



# BEFORE THE CRASH

early video game history



EDITED BY MARK J.P. WOLF



## BEFORE THE CRASH

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# BEFORE THE CRASH

*Early Video Game History*

EDITED BY MARK J. P. WOLF



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## FOREWORD

When Mark asked me to write the foreword for *Before the Crash*, I was certainly flattered, but my first thought was: “Why me?” A little introspection quickly gave me the answer—I’m *old*! Certainly relative to this industry I’m old. Before I started to work for Atari, I had been working for a large pharmaceutical corporation, integrating microcomputers into lab equipment for real-time data acquisition and analysis—fun stuff, huh? In my spare time, however, I was programming the Xerox Sigma 7 computer and some of our SBC-80s to play games like *Mastermind* and refine games like the wonderful, text-based *Star Trek* game. A friend of mine at work knew of my passion and handed me a copy of an ad in *InfoWorld* (an industry rag) for programmers at Atari. I moved to California and my new career about a month later.

The reason I mention all of this is because I want you to understand that I had stepped into a completely new world. By 1979, I had been programming professionally for six years already, at three different companies. The engineering team at Atari was a complete change from everything I knew. To this day, that group remains the single most talented and creative group of individuals I have ever had the privilege of working with. People like Ed Logg, Dave Theurer, Howard Delman, Lyle Rains, John Ray, Dave Sherman, Owen Rubin, Rich Adam, Mike Albaugh, Dave Sheppard, Jed Margolin . . . the list goes on and on. Everything was new back then. There weren’t many rules; there was no vast body of work before us pointing the way. Our five-year mission: to boldly create fun where no fun had gone before. We were pioneers given a speedy go-cart and a vast open roadway. Who needed a rearview mirror?

In some ways, it did turn out to be about a five-year mission—before the Crash. Right about the time I arrived at Atari, the world had started to sit up and take note of video games. The VCS cartridge system was just mak-

ing its debut, and the media had started to actually report about what was happening in our fledgling industry. Oh, and Time-Warner had just bought Atari and was in the process of nudging Nolan Bushnell out of the company. But management in engineering kept the development process intact, and I was so jazzed about the new job that I couldn't put it all in perspective at the time.

All the same, it was a wonderful new job and though I didn't know it at the time, it would become my career. To my mind, the best thing about the job was that it was not just technical—it was also creative. We were given a lot of leeway to create fun (which is *not* an easy task), with a new medium. It wasn't a completely solitary job. We had small teams of three or four people, generally with one programmer, one hardware designer, one technician, and a project leader who may have been wearing one of the three previous "hats." But everyone got along, there was no shortage of friendly suggestions, and it seemed like idea brainstorming was a daily spontaneous occurrence. We also had a lot of time for play, and I don't mean strictly video game play, though there was plenty of that. Our team was close-knit, and we all actually liked one another.

These were pretty heady times. Though we certainly did not think of it this way on a daily basis, we were aware that we were doing something special, breaking new ground, and being wildly successful at it. Almost every new game we produced would feature some new gameplay mechanic, or at least some novel technical approach that had never been done before. It kept us fresh, engaged, and working insanely long hours.

Our idea sharing was not purely creative either. There were many times when someone would have a knotty problem to solve—maybe trying to reduce the cycle count on an inner loop of an algorithm—and we would all try to find the optimal solution (though it usually came from Mike Albaugh). A basic tenet of our job was to keep the cost down. Saving a single chip in the game-board design was a big deal profit-wise, so we often traded programming convenience for reduced hardware cost. The instruction set was small, the memory, both RAM and ROM, tiny. By today's standards, it was miniscule. In the late 1970s and early 1980s, games were often programmed for an architecture with 2 to 4kb of ROM and 256 bytes of RAM!

Programming on the 8-bit processors (we were usually using 6502s) was always done in assembler. It was a terribly confining task, but at the same time it was very liberating. The confining aspect is pretty obvious. It was liberating because you always knew what your limitations were, and it was really exhilarating when you came up with three-instruction, 3-bit arc-tangent function (with pixels there are only eight adjacent

places to go), allowing you to squeeze your program into one less ROM or finish your frame update loop before vertical sync. Yeah, I guess I'm still a geek at heart.

Atari was not the only coin-op game company out there. Here in the United States there was Cinematronics, Exidy, Williams, Midway, Gottlieb, and others. In Japan, there was Namco, Konami, Taito, Nintendo, and others. Atari was still the biggest name in the business, but we were starting to feel the competition from the others. Near the end of 1981, despite the success of games like *Asteroids* (1979), *Tempest* (1980), and *BattleZone* (1980), upper management was increasingly taking a hand in the creative direction of our engineering team. We were no longer alone on that vast open roadway, and management was looking over our proverbial shoulder at the competition and increasingly asking us to emulate their work instead of finding new ground to break. Where was that darned rearview mirror?

Personally, I didn't like the change, but I also did not see where it might eventually lead just two years later. Everyone wanted in on the business. In the consumer market, the retailers were selling everything they could get their hands on, and the bar for quality games started dropping as more and more people tried to cash in on the craze. The rest is history and is documented in many books.

But this book is different in that it takes an in-depth look at those early, pioneering days of video game development. And it looks at them from the different portals of the various distinguished contributors. Reading these essays will not only provide you with the context of the rise of the video game industry, but it will also shed some light on why the Crash was inevitable. Hopefully, you too will find within these pages some of what made this period such a magical time in my life.

