999).

Did the modern technology and culture of computer game design begin with id's first-person shooters? Similar historical questions could be asked about cyberculture and new media generally. For example, "virtual communities" have transformed the computer from the mainframe of cultural repression into a symbol for wired freedom of expression, experimentation, and open collaboration. Turner has argued that their ideologies and practices echoed "habits of mind" established decades earlier (Turner, 2002). The biography of the modern computer game, including an assessment of id's status as "one of [its] fathers" (id Software, n.d.), also requires a closer look at its history.

FAMILY HISTORY: PLAYING GAMES ON COMPUTERS

> Of all the toys that are machines and that work by themselves and can be enjoyed in solitude for endless periods of time, the apotheosis is undoubtedly today's video game. The "video game" is an automaton that might have made Descartes shout with delight. (Sutton-Smith, 1986, pp. 61–62)

The idea of playing games on computers is about as old as the computer itself because games often inform the study of computation and computer technology. For example, Shannon proposed in 1950 that computers could be programmed to play chess in order to explore whether a machine "would be capable of 'thinking.'" His goal was not the chess-playing machine—"of no importance in itself"—but "techniques that can be used for more practical applications" (Shannon, 1950, p. 48). His essay stimulated decades of research on chess-and checkers-playing programs in the field of artificial intelligence. Shannon's notion of the machine as player could be traced back to Wolfgang von Kempelen (1734–1804) and his "Turk," a chess-playing contrivance presented as a life-sized mechanical model in Turkish garb (Windisch, 1783; Standage, 2001). Before World War I, the Spanish engineer Leonardo Torres y Quevedo (1852–1936) constructed an electromechanical automaton that could play a perfect endgame ("Torres…", 1915; Randell, 1982). Following Shannon's essay, research through the 1960s considered strategy games such as chess and checkers as laboratories for investigations of weightier computer science problems (Newell et al., 1958; Samuel, 1959). These projects encouraged tolerance for play with a "serious purpose" (Shannon, 1950, p. 48) in computer science laboratories. The first generation of games were thus born and incubated largely at universities or in industrial laboratories.

Anthropologists and philosophers of play have described games as expressing an "interdependence of games and culture." (Caillois, 1961, p. 82). Huizinga (1938) depicted this "play-element" as historically and culturally specific. McLuhan traced this social element of play to the "simultaneous participation of many people in some significant pattern of their own corporate lives" (McLuhan, 1964, p. 245). Sutton-Smith has put games in the historical context of providing tools for rehearsing adaptive problems faced by a society. He applied this framework of analysis to the topic of electronic and computer games by reasoning that, for contemporary society, the "adaptive problem to which the video game is a response is the computer" (Sutton-Smith, 1986, p.

64). For Sutton-Smith, computer games function as a rehearsal for life and work in a world dominated by information technology and demanding "training to understand how to read a computer and even more to understand how to make it give the answers one wants." Game play overcomes the anxiety associated with achieving mastery over the computer as a "machine which in many respects is more intelligent than human beings" (Sutton-Smith, 1986, p. 65). In these critical writings, play as real-world mastery of the machine became something more than a game in a wider social context, reinforcing the respectability of computer games in laboratories that associated them with programs of computer research.

The project often considered the first interactive, electronic game was assembled at one of the centers of Cold War technology. William ("Willy") Higinbotham, head of the Brookhaven National Laboratory's Instrumentation Division, created *Tennis for Two* for the laboratory's open house exhibit in 1958 from an analog computer, control boxes, and an oscilloscope display. Higinbotham was a physicist who had worked in the Manhattan Project during World War II and at the national laboratory in Los Alamos. Having witnessed the first test detonation of the atomic bomb and founded Brookhaven's own nuclear safeguards group in the 1960s, he sympathized with anxiety about nuclear research and probably created *Tennis for Two* to suggest an alternative, perhaps less threatening realm for the work of laboratory scientists (Schwarz, 1990). He felt that "people were not much interested in static exhibits," and that a "hands-on display" such as an interactive game would provide an enjoyable alternative ("Video Games," n.d.). David Ahl, who later founded *Creative Computing* magazine, remembered that "hundreds of students saw it and went away with the idea that in addition to doing thousands of statistical calculations in a remarkably short time, computers could also be fun" (Ahl, 1983). Yet, despite this enthusiasm, the technology of *Tennis for Two* was never patented and, dismissed as a "lab curiosity" by later inventors such as Ralph Baer (1996?), apparently had little or no impact on future work.

PARENTS: EARLY COMPUTER GAMES

Spacewar!