ED ROTBERG  
May 5, 2010

*A key member of Atari's arcade games division during the Golden Age of video games, Ed Rotberg was the guiding force behind the arcade game BattleZone (1980) and S.T.U.N. Runner (1989) as well as a number of other arcade classics. During his long and storied career, he worked in a variety of positions for a number of well-known companies including Atari, Apple Computer, 3DO, Silicon Entertainment, and Nolan Bushnell's Sente, where he was Vice President of Software. He has participated in many industry conferences, including the Game Developers' Conference. In 2004, Rotberg received a Lifetime Achievement Award in Video Games from the Classic Gaming Expo.*



## ACKNOWLEDGMENTS

It is encouraging to note that there is now enough academic interest in the early days of video games that such a volume as this, concentrating on the years before the great video game industry crash, can be made possible. I would first like to thank all the contributors to this volume, who are some of the best people writing about video game history today: Jessica Aldred, Ralph H. Baer, Brett Camper, Karen Collins, Ross A. Dannenberg, Leonard Herman, Erkki Huhtamo, Carly A. Kocurek, Sheila C. Murphy, Tim Skelly, Carl Therrien, and Zach Whalen. I am thankful to have such a fine collection of contributors whose essays feature such a variety of approaches, topics, and coverage. I must also thank Annie Martin at Wayne State University Press, whose support, enthusiasm, and patience was much appreciated. Over the years, a number of others have also helped me in my historical research into the pre-Crash era; collectors from the Video Arcade Game Preservation Society (VAPS) and the keepers of the Killer List of Video Games (KLOV) all of whom were very generous in answering my questions, and Keith Feinstein who provided me with an opportunity for firsthand playing experience of so many older arcade games when I visited Videotopia in 1997. Finally, for support on the home front, I must thank my wife, Diane, and my sons, Michael, Christian, and Francis. And, as always, thanks be to God.



## Introduction

This invention relates to a device with which a game can be played. The game is of such a character that it requires care and skill in playing it or operating the device with which the game is played. Skill can be increased with practice and the exercise of care contributes to success.

In carrying out the invention a cathode-ray tube is used upon the face of which the trace of the ray or electron beam can be seen. One or more targets, such as pictures of airplanes, for example, are placed upon the face of the tube and controls are available to the player so that he can manipulate the trace or position of the beam which is automatically caused to move across the face of the tube. This movement of the beam may be periodic and its repetition rate may be varied. Its path is preferably caused to depart from a straight line so as to require an increased amount of skill and care for success in playing the game.

The game can be made more spectacular, and the interest therein both from the player's and the observer's standpoint can be increased, by making a visible explosion of the cathode-ray beam take place when the target is hit. (United States Patent #2,455,992, "Cathode-Ray Tube Amusement Device," 1947)<sup>1</sup>

So begins patent number 2,455,992, issued to Thomas T. Goldsmith and Estle Ray Mann, who applied for the patent January 25, 1947, and received it December 14, 1948, for what can now be considered the world's first description of an interactive game played on a cathode-ray tube. But the pat-

ent was never used, fell into obscurity, and had no effect on the video game industry that would one day arise. In fact, it would take almost 23 years before the video game would become a commercial product, and around a dozen years after that before the growing industry, having enjoyed a brief Golden Age, would experience a crash that would change its course forever.

Now that the video game has been around for over half a century, its history is being explored and written, by practitioners, journalists, and scholars, through a variety of perspectives. The history of video games is long enough to be divided into parts, and the periodization of video game history typically occurs in the following ways:

- by arbitrary means (decades, eras, etc.)
- by technology (generations of home systems, arcade systems, or computer technology)
- by industry (companies, trends, crashes, etc.)
- by innovation (breakthroughs, firsts, influential games and game systems, etc.)
- by dominants (whichever factor is most influential at a given point in time)

The Great Video Game Industry Crash of North America, however, is a turning point in almost all of these areas and separates early and later video game history as dramatically as the coming of sound separates sound film and silent film in film history. At present, a disproportionate amount of scholarship in video game studies is concerned with games from the last ten years or so, while earlier games are often neglected. This is partly due to a lack of familiarity with (or interest in) the older games, the lack of availability of the older games, or even the games' perceived primitiveness when compared to contemporary video games. But those of us who remember playing the early games when they first appeared can recall the excitement they engendered, the hours of fun they provided, and the sheer novelty of playing games on your television at home. That the image on screen was interactive, something you could control, was really something new (and neat and cool besides). My generation grew up with video games; and by the time the Crash ended and the Nintendo Entertainment System (NES) was available in the United States, I was already in college, and video games were an established part of the cultural landscape.

The Crash took place mainly in 1983 and 1984, though it could be said to have started as early as the last quarter of 1982, when arcade game profits began falling. It conclusively ended in 1985 with the North American re-

lease of the NES. The years leading up to the Crash were full of exhilaration and enthusiasm, as video games developed alongside handheld electronic games and toys, pocket calculators and digital watches, home computer systems, the Internet with its bulletin board systems (BBSs) and e-mail, video cassette recorders (VCRs), cable television (with MTV, of course), and blockbuster films with improved special effects. Of course, some of the promised technologies—interactive TV, videophones, and tiny but powerful computer devices, would take much longer to appear (and we're still waiting for affordable flying cars). Many advances that did occur, however, were thanks to the integrated circuit.

With the invention of the integrated circuit in 1971, mainframe games could shrink down and brave the commercial marketplace, following the lead of pinball and other electromechanical arcade games. One mainframe game, *Spacewar!* (1962), inspired the first two commercial games. In September 1971, *Galaxy Game*, installed in Stanford's Tresidder Union, was the first video game with a coin slot. Two months later, Nolan Bushnell's *Computer Space*, the first mass-produced game with a coin slot, tested the waters among the electromechanical games in the arcades, but its controls were too complicated for the times. The first home video game console system, Ralph Baer's Magnavox Odyssey, appeared in 1972, and its arcade imitator, *PONG* (1972) became the first hit arcade video game.

After the successes of 1972, the race was on. New games and game systems were released, new game companies appeared, and eventually even companies in other industries, like 20th Century Fox, Milton Bradley, and Quaker Oats, started releasing their own games, hoping for a hit. Amid all the excitement, the arcade led the way, and it was there that the state of the art could be found. In those heady days, groundbreaking games were coming out every year. Design variations hint at genealogies of innovations. Replace one of the paddles in *PONG* (1972) with a grid of bricks, turn the screen, and you've got *Breakout* (1976). Let the bricks become a grid of aliens who can fire at you, and you've got *Space Invaders* (1978). Let the aliens break formation and fly around the screen, and you've got *Galaxian* (1979). Twist the screen into a tube, so the player-character can slide around the perimeter of the screen instead of just across the bottom, and the aliens are coming up from the middle of the screen, and you've got the basic design of *Tempest* (1980).

Successful innovations were often imitated and became accepted conventions. New games built on the conventions established by older ones, and even when they didn't, gameplay was often intuitive due to conventions adapted from elsewhere. Title screens, credits, screen-to-screen cutting and conservation of screen direction (exit left, enter right, and vice

versa) all were borrowed from cinema; other conventions and technologies were adapted from interactive interfaces like car dashboards, airplane instrument panels, and submarine or tank periscopes. Home video games, which did not need to limit players to a few minutes of fast action in order to make money, expanded their worlds to huge landmasses that scrolled through the screen in multiscreen games with adjoining areas, increasingly complicated strategy games, and action-based games with many levels and endless parades of enemies to conquer. Home computer systems were improving and better able to compete with home consoles, and floods of games appeared on cartridges and floppy diskettes.

In 1981, the home video game market tripled, and the arcade video game industry had an estimated income of \$5–7 billion, with 24,000 full arcades, 400,000 street locations, and 1.5 million arcade video games in operation.<sup>2</sup> And in both home and arcade industries, even more growth was expected. Hundreds of games from third-party developers took advantage of the boom, and many of them were derivative, substandard, and cheaply produced. Prices were slashed as economies of scale grew, and competition became more fierce and cutthroat. And sales continued escalating.

The craze continued into 1982. Even single arcade games, like *Space Invaders* (1978), *Pac-Man* (1980), and *Defender* (1980) had each pulled in hundreds of millions of dollars on their own. But warning signs had already appeared. In October 1981, Atari expected around 10,000 players for its \$50,000 World Championship held in Chicago, but only around 250 players attended.<sup>3</sup> Yet sales in the home video game sector were still up, and were higher than ever, and it was hard to believe it wouldn't stay that way. History seemed to suggest otherwise. Other electronics industries had seen crashes in the 1970s, including those that produced pocket calculators, digital watches, and CB radios. Even the video game industry had experienced a crash in the first half of 1977, but promptly forgot about it when the Atari VCS 2600 found success later that year.

By the end of 1982, profits in the arcade video game sector started to falter. Although the number of video game arcades more than doubled after 1980, peaking at about 10,000 arcades in 1982, over 2000 would close in 1983.<sup>4</sup> Home video game sales dropped, as the market became oversaturated and glutted with cheap products that disappointed consumers who were coming to expect more and more. The video games industry's profits in 1983 were down 35 percent from 1982, and industry-wide losses were around \$1.5 billion.<sup>5</sup> Attempts were made to rejuvenate the industry; laser-disc games such as *Dragon's Lair* (1983) brought traditional hand-drawn animation into games, but at the expense of interactivity (and at twice the cost, since they were 50 cents a game). Three-dimensional filled-polygon

graphics were introduced the same year, in Atari's *I, Robot* (1983), but the game was abstract and its unusual gameplay was poorly received, leading to the game's failure (and a postponement of three-dimensional filled-polygon graphics, which would not return until the end of the 1980s). In 1983, Atari lost over half a billion dollars, and Mattel, the third largest player in the home game industry due to its Intellivision system, left the industry. In 1984, only one new home system appeared, Rick Dyer's Halcyon home laserdisc game system, and it was also a failure. The Golden Age of video games was over.

The Crash finally ended in 1985 when a new system appeared that advanced home video games to a new level. The Nintendo Entertainment System was already a success in Japan, where it had been released in 1983 as the Nintendo Famicom, and it, along with its large library of games, helped revive the American video game industry and end the problems it was suffering. Carefully avoiding the problems brought on by the free reign that Atari's third-party developers had, Nintendo was more careful with third-party game development, policing its licensing more closely to keep the NES's reputation from being tarnished.

The success of the NES encouraged other companies to produce home systems again, but the more complex and expensive technology of the new generation of machines ensured that smaller companies simply hoping to cash in on a craze would be unable to compete. The arcades, however, would never recover. While they struggled to stay ahead of home systems throughout the 1980s, and renewed their lease on life with the widespread appearance of three-dimensional filled-polygon graphics in the 1990s, home console systems and home computer games eventually managed to eclipse them, and the arcades all but closed. And just as communities of arcade players lost their gathering places, new ones were found online where the BBSs and multi-user dungeons (MUDs) of earlier years blossomed into massively multiplayer online role-playing games (MMORPGs). As of 2011, the industry has streamlined into an oligopoly of systems supported by an ever-growing variety of independent developers, as games spread to new platforms such as the World Wide Web, cell phones, iPads, and practically every kind of interactive screen technology. And despite the dazzle and flash of the newest photorealistic game worlds and their high-octane action and intricate storylines, the old games of the pre-Crash period have made a comeback as nostalgia and the focus of the retrogaming movement. Younger players who were born after the Crash are discovering the gameplay value of the older games, which are well-suited to the tiny screens on cell phones and other pocket devices. Many of the old franchises, like Pac-Man and Mario, are still around and continually evolving. As a result, there

is more interest in video game history, making a book like this anthology possible.