> Not surprisingly, the first computer wargames were developed unofficially by students at universities specializing in computer research…. Space War was the ancestor of all PC based wargames. (Dunnigan, 2000, p. 237)
>
> If, when walking down the halls of MIT, you should happen to hear strange cries of "No! No! Turn! Fire! ARRRGGGHHH!!," do not be alarmed. Another western is not being filmed—MIT students and others are merely participating in a new sport, SPACEWAR! (Edwards & Graetz, 1962, p. 2)

Steve Russell, Alan Kotok, J.Martin Graetz, and others at the Massachusetts Institute of Technology created *Spacewar!* as a demonstration program in 1962. M.I.T.'s new PDP-1 mini-computer and the Precision CRT Display Type 30, donated by Digital Equipment Corporation (DEC), appealed to the "hacker" culture of M.I.T.'Zs Tech Model Railroad Club (TMRC), including the *Spacewar!* authors. They were unimpressed by previous "little pattern-generating programs" that were "not a very good demonstration." So Russell's group reasoned that with this computing power and display technology, they could make a "two-dimensional maneuvering sort of thing." They concluded that "naturally the obvious thing to do was spaceships" (Brand, quoting Russell, 1972). They believed that a good demo program "should involve the onlooker in a pleasurable and active way—in short, it should be a game" (Graetz, 1983). Playful programs had been written in the lab before *Spacewar!,* such as Tic-Tac-Toe or Prof. Marvin Minsky's "Tri-Pos: Three Position Display" for the PDP-1, better known as the Minskytron. The *Spacewar!* collaborators wrote software and built control boxes so that players could maneuver virtual spaceships and fire at opponents against a background of black, empty space and a few bright stars shown on the CRT.

Spacewar! demonstrated the technical mastery of programmers and hardware hackers by producing a popular and competitive game available in any U.S. computer science laboratory of the 1960s and 1970s. It drew upon the popularity of the emerging genre of science fiction, especially the serialized novels of Edward Elmer ("Doc") Smith's *Lensman* series, reprinted in book form by Fantasy Press in the late 1940s and through the 1950s. This was the Space Age, and it is not surprising that a fan like Russell would place his game in a setting reminiscent of these novels. Smith excelled at action, with spaceships blasting away at each other, so Russell's homage became a fast-paced shoot-'em-up game. Setting the game in outer space meant that a black visual backdrop with a few flickering stars sufficed, easy to program and render graphically. As Russell noted, "by picking a world which people weren't familiar with, we could alter a number of parameters of the world in the interests of making a good game and of making it possible to get it onto a computer" (Brand, 1972). Dan Edwards' gravity calculations were a realistic feature, but the game's "photon torpedoes" ignored its attraction (thus easing the computational task) and "hyperspace" jumps allowed players to move instantly to a random location.

The game was modified soon and often. Peter Samson coded "Expensive Planetarium" to portray stars in the night sky more accurately; Edwards improved gravity algorithms; and so on. The game superbly showcased the lab's new computer, stimulating experimentation with its graphics, I/O, and display technology. Edwards told the emerging PDP users community shortly after *Spacewar!* was unveiled that the "use of switches to control apparent motion of displayed objects amply demonstrates the real-time capabilities of the PDP-1." He could "verify an excellent performance" (Edwards & Graetz, 1962). A new configuration of real-time processing power, control hardware, and graphical display had been assembled for the game.

A community of programmers and players formed around *Spacewar!* In his reportage of the 1972 *Spacewar!* Olympics competition at Stanford University, Brand described players with sharp competitive skills, "brandishing control buttons in triumph" (Brand, 1972, photo caption) after winning the tournament and achieving renown. Public competition signaled the dawn of the cyberathlete, but at the same time, *Spacewar!* grew out of an unstructured development process, a vast collaboration of programmers who added significant elements to the game or merely tweaked settings and controls—"within weeks of its invention *Spacewar* was spreading across the country to other computer research centers, who began adding their own wrinkles" (Brand, 1972). Performance was not limited to game play, but included displays of technical mastery, such as a superior programming trick or impressive feature. *Spacewar!* established computer game performance as a convergence of competitive skill, programming wizardry, and the formation of player communities.

Adventure

Nelson (2001) has called computer games emerging during the 1970s from research laboratories "university games." This term encompasses both the technical interests embedded in these games and the institutional setting of their creators. Like *Spacewar!,* Willv Crowther's *ADVENT*[2] (henceforth: *Adventure*) sprang from the network—both technical and institutional—of computer science and engineering. As part of the software team at Bolt Beranek & Newman (BBN) that in 1969 had built the first packet-switching Interface Message Processor (IMP) under a contract from the Advanced Research Projects Agency, Crowther figured prominently in laying down a fundamental piece of the ARPANET infrastructure. Like other members of BBN's carefully assembled group, he was a crack programmer. The setting was a "kind of hybrid version of Harvard and M.I.T." and among corporate labs, it was "the cognac of the research business, very distilled" (Abbate, 1999, quoting Bob Kahn, p. 57).