The essays collected here reflect much of what was going on during the pre-Crash era; arcade games, home game consoles, home computer games, and even early online games, as well as other areas including the aesthetics, economics, industries, and technologies of early video games. The first essay, by Carl Therrien, examines various methodological issues of studying video game history, such as periodization, accessibility to older games and game systems, teleological distortion, and such things as emulation and the use of walkthroughs. Next, media archaeologist Erkki Huhtamo explores the early entry of media devices into the home, showing how video games were only the latest entries in a long line of domestic media devices. Some of the earliest games to enter the home are discussed in Leonard Herman's essay, which covers the era of ball-and-paddle games, the time when video games began to blossom and become a cultural phenomenon, right before dedicated console-based games gave way to games stored on interchangeable cartridges.

The move from dedicated systems to cartridge-based systems was a turning point within the pre-Crash era, and the first cartridge-based system, the Fairchild Channel F Video Entertainment System, is described in Zach Whalen's essay, which examines the system's historical significance. Following Whalen's essay is my own essay on the crash before the Crash, the video game industry crash of 1977, which was a warning of events to come. The late 1970s saw the rise of cross-media merchandising, and an aspect of this trend is discussed in Jessica Aldred's essay on character abstraction and identification in early games licensed from movies, and the transmedial issues surrounding them. Transmedial issues also appear in Sheila C. Murphy's essay, which begins by looking at the Atari catalogs of the 1980s and how they positioned the company's game cartridges, and expands into a discussion of the value of paratextual analysis for early video game history.

Karen Collins looks at game sound in the pre-Crash era: how it was made and programmed, what was done with sound, and some of the groundbreaking games that introduced innovations in sound technology. Driving the technology were the companies who dared to try new approaches to game making, and in the next essay, video game designer and programmer Tim Skelly gives a firsthand account of the rise and fall of Cinematronics and Vectorbeam, two early companies that produced arcade video games. A look at the pre-Crash era would not be complete without a detailed examination of an arcade platform; Brett Camper provides this in his essay, which looks at the Williams arcade platform from the early 1980s and gives

a detailed analysis of how it affected the design of the games made on it. Arcades are also the topic of the next essay by Carly A. Kocurek, which looks at arcades in both cultural and economic contexts. The last essay, set in the latter part of the pre-Crash era, is Staci Tucker's look at the birth of online gaming in the form of bulletin board systems (BBSs) and multi-user dungeons (also known as multi-user dimensions), and how they set the stage for later online game worlds. Finally, the appendix features an essay on early video game history by Ralph H. Baer, the father of home video games and creator of the Magnavox Odyssey, and a summary of an important early court case, *The Magnavox Co. v. Activision, Inc.*, by intellectual property attorney Ross A. Dannenberg. From all these various interwoven perspectives—aesthetic, cultural, economic, industrial, legal, and technical—an image of the pre-Crash era arises, hinting at the tumult and turbulence of the times, without losing a sense of the optimism, enthusiasm, and excitement of those early days.

Back in 1948, Goldsmith and Mann could not have possibly imagined what video games would have become, both aesthetically and industrially. Today, with flat screens replacing cathode-ray tubes in televisions and computer monitors, the original "Cathode-Ray Tube Amusement Device" sounds even more antiquated, for soon there will be no more "video games" by a strict definition that requires a video signal and raster imagery on a cathode-ray tube. And that will be the end of another era in video game history.

## NOTES

1. Thomas T. Goldsmith Jr. and Estle Ray Mann, Cathode-Ray Tube Amusement Device, U.S. Patent 2,455,992, filed January 25, 1947, accessed April 20, 2010 [http://www.google.com/patents?id=n-NZAAAAEBAJ&printsec=abstract&zoom=4&source=gbs\\_overview\\_r&cad=0#v=onepage&q&f=false](http://www.google.com/patents?id=n-NZAAAAEBAJ&printsec=abstract&zoom=4&source=gbs_overview_r&cad=0#v=onepage&q&f=false).

2. The figure of \$5 billion for 1981 is found in both *Newsweek* and *Time*. See Lynn Langway et al., "Invasion of the Video Creatures," *Newsweek*, November 16, 1981, 90–94; and John Skow, "Games that Play People," *Time*, January 18, 1982, 50–58. But another article, "Arcade games start to flicker," *Business Week*, December 6, 1982, 39, claims "players slid an estimated \$7 billion worth of quarters into arcade game machines."

The figures for arcades and machines in operation come from *Play Meter* magazine, as mentioned in Steven Kent, *The Ultimate History of Video Games: The Story Behind the Craze That Touched Our Lives and Changed the World*, (Roseville, California: Prima Publishing, 2001), 152.

3. See *Game Informer*, May 2005, 150.

4. These numbers are from Bernstein Research, reported in Albert Meh-

rabian and Warren Wixen, "Lights Out at the Arcade," *Psychology Today*, December 1983, 72; and Charles P. Alexander, "Video Games Go Crunch!," *Time*, October 17, 1983, 64.

5. "The Trend is Back to Pinball Machines," *Business Week*, May 7, 1984, 37.

CARL THERRIEN

## Video Games Caught Up in History

*Accessibility, Teleological Distortion,  
and Other Methodological Issues*

One notices that each generation of historians performs a selection, neglects certain traces, on the contrary exhumes others, for which no one, for some time, or since the beginning, showed interest. Consequently, the view we have of this detritus is already subjective; it relies on a specific interrogation . . .

—GEORGES DUBY<sup>1</sup>

At the foundation of history as a discipline, lies the necessity to synthesize vast bodies of information in order to represent the evolution of human cultures. The exclusion of sources and artifacts constitutes its inevitable shortcoming. The self-proclaimed objective accumulation of facts—thematically organized, chronologically ordered—associated with positivistic methodology fails to conceal the same unavoidable reality: the selection of relevant information is always subjected to the world vision of contemporary historians. Following Duby's introductory quote, a cautious and self-aware historical approach should be able to piece together a series of phenomena through a conceptual lens that can account for the complexity of its object, while remaining conscious of how this lens partially constructs the object. Gazing at the past thus becomes an inevitable window into our own contemporary fascinations. The current state of a given culture, its obsessions and its ideals, often acts as an implicit telos which already conditions the gaze, preselects relevant information in order to piece together a teleological causal chain. Whether to serve the glorification of a national

identity or to create a comforting illusion of mastery over the informational chaos that surrounds us, these forms of exclusion only echo the selection carried out by any given period under examination; this chain of exclusions greatly complicates the work of historians. What holds true for historical science as a whole cannot be avoided by a more focused subfield like art history.

In an article that exposes the methodological problems encountered by early cinema historians, André Gaudreault notes the partial nature of his practice on two distinct levels.<sup>2</sup> First, only part of the early film strips is still accessible to today's historians; second, it is impossible for any historian to look back on such a distant object in an unbiased manner. For post-Brighton cinema historians, the emphasis on narrative figures in moving pictures before 1906 (and the corollary praise afforded to filmmakers such as Edwin Porter), at the expense of more widely spread practices, constitutes a teleological travesty; only after 1915 did cinema become the storytelling institution we now take for granted. Of course, such biases influenced film conservation and thus contributed to the accessibility problem underlined by Gaudreault. On the surface, things might appear simpler for video games historians. A strong community constantly feeds online documentation resources, seeking to preserve the memory of games, and some historians experienced the emergence of arcade games firsthand. The commodity of the computer age, with its data storage, organization and transcoding abilities, promises to solve accessibility problems. Yet in spite of these resources, and to a certain extent because of them, the challenges in bringing the young, new medium to history books are considerable. Moreover, this medium appears to constantly vie for perfection through the evolution of imaging techniques, processing power, and interactive devices. How is one to avoid a progress-laden teleological discourse when faced with an object that seems to be defined by its constant evolution? Drawing on historical research experience, notably field and conceptual work for Bernard Peron's research projects on interactive cinema and horror games, as well as a postdoctoral research project on the evolution of game design, this essay seeks to expose both the trivial and conceptual challenges pertaining to the methodology of video game history.

#### LOOK BACK IN ANGER: ACCESSIBILITY ISSUES IN THE COMPUTER AGE

Relatively little has appeared regarding older games and game systems, arcade games, or video game history in general. Part of the reason is that many of the old games are already gone or very hard to find and play; although this may

make writing about them more difficult, it also suggests a greater need for historical research, before it is too late.

— MARK J. P. WOLF<sup>3</sup>

In spite of the vigorous wake of video game studies in the past 10 years, video game equivalents of film conservation institutions are merely starting to emerge. For many years, the closest approximation of such an essential resource came in the shape of the itinerant Videotopia exhibit. Acknowledging “the destruction of the majority of these games and fearing the loss of their historical importance,”<sup>4</sup> the Electronics Conservancy organization set out to find and restore 400 rare arcade cabinets, while also collecting home video game systems. The Computerspielemuseum opened in 1997 in Berlin; the new permanent exhibition “Computer Games: Evolution of a Medium” opened in January 2011 and features more than 300 exhibits. In 2007, following a proposition from major universities led by games researcher Henry Lowood from Stanford,<sup>5</sup> the Library of Congress announced it would preserve a “game canon” formed of the ten “most significant” titles.<sup>6</sup> Academia-related collections are emerging along dedicated games programs, but with obvious budget and conservation space limitations. Since the end of the 1990s, Stanford Libraries has amassed a significant number of video game artifacts as part of the “History of Science and Technology” collections, curated by Lowood; it features thousands of games on systems ranging from the Atari 2600 to the Microsoft Xbox. English Scholars from the Nottingham Trent University, in cooperation with the National Media Museum in Bradford, recently announced an ambitious conservation project; the National Video Game Archive specifically seeks to avoid “the ‘mistakes’ made in the film industry that lead to the loss of historically significant materials in the past.”<sup>7</sup> Still, in the realm of video games today, the most exhaustive equivalents of conservation institutions are purely virtual ones. The following observations should not be seen as a rebuttal of the incredible contribution offered by online databases and emulation endeavors; rather, they seek to expose the almost inevitable drawbacks associated with such projects.