Programmers at BBN shared an intellectual and engineering culture with the M.I.T. hackers that joined programming skill, laboratory life, and enthusiasm for games and fantasy worlds. As with *Spacewar!,* a fantasy setting inspired Crowther's game. This was the fantasy role-playing game, *Dungeons and Dragons (D&D).* Crowther played in a regular *D&D* game with several BBN and Boston-area computer programmers, starting soon after these "rules for fantastic medieval wargames campaigns" were issued (Gygax & Arneson, 1974). In this long-running game, the players role-played a series of adventures inspired by J.R.R.Tolkien's *Lord of the Rings* trilogy. The game's leader, or Dungeon Master, was Eric Roberts, a Harvard student recruited to the IMP team by another player, Dave Walden. Roberts had "dungeonmastered up a dungeon and a bunch of us from the project team got sucked into playing" (Koster, 2002, quoting Sandy Morton). Roberts carefully chronicled the proceedings (Roberts, 1977). His account of their *Mirkwood Tales* describes a distinctive style of play, with the group diverging from *D&D's* origins in historical miniatures or "hack-and-slash" adventuring based on combat. They preferred to solve imaginative plot puzzles and role-play cleverly with the objects and locations in the game.

Game studies have paid little attention to the ways in which "paper gamers, as they would be known after the rise of the computer age, served very much as prototypes for the kinds of digital communities that would come later" (King & Borland, 2003, p. 5). Even though Crowther's *Adventure* was not a role-playing game, many of its elements can be tracked back to the *Mirkwood Tales,* an example of how games "playable with paper and pencil" (Gygax & Arneson, 1974, title) inspired game programmers. Crowther began work on his computer game after the group "had been playing *D&D* for a few months" (Koster, 2002, quoting Sandy Morton). The original version has apparently been lost. He wrote the FORTRAN program on a DEC PDP-10 and most likely completed it in 1975, releasing *Adventure* to the small ARPANET community by early 1976 (Montfort, 2003; Nelson, 2001; Hafner & Lyon, 1996, p. 206).

Adventure was not an action game; unlike *Spacewar!,* it did not require fast graphics displays or special controllers. Rather, it became the prototype for a narrative genre of games. Players revealed scripted story lines by typing responses to text generated and displayed by the computer program; hence, these games were called text adventures. They moved through the virtual game space by reading descriptions of "rooms" they occupied, then typing simple instructions at the keyboard that could be understood by the software "parser," the set of routines that translated phrases such as "go north" or "pick up lantern." Descriptive details about the locations were often based on Crowther's personal experiences as a caver, adding to the delight of exploration the knowledge that players could match specific rooms in *Adventure's* Colossal Cave to real locations in the Mammoth Cave system. *Adventure* was played by completing specific tasks through movement, actions, and puzzle-solving, always expressed as text. As a "vehicle for the delivery of fictional texts" (Atkins, 2003, p. 7), the tension between "fixity" of narrative and freedom of movement through the game world was carried by another term often applied to such games: *interactive* fiction.

Adventure, born in the development lab of the ARPANET, grew alongside it. Arguably the preeminent coder at BBN, Crowther's work on the IMP software contributed significantly to the success of the early ARPA network (Hafner & Lyon, 1996, pp. 108–114). ARPANET-connected researchers, graduate students, and programmers distributed and played *Adventure.* In 1976, Don Woods, a graduate student in the Stanford Artificial Intelligence Laboratory (SAIL), found the source code on the lab's computer. He thoroughly revised the game, adding elements that reoriented the cave crawl into a magical fantasy world. Wood's popular revision became the canonical version of the game and its variants were distributed as an open guest account on the SAIL computer or as free software distributed by the DEC Users Group (DECUS). *Adventure* became ubiquitous on the growing network of university-based computer laboratories:

> I remember being fascinated by this game when John McCarthy showed it to me in 1977. I started with no clues about the purpose of the game or what I should do; just the computer's comment that I was at the end of a forest road facing a small brick building. Little by little, the game revealed its secrets, just as its designers had cleverly plotted. What a thrill it was when I first got past the green snake! Clearly the game was potentially addictive, so I forced myself to stop playing—reasoning that it was great fun, sure, but traditional computer science research is great fun too, possibly even more so. (Knuth, 2002)

Some programmers and players, like Woods, sought to improve on *Adventure.* One group, which included players from Roberts' *D&D* group, "played ADVENT, liked it, wished it were better, and tried to do a 'better' one" (Koster, 2002, quoting Mark Blank). They wrote *Zork* for the PDP-10 in 1977 while still at M.I.T. This group, with several M.I.T. professors and students, founded Infocom 2 years later to market a version of *Zork* for home computers; this company became one of the leading computer game developers of the early 1980s. *Adventure* and other text adventures such as Infocom's wildly successful *Zork* series reached the height of their popularity by the mid-1980s.

The linkage between game authorship and the network of computer science laboratories was not limited to M.I.T., the Boston area (with BBN and M.I.T.), Stanford

University, or even the ARPANET. Other active centers of game development could be found in the PLATO (Programmed Logic for Automatic Teaching Operations) Project founded in 1962 and headquartered at the University of Illinois, where multiplayer, social and graphics-enhanced games such as *Empire* and *Mines of Moria* were developed (Woolley, 1994), as well as several English universities, such as the University of Essex, home of the first Multi-User Dungeon (MUD).

While it emerged from a similar environment for computing, the impact of *Adventure* on game design differed from that of *Spacewar!* The difference was more than the contrast of competitive action versus narrative. *Adventure* was also significant in presenting a richer virtual world than *Spacewar!,* one that could be explored in different ways determined by players. Also unlike *Spacewar!,* the keyboard and text interface of *Adventure* was identical to that used for communicating in new computer networks such as the ARPANET. Perhaps partly for this reason it inspired dial-up and networked games that combined *Adventure-like* exploration of virtual spaces with social interaction. Persistent virtual worlds such as the original MUD, developed by Bartle and Trubshaw at the University of Essex in late 1978 and early 1979 (Bartle, 2003), along with its many offshoots, created environments for performative play within a community of player-actors. Made possible by the modem, hundreds of themed multiplayer MUDs, MOOs (MUDS, Object-Oriented), and BBS-based games were written and played throughout the 1980s and 1990s. These games underwent constant and extensive modification, as players attained the required status and developed skills for creating intricate rooms that could be showed off to other players (Dibbell, 1998). *Adventure* defined a kind of computer game flexible enough to redefine the computer program itself as a game *space,* both for play and as something to be studied, taken apart, and changed by the player community.

Families of computer games descended from *Spacewar!* and *Adventure.* Both games grew out of institutions that defined networked computing during the 1960s and 1970s, thus establishing a contextual relationship between exploratory work in computer science and the emergence of computer games. Computer games rose out of the very institutions that defined the networked computer—M.I.T., BBN, the University of Utah, and Stanford. The networked and graphics-based games of the PLATO Project, close ties between Infocom and M.I.T., and programming projects by graduate students and researchers such as SHRDLU and Eliza, refined and extended this relationship—one that would never again be so close. By the mid-1970s, the emergence of the video game console from television technology and consumer-oriented industries focused on commercial exploitation transformed the institutional matrix for game development. Nonetheless, the connection between the development of computer technology and the first computer games, particularly as demonstrations of the computer's capabilities, recalls Sutton-Smith's claim that games are fundamentally "problems in adaptation," specifically, that computer games address the adaptive problem that "is the computer" (Sutton-Smith, 1986, p. 64).

CHAPTER 2. BIRTH: EXPANSION, COMPETITION, CRASH, CONTROL

> And there was another Atari logo, and another, and still more, a brand-new complex of over a dozen buildings, large lawns, fresh

> instant landscaping, discreetly small logos, street numbers, and that crystalline silicon sunlight. Laidback, sophisticated, nouveau riche residences for the PAC-MAN family, sleek red and terra-cotta buildings with lots of glass and pitched tile roofs, retinas themselves for all I knew, snazzy industrial homes for Space Invaders, Asteroids, Tempest, and their brothers. (Sudnow, 1983, p. 90)

Like computing generally, computer games during the 1970s broke out of the laboratory and computer center into the living room and study. Technical, social, and cultural factors that launched the home and personal computer also produced game machines and software. Advances in microelectronics and component miniaturization fostered expectations of affordable computers and electronic devices. Innovation in software design such as prototypes of graphical user interfaces and other productivity applications redefined computers from calculating machines to technologies of personal productivity, communication, and entertainment. The MITS Altair 8800, generally considered the first microcomputer, made its debut as the cover story of *Popular Electronics* in January 1975. Hobbyists responded by sharing information about the new technology in groups such as the Homebrew Computer Club in Palo Alto, California. Its members were "were intensely interested in getting computers into their homes to study, to play with, to create with," and they were willing to build the hardware to do it (Levy, 1984, p. 202).

Ted Nelson's *Computer Lib/Dream Machines* (1974) had already envisioned that "computer liberation" would bring computing power to the masses who "can and must understand computers NOW" (Nelson, 1974, title page). He recognized that these "versatile gizmos" had been "turned to any purpose, in any style," including games, noting that "wherever there are graphic displays, there is usually a version of the game *Spacewar*." Noting that "games with computer programs are universally enjoyed in the computer community, Nelson insisted that "computers belong to all mankind." He foresaw that wider access to computer games was a means to achieving this vision (Nelson, 1974, pp. 3, 48). His favorite examples included John Horton Conway's popular *Game of Life* and BASIC recreational and educational games published by the People's Computer Company to bring programming power to the people.