Little more than a decade after the worldwide explosion of the Internet, there is a staggering amount of general-purpose video game databases available online. Every major gaming publication on the web (IGN.com, 1Up.com, Gamespot.com, etc.) eventually incorporated titles that predate their own creation. However, these corporate databases only echo the most basic information (such as release date, platform, and genre) about older titles; with the exception of IGN.com’s retro section (<http://retro.ign.com>), publications focus first and foremost on creating editorial content for new

releases. Competing for the web-surfer's click, major gaming sites create an echo chamber of basic information, artificially multiplying results on search engines, which only burdens the work of the researcher. Thankfully, extensive data collecting projects have emerged. Founded in 1999, Mobygames.com officially set out to amass information about computer, console, and arcade games, such as release history, developer bios, screen captures, and box art. Limited to a few platforms before 2001, it eventually included most major home systems, all the way back to the Odyssey. As of 2011, it contains data about more than 56,000 games on 95 different platforms. More than 180,000 digitized visual elements (such as box covers and game media) also provide invaluable information.<sup>8</sup> To this day, the arcade portion of the database has not been developed. However, other dedicated projects have gained the respect and admiration of the community. The Killer List of Video Games (KLOV) database (<http://www.klov.com>) focuses exclusively on coin-operated arcade video games. Its origins can be traced back to the bulletin board system (BBS) era, where enthusiasts gathered to share information. The project eventually led to the creation of The International Arcade Museum and now encompasses the entire coin-operated entertainment phenomenon. The site has detailed pages with technical descriptions, gameplay information, cabinet pictures, and screenshots for more than 4,400 arcade video games. The Arcade History project is even larger and has information about arcade video games, pinballs, slot machines/pachislots, pachinkos, bat games, bingos, gun games, bowlers/shuffle alleys, jukeboxes, musical instruments, trade stimulators, fortune tellers, strength testers and much more.<sup>9</sup>

Literally dozens of smaller websites dedicated to a specific platform (Lemon Commodore 64/Lemon Amiga, PC Engine Catalog Project), developer (AtariAge, the Nintendo database at Gamespy.com, The LucasArts Museum), genre or theme (Dragon's Lair Project, Home of the Underdogs) supplement the larger databases.<sup>10</sup> These projects grew to considerable proportions by relying heavily on user-contributed content; similar in concept to a wiki, editing descriptions on Mobygames or the KLOV is a matter of being a registered user.<sup>11</sup> Closed editorial resources about older games do exist, and sometimes prove to be the only detailed source of information about rare or lesser-known games and systems. From short reviews on a great variety of consoles (The Video Game Critic) to extensive evaluation of graphic adventure games (JustAdventure+), amateur enthusiasts often spend incredible amounts of energy on these projects.<sup>12</sup> Clearly, the community's genuine concern and dedication to preserve the history of games is commendable. Both open contribution and restricted editorial

resources, however, are ultimately amateur endeavors and face the same challenge of providing accurate information.

The appeal of retrogaming review projects lies precisely in the surrogate firsthand experience of rare or inaccessible objects. Despite the guarantee of an actual encounter with the object, however, game descriptions cannot always be taken at face value. Even with firsthand experience, one can misinterpret the actual algorithmic complexity of a game. This raises the fundamental question of the researcher's competence to examine historical objects; the ever-changing technical aspect of video games makes this medium even more demanding than cinema. As Wolf observes, "The history of video games now spans over four decades, and while this is a relatively short time compared to the histories of other more traditional media, it is fast moving and exciting, with innovations and advances occurring at a rate unparalleled in other media."<sup>13</sup>

Acute technical information about a game is not always readily available in the professional press, and relying on promotional material, which often overemphasizes or blatantly distorts technical features, is not an option. *Cruise for a Corpse* (Delphine Software, Amiga, 1991), *Axelay* (Konami, SNES, 1992), and *Doom* (Id Software, DOS, 1993) have all been promoted as achievements in 3-D graphics, even though neither the manipulation of vector shapes, the "mode 7" bitmap scaling, nor the "2.5-D" texture interpolation engine truly correspond to the contemporary definition of a 3-D game engine.<sup>14</sup> Moreover, the "omnidimension 4-D" touted on the box of *Beyond the Forbidden Forest* (Cosmi, Commodore 64, 1985) is highly suspicious.

The question is certainly legitimate: would a programmer or technician familiar with the various creation tools be the ideal video game historian? Researchers should possess sufficient knowledge to contextualize information given by the publishers or made available in databanks. A few noteworthy contributions that take into account these aspects have already been made. In "Video Games in Computer Space: The Complex History of Pong," Henry Lowood explains how the first arcade cabinets are often discussed as computer games, when to a large extent they were created by repurposing television technology.<sup>15</sup> Ian Bogost and Nick Montfort's *Racing the Beam* (2009) provides in-depth information about the Atari VCS 2600's inner workings and its decisive influence on game design. The author's Platform Studies collection seeks precisely to explain "how certain platforms facilitate certain types of computational expression and innovation."<sup>16</sup> Similarly, Noah Wardrip-Fruin makes a case for a closer inspection of the actual computational processes involved in the video game experi-

ence; in *Expressive Processing: Digital Fictions, Computer Games and Software Studies* (2009), he begins to trace the historical developments of this procedural reality—including authoring systems and A.I. routines.