The transition from games available within the research network of computing to an accessible entertainment and educational medium did not happen all at once. Revolutionary computer hardware that could be sited in the home was not enough; the community of programmers and players needed to grow dramatically. In the mid-1970s, an unprecedented number of hobbyist programmers were introduced to easily mastered programming languages, particularly BASIC, and they usually honed their skills by programming games. The popular and influential *Hunt the Wumpus* emerged from this scene for game design and illustrates its importance. Originally programmed by Gregory Yob, it appeared in the inaugural issue of *People s Computer Company* (1973), founded by Robert Albrecht to promote use of computers by hobbyists, children, and others who might benefit from its educational and recreational potential. John Kemeny and Thomas Kurtz had created BASIC (Beginner's All-Purpose Symbolic Instruction Code) in 1964 as a general-purpose, high-level programming language whose relative ease of use would encourage students to program without making them learn all the intricacies of computers. Albrecht realized that games attracted the previously uninitiated to programming, and BASIC provided a satisfactory beginner's language. He realized that games made good demos of programming power, and every issue of *PCC* included the source code for BASIC games.

Albrecht also organized a walk-in computing center in Menlo Park, California, not far from the Stanford University campus. In 1973, Yob happened by the center and noticed that several simple BASIC games featured the same topology, a flat 10×10 grid. He wondered about the possibility of a "topological computer game," that is, a more imaginative layout of the virtual game space. His solution was a simple explore-and-hunt game taking place in a"squashed dodecahedron." Players explored this space—an arrangement of "rooms"—by inputting simple commands such as room numbers from their keyboards. He programmed it immediately for free use at the PCC center. About a month later, while attending a Synergy conference on the Stanford campus, "where many of the far-out folk were gathered to share their visions of improving the world," Yob realized that *Hunt the Wumpus* was being played on every computer monitor in the room. He had "spawned a hit computer game!!!" (Yob, 1976). Yob's *Hunt the Wumpus* introduced countless programmers to the notion of defining a virtual space by coordinates or simple room numbers. Games like this could easily be shared, modified, and extended by programmers, resulting in a great variety of games based on similar designs. Variants could be found for any computer system of the 1970s. For example, Kenneth Thompson, developer of UNIX at the Bell Telephone Laboratories, wrote one version in C shortly after he had used Dennis Ritchie's new programming language to rewrite the operating system in 1973 (Ritchie, 2001), and the *UNIX Programmer's Manual* included a listing for WUMP, while noting under bugs that "it will never replace Space War" (Bell Telephone Laboratories, 1979, section 6, n.p.). Even so, *Hunt the Wumpus* spearheaded a generation of simple games that brought game programming to the people.

Just as the people's computing movement was getting underway, the microcomputer revolution opened up access to computing technology. Dozens of companies emerged between 1975 and 1977 to manufacture microcomputers. Apple Computer was the most significant with respect to the future of computer gaming. Steve Jobs and Stephen Wozniak founded Apple in 1976 to sell Wozniak's elegantly designed Apple I microcomputer, and they launched its successor, the Apple II, at the first West Coast Computer Fair in 1977. Wozniak had previously designed a successful game, *Breakout,* for Atari. Apple's home computer was nothing less than a *Breakout* machine, with features such as color graphics, sound, and paddle support built into the Apple II; Wozniak acknowledged that many of the features "that made the Apple II stand out in its day came from a game" and the "fun features… were built in… only to do one pet project, which was to program a BASIC version of *Breakout* and show it off to the [Homebrew Computer] Club" (quoted in Connick, 1986, p. 24). The Apple II became a leading platform for grassroots game programming through the early 1980s; its alumni developed commercial games and founded game publishers. Scott Adams, for example, popularized "adventure games" for microcomputers such as the Apple II after learning about *Adventure* at the Canadian Computer Conference in 1977 (Adams, 1979). Home computers provided a significant market for commercial game software through the 1980s.

Emergence of the Video Game Console

It is tempting to conclude from *Spacewar!* and *Adventure* that computer games emerged whole out of laboratories and research centers. This conclusion ignores, however, the significant role of consumer product development in the definition and development of the dedicated game console. The technical efforts of television engineers established proprietary console designs as delivery mechanisms for location- and home-based interactive entertainment, not as openly accessible software programs, but as closed boxes for proprietary computer games. This is not to say that the early development of arcade and home console systems was disconnected from research spaces. As we have seen, *Spacewar!* was available in virtually any computer science laboratory of the 1970s, such as the University of Utah, home of a strong program in computer graphics. Nolan Bushnell began to play *Spacewar!* as a student in electrical engineering there. After graduating, he moved to California to work for Ampex Corporation, near Stanford University and the active *Spacewar!* players in the Stanford Artificial Intelligence Laboratory (SAIL), the same lab in which Don Woods would discover *Adventure.* Bushnell had worked in an amusement park as a student, and he recognized that *Spacewar!* presaged a new form of entertainment arcade filled with computer games. He may have known of *The Galaxy Game,* undertaken by a recent SAIL graduate, Bill Pitts, and his high school friend, Hugh Tuck. This coin-operated game was a version of *Spacewar!* for the PDP-11 installed in a custom cabinet. Constructed in 1971, this *Spacewar!* console was installed in the Stanford student union, and a later version remained there until 1979 (Pitts, 1997).

Bushnell, joined by Ampex coworker Ted Dabney, drew upon his knowledge of arcade machines in designing *Computer Space* (1971), essentially a coin-operated version of *Spacewar!* Nutting Associates manufactured 1,500 of the consoles in wildly futuristic fiberglass cabinets. Due to the complexity of its interface and game play, *Computer Space* was a commercial failure, yet Bushnell had established a design format and configuration for video game arcade consoles. Bushnell and Dabney soon severed their relationship with Nutting and founded a new company, incorporated as Atari Corporation in June 1972. Al Alcorn, another talented engineer from Ampex, joined them. Bushnell assigned him the task of designing a simple electronic game based on Ping-Pong. Alcorn rapidly produced a prototype from an off-the-shelf television set, a homemade cabinet, and several tricks from his bag of analog and television engineering tricks. Unable to attract interest from manufacturers of pinball games such as Bally, Bushnell and Alcorn designed their own coin-operated version of the game, named *Pong.* Installed in in a local bar, it was an immediate success. In order to begin volume production of *Pong,* however, Atari first cleared legal hurdles caused by Magnavox's hold on Ralph Baer's video game patent (about which more below) and Bushnell's attendance at a demonstration of the new home system based on this patent.

Bushnell and Alcorn exemplified the intersection of computer science and television engineering as converging technical paths to the modern computer game. Alongside computers and coin-operated arcades, television also stimulated development of computer games. Ralph Baer, a television engineer and manager of consumer product development at the military electronics firm Sanders Associates, personified its influence. Since the 1950s, he had been intrigued by the idea of interactive television as a way of increasing its educational value. By September 1966, he had work out several ideas for a technology he described as "low cost data entry devices" enabling an operator to "communicate with a monochrome or color TV set of standard, commercial unmodified type" (Baer, 1996). He designed circuitry to display and control moving dots on a television screen, followed by the simple chase game *Fox and Hounds* in 1967. Following this success, Sanders management gave Baer permission and funding to assemble a small development team, the TV Game Project. Within a year, he established fundamental design parameters for home video game consoles and demonstrated several rudimentary games. By early 1969, Baer's group completed the Brown Box, a solid-state prototype for a video game console. Two years later, Baer applied for the U.S. patent on a "television gaming apparatus" that would be granted in 1973, with rights assigned to Sanders. Magnavox Corporation licensed the technology from Sanders and in May 1972 began production of the first home video console, the "Odyssey Home Entertainment System."

Takeoff and Crash of the Video Game Industry

Pong and the Odyssey inspired numerous imitators, both arcade and home systems. Atari led by creating Atari *Pong,* a home version designed by Alcorn, Harold Lee, and Bob Brown. It was released in 1975 and sold by Sears under its Tele-Games brand. The popularity of *Pong* home consoles established an important synergy between arcade and home systems for Atari. Its phenomenal success also led to brutal competition as more companies entered the market and released new home and arcade systems. Some manufacturers followed the Odyssey's model by offering flexibility in the choice of games. Unlike *Pong,* these new consoles were platforms for playing multiple cartridge-based games. Atari released its 2600 VCS (Video Computer System) in 1977. The coin-operated arcade business depended on exclusive distribution of hardwired games playable only on dedicated machines; home consoles such as the market-leading VCS were programmable in that software contained in a game cartridge's read-only memory (ROM) could be read after insertion into special slots and then executed by the system's processing unit. The separation of game development from hardware manufacturing symbolized by the game cartridge stimulated a boom in demand for new games through the early 1980s. Activision, founded in 1979 by former Atari game designers, became the first third-party game publisher, followed by a rush of competitors.