#### EMULATION AND TECHNICAL PROFICIENCY

Needless to say, all the previously listed resources are useful inasmuch as firsthand experience of the historical objects (both in their material aspect—the original boxes, manuals, cartridges—and the experience of the game itself) is not easily accessible. Some older systems and games can be bought in online auctions (prices are potentially restrictive, particularly in the case of arcade cabinets), but many early consoles and arcade games have already disappeared, and specific types of hardware (such as the first generation CD-ROM add-ons, consoles, and discs) are unlikely to be found in optimum functioning state. Thanks to the transcoding abilities of the computer medium, however, there is another opportunity for researchers to experience their object: emulation. An emulator attempts to duplicate on a recent system the functions and instruction sets associated with previous hardware. Dedicated software can be used directly (if the media reader, such as a disk or CD-ROM drive, is available in the host machine) or from digital copies (typically referred to as ROMs, from “read-only memory,” or ISOs, from the ISO archive file system, in the case of CD games). Preservation of the software is taken very seriously by emulation enthusiasts. The Old School Emulation Center project (TOSEC) established a clear protocol to archive and name ROM sets; users constantly update lists about software released on more than 200 platforms. Emulation remains a delicate issue, for the creation or appropriation of ROMs for games that have not been declared public domain by the copyright holder is considered illegal in many cases.

Classic computers and consoles tend to attract the most attention from the emulation community; four major emulators exist for the Atari 2600, and many projects associated with the Super Nintendo Entertainment System are being developed. Exclusion of lesser-known systems and games is just one of many issues raised by emulation. As a general rule, more accurate emulation of original components requires more powerful host machines,<sup>17</sup> and many consoles or specific hardware parts are difficult to emulate perfectly. Relatively old computers, like the Commodore Amiga (1985), already featured a complex assemblage of co-processing units that can be taxing to emulate even on modern computers. To recreate a playable experience, programmers sometimes rely on emulation shortcuts: leaving out nonessential hardware modules or functions, or using alternate com-

puting methods that are more efficient on the host system. A potential pitfall resides not so much in the obvious performance disparities that occur in CCS64 (for Commodore 64 emulation) or the impossibility of using the original game controllers in Bliss (for Intellivision emulation), but rather the subtle differences in emulation speed or audiovisual output that are not readily apparent. Far from a simple blessing, a journey in the realm of emulation requires researchers to have even more proficiency with technical aspects.

Thankfully, the emulation community is very concerned about creating the most accurate emulation possible. Emulators are constantly updated by their creators. One of the most ambitious projects, Multiple Arcade Machine Emulator (MAME) emulates a number of arcade games. Since its initial release in 1997, over 4,000 unique games have been emulated, encompassing a great variety of chipsets (such as Capcom's CPS-1 or SNK's Neo-Geo boards). The incredible variety of input devices used in arcade cabinets since the early days of the phenomenon adds to the complexity; trackballs, light guns, pedals, and more have to be mapped to present-day devices like keyboards, mice, and third-party control pads. Display technology discrepancy, although not as apparent as previously discussed difficulties, can also be a significant issue. Beyond the theoretical specifications of the visual assets stored on the game disk or cartridge (e.g., resolution and color depth), display technologies affect how the actual image appears to the user. Different types of cathode-ray tubes have been used in arcade cabinets during the period covered by MAME (at the time of this writing: 1976–2007). Without getting into complicated technical details, we can observe that the phosphorescent end of cathode-ray tubes—the area scanned by an electron beam whose intensity is modulated to reproduce the signal—had specific characteristics that came to be associated with the video game experience. In an attempt to mimic screen artifacts such as scan lines and red/green/blue dots, MAME offers the possibility to overlay a visual representation of these artifacts on top of the emulated game (Fig. 1.1).<sup>18</sup> Even with the use of these masks, an exact reproduction of original monitor effects on modern-day LCD panels, and even on the CRTs used with computers in the 1990s, is nearly impossible. The clarity of modern computer displays is making the blurriness associated with arcade monitors a thing of the past. This is not an improvement or a way to belatedly do justice to the original experience; this blurriness, resulting from less efficient luminance and color handling, often masked the imperfections and aliasing of the original source visuals or contributed to the illusion of deeper color depth with the use of dithering.<sup>19</sup>

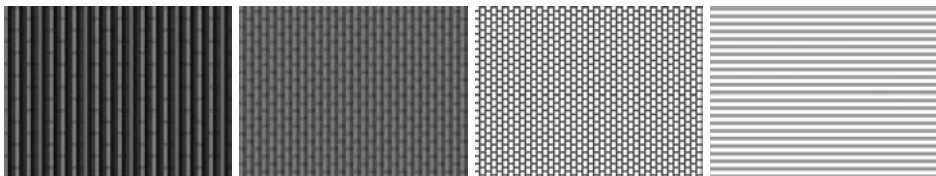


Fig. 1.1. Visual masks in MAME (blown-up sections of tiled patterns)

## THE INCOMPLETE OBJECT

It is now clear that the inaccessibility of objects and the palliative resources available to researchers open many methodological issues. Even when first-hand contact is possible, given the highly technical nature of the medium, it is the researcher's competency (or lack thereof) that can become a source of misinformation. The ultimate accessibility issue, however, goes beyond the availability of the object or the technical expertise of the researcher. Video games require nontrivial effort, and in many instances, actual proficiency in order to evaluate the object in its entirety. As Wolf points out, "Gameplaying skills may be required to advance beyond the first few levels, or some puzzle-solving ability may be needed just to enter a locked door encountered early on in the game."<sup>20</sup> It is technically possible for researchers to use cheat codes or other tricks, or to simply access later stages in the games. However, cheats are clearly a distortion that prevents proper evaluation of gameplay mechanics. Skipping to later stages is even more likely to push researchers to their limit because it will place them right in the middle of the learning curve. Most emulators offer a save-state functionality, allowing the user to create a marker that can complement the game's checkpoint, password, or save system. These various save points could be used to facilitate researchers' access, but the same proficiency issue would surface.