Rudimentary action games dominated the title lists of arcade and home consoles circa 1980. Display technologies, microprocessors, and other components of the time limited designers, but quick, repetitive games also swallowed more quarters or, in the case of home consoles, could be manufactured cheaply and run reliably on underpowered hardware. While the designs of unqualified hits such as *Breakout* (1976) or Taito's *Space Invaders* (1978) were elegantly streamlined, most of the early console games offered little in terms of strategic and narrative depth. By 1983, competition, overreliance on knockoff imitations of proven hits, and a flood of weak game titles depressed the arcade and home console markets. The disastrous Christmas 1982 release of Atari's *ET* for the 2600 was the beginning of the crash and shakeout. Companies such as Mattel, Coleco, and Magnavox dropped out of the industry; Atari began a long decline, never again leading the industry. Software manufacturers also suffered; as Chris Crawford, then at Atari, put it, "The dozens of opportunistic cartridge publishers that had sprouted like weeds in 1982 died just as quickly in 1983" (Crawford, 1991). The details of the industry crash are well documented (Herman, 2001, pp. 89–98; Kent, 2001, pp. 234–240, 252–255; Sheff, 1999, pp. 150–157). Their significance lies in the lessons learned by the survivors.

Those survivors learned not only from the demise of the Atari generation, but also from its successes. The greatest was arguably *Pac-Man,* released by Japanese arcade game manufacturer Namco in 1980. The lead designer was Toru Iwatani, eager to find an alternative to the implied violence of earlier hits such as *Space Invaders.* By careful attention to concept, design, and color, Namco tried to create an arcade game that appealed to women and girls. The concept was inspired by food and eating, not shooting as in most arcade games. Players used joysticks to maneuver through a simple maze, gobbling colored dots—and occasionally devouring or being devoured by a gang of colored "ghosts"—until all were devoured and a fresh maze appeared. In Japanese slang, *paku paku* describes a mouth snapping open and shut, and thus the central character was given the name *Pac-Man.* It became the most popular arcade game in terms of unit sales, with more than 100,000 consoles sold in the United States alone. Its impact on popular culture was unprecedented, due largely to Iwatani's innovative design. Players discovered that the ghosts moved in patterns, became obsessed with devising precise routes for Pac-Man to follow, but were thwarted in this quest by the vast number of game levels. Guidebooks to playing *Pac-Man* became best-sellers, followed by popular songs, cartoon shows, merchandise, and magazine articles as well as versions or imitations for every electronic gaming platform. *Pac-Man* represented the game as tightly controlled intellectual property, the product of a closed industrial design studio, a toy to be played—not toyed with.[3] Given the failure of most crashed hardware manufacturers to control the quality of software cartridges playable on their machines, the next generation of companies would carefully guard their technology platforms and intellectual property.

The Nintendo Generation: Control of the Product

By 1985, this new generation was led from Japan. On the heels of the commercial collapse of the Atari generation, Nintendo released its video console, the Famicom (Family Computer), in Japan in 1983, followed by the Nintendo Entertainment System, a U.S. version of this system, in 1985. Its notable features included improved graphics processing supplied by Nintendo's MMC (Memory Map Controller) chip and the provision of battery-powered backup storage in the game cartridge. The NES and its followers, such as the Sega Genesis (1989), equaled or exceeded contemporary home or personal computers as game machines. Above all, Nintendo had learned how to control its platform and product, deploying technical, legal, and business measures that restrained access by independent software developers to its cartridge-based console. For example, Nintendo vigorously protected its patent on the cartridge device to restrict game software developers from publishing compatible cartridges without its explicit permission. It also insisted on a high level of quality control, both for titles developed in-house, such as Shigeru Miyamoto's *Super Mario Brothers* (1985) and *The Legend of Zelda* (1986, U.S. version, 1987), and third-party titles.

Published by Nintendo for the Japanese market in 1986 and in the United States one year later, *The Legend of Zelda* justified heightened expectations for video games. It exemplified the new technology, design aspirations, and business culture. Miyamoto was already Nintendo's star designer, having produced *Donkey Kong* and the *Mario Bros.* series. Now he added open-ended exploration by giving players a large fantasy world in which to find their own path for the story and main character, Link. It exploited several capabilities of the NES, such as the graphical rendering of a navigable, 2-dimensional world and the ability to use backup storage as one progressed through the lengthy game. Miyamoto also added interface elements such as screens that were activated to manage the hero's items and abilities, much like the pull-down menus then beginning to appear in business software applications. Finally, Miyamoto paid equally careful attention to the pacing and complexity of the game, so that players attained requisite abilities before progressing to increasingly difficult challenges. Miyamoto raised expectations for the narrative scope and game mechanics of a new generation of video games, qualities that encouraged comparisons to other narrative media such as cinema.

Nintendo was not the only game studio built on high production qualities, carefully guarded intellectual property, and *auteur* designers. LucasArts, founded in 1982 as LucasFilm Games by *Star Wars* filmmaker George Lucas, added interactive media such as game software to his multifaceted vision for the future of entertainment technology. Beginning with *Ballblazer* and *Rescue on Factalus!* in 1984, LucasArts established itself as a leading publisher of adventure games with strong stories, memorable characters, and vivid worlds, such as *Maniac Mansion* (1987), the *Secret of Monkey Island* (1987) and *Grim Fandango* (1998), as well as games from the worlds of *Star Wars* and *Indiana Jones.* Electronic Arts, founded in 1982, was inspired by United Artists Pictures, the Hollywood "company built by the stars." Just as UA had promoted independent production, Electronic Arts initially left game development to established designers and programmers while gaining control over publishing of its games in a manner that "deliberately [emulated] the music recording industry in producing and marketing its computer software" (Duberman, 1983, p. 63). The elements of its business success during the 1980s included strong branding, sports licensing, distinctive packaging and marketing, and control of the distribution network. Electronic Arts became strong enough to challenge the strict licensing requirements of Nintendo and Sega for access to their consoles, most notably by reverse engineering the 16-bit Sega Genesis and facing down Sega management to secure more favorable terms. Like Sega and Nintendo, its formula for success depended on control of its product.

CONCLUSION

> Bigger critters than Atari have bitten the dust; bigger industries than ours have shriveled and died. Size and past success are no guarantee of permanence. We need substantive reasons for confidence in the future rather than simple extrapolations of past history. I am convinced that substantive reasons for optimism exist…. For now let me say that computer games satisfy a fundamental desire for active recreation, and as such are assured of a bright future. (Crawford, 1982 p. 76).

Convergences of technology between the latest video game consoles, such as the Sony Playstation 2 (2000) and Microsoft Xbox (2001), and personal computers with high-end graphics cards and peripherals are misleading. These convergences mask historical differences in the development and business cultures of these platforms for computer games, one built on the Nintendo model of corporate control and the other on the *DOOM* economy of mod-makers and player-generated content.

John Carmack has noted that *DOOM* was a "really significant inflection point for things, because all of a sudden the world was vivid enough that normal people could look at a game and understand what computer gamers were excited about" (Carmack, 2002b). This chapter began with *DOOM* as the beginning of the modern computer game, not only as a technical achievement, but also as the springboard for networked player communities, modifiable content, and other characteristics associated with PC-based computer games since the mid-1990s. The parents of the first generation of computer games—*Spacewar!* and *Adventure*—expressed similar qualities in a rather different milieu. The success of these open "university games" led to commercialization, rapid expansion, and cutthroat competition, particularly in the arcade and home console businesses. After the Atari generation crashed, savvy successors such as Nintendo, Sega, and Electronic Arts applied lessons learned about technology, marketing, and content. The result was an expanded market for a tightly controlled product, but with the loss of close connections with the open community based in research laboratories or the "people's computing" movement.

In this framework of technology, culture, and business, the relationship of the new culture of computer gaming after *DOOM* to its past shape-shifts between two dominant images: the offspring that reveals the characteristics of its ancestors *(Spacewar!, Adventure)* and the petulant child that breaks with its parents (the Nintendo/Electronic Arts generation). These rather different relationships between present and past in *post-DOOM* game culture are not exclusive. It is possible to be part of something new and yet share a bond with the past; the history of modern computing offers examples. In *Hackers* (1984), Levy proposed described a loose set of values he called the Hacker Ethic, which he traced historically in three phases from M.I.T. through People's Computing and the Microcomputer Revolution, and then to the computer game industry of the early 1980s. Hacker culture emphasized sharing, openness, decentralization, and other qualities similar to post-*DOOM* game culture, such as "access to computers should be unlimited and total" or "you can create art and beauty on a computer" (Levy, 1984, pp. 27–33). Carmack, author of the Nintendo homage that transformed computer game culture, knew about Levy's book: "I read that as a teenager. At that third section I was like 'Goddammit, I should be here!' Then about 10 years later, I thought back about it: 'You know, if there was a fourth section in that book, maybe I would be in there!' That's a nice thought" (Carmack, 2000).

NOTES

[1]However, the original version of *DOOM* was not released as open-source software and, in fact, id's initial stance toward editing of the game code was not quite as encouraging as it has often been depicted. Id issued a "Data Utility License" that allowed modification of the game software under strictly defined conditions. With

the release of *DOOM II* in 1994, Romero released more information about the game program. Carmack released the *DOOM* source code as a Christmas present to the player community in December 1997.

[2]ADVENT was the file name for the program. It was more often called *The Colossal Cave Adventure* or simply, *Adventure.*

[3]It was possible in principle to alter an arcade game like *Pac-Man,* through daughter-boards, for example, as the history of *Ms. Pac-Man* demonstrates.

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