A dedicated community, yet again, has answered the call: thousands of hours of archived audiovisual playthroughs are available online, including "speedruns," where apt gamers record their fastest performance of any given game, and "longplays," where gamers try to expose the content of the game as thoroughly as possible. The commented playthrough is also a growing Internet meme; unrelated members of the gaming community compulsively started to produce content under the same "Let's Play . . ." name, with hundreds of examples to be found on YouTube. Quick-thrill classics such as *Jungle Hunt* (Taito, 1982) are of course well suited to this archival process, but the number of playthroughs of lengthier games, such as interactive movies and role-playing games, is surprisingly large. *Phan-*

*tasmagoria: A Puzzle in Flesh* (Sierra On-Line, 1996) is divided into 25 ten-minutes segments; the typical *Kingdom Hearts* (Square, 2002) playthrough lasts several hours. Needless to say, archived playthroughs should not act as a substitute for firsthand experience and, in themselves, are prone to misinterpretation. In the context of the *Ludiciné* research project on interactive cinema (<http://www.ludicine.ca>), Bernard Perron decided to invest resources in the archiving of an actual playthrough for many games. The database built for the project allows researchers to tag the videos with a consistent set of descriptors that seeks to dissipate any confusion regarding the gameplay. In conjunction with other information, audiovisual archives provide access to content that can take several hours to reach under normal circumstances, while minimizing the risk of distortion.

#### TELEOLOGICAL ILLUSION: FROM EARLY CINEMA TO EARLY VIDEO GAMES

The significance of the accessibility problem cannot be overstated. The conceptual organization and presentation of a phenomenon's development over time, by definition, depends on the available historical traces. The ongoing and rapid technological evolution partly responsible for these accessibility problems also favors a teleological view of video game history. *Teleology* can be defined as the tendency to conceptualize the evolution of a phenomenon as a purposeful development toward a clear goal. From 1978 onward, cinema historians sought to evacuate teleological distortion from history books. André Gaudreault and Tom Gunning, among others, exposed the numerous manifestations of teleology in the work of traditional cinema historians. The primary form of exclusion is so readily apparent in the books of Sadoul and Mitry that it might not have been completely unconscious: cinema's recognition as a noble art form is strongly tied to the development of its storytelling abilities, and pre-Brighton historians were keen to underline the early manifestations of this very specific and noble practice,<sup>21</sup> while promptly discarding the residual information, a protean landscape of practices that truly defined early moving pictures. Gunning clearly summarized the problem:

The history of early cinema, like the history of cinema generally, has been written and theorized under the hegemony of narrative films. Early filmmakers like Smith, Méliès and Porter have been studied primarily from the viewpoint of their contribution to film as a storytelling medium, particularly the evolution of narrative editing. Although such approaches are not totally misguided, they

are one-sided and potentially distort both the work of these filmmakers and the actual forces shaping cinema before 1906.<sup>22</sup>

Focusing only on figures and codes that *retrospectively echo* those privileged by the institution of cinema—and the corollary obsession to establish a list of their first incidences—is clearly a teleological distortion. In this period of *primitive* cinema, not everything seems to be equally primitive. Incidentally, this very designation of “primitive” is not only a contemporary value judgment alien to the object studied, it also happens to be part of a biologic metaphor that reinforces the teleological illusion. By listing the first occurrences of these primitive figures—just like proud parents cataloguing their child’s first footsteps and words—such historical discourse places the phenomenon on a pre-written progressive path going from naive infancy up to the great accomplishments of maturity. Is it any wonder, then, that historians kept looking for the fathers and forefathers of narrative editing? To paraphrase André Gaudreault: by putting early cinema in a crib, this historical account is rocking us with comforting illusions.

Through this teleological conception of history, each period simply becomes the antechamber of the following one. Post-Brighton cinema historians proposed some guidelines to avoid teleological pitfalls. Resorting to a falsely objective decoupage of time, for example by matching periods with decades, would constitute a naive abdication with respect to the historian’s duty to conceptualize history. The main idea was not to completely abandon chronological periodization, but rather to emphasize the insurmountable heterogeneity of the early period by documenting the multiple ongoing, and often contradictory, practices. The end result was the promotion of a unique yet multifaceted concept to better understand the early days as a continuation of cultural series that existed prior to the invention of cinematography: the attraction. “The cinema of attractions directly solicits spectator attention, inciting visual curiosity, and supplying pleasure through an exciting spectacle . . . It is the direct address to the audience, in which an attraction is offered to the spectator by a cinema showman, that defines this approach to film making.”<sup>23</sup> This exhibitionist mode of address contrasts most clearly with the voyeuristic aspect that Noël Burch and Christian Metz, among others, associate with narrative cinema. Interestingly, an attraction doesn’t refer solely to the enticing content of the film strips (exotic travelogues, Hale’s vehicle rides, saucy vignettes, etc.), but also to the apparatus itself or to new cinematographic tricks and innovations (splice effects, close-ups). Such a concept encompasses larger cultural manifestations and thus favors an historical account based on cultural paradigms that can overlap at any given time rather than discrete successive

periods; attraction and narration both coexist during the early days, and the resurgence of attraction in later stages of the medium's development (musical numbers, special effects) is a frequent observation.<sup>24</sup>

The video game medium poses an interesting challenge in terms of historical conceptualization. The industry has grown to considerable proportions over the course of the past four decades, and in spite of the undeniable frailty one can observe in the constant acquisitions, mergers, and studio shutdowns, this growth has triggered the establishment of major players, production molds, specialized roles, and training. Many history books focus on the anecdote surrounding the development of the industry and the creation of landmark games. Steven L. Kent's *The Ultimate History of Video Games* was built from a previous account by Leonard Herman (*Phoenix: The Fall & Rise of Videogames*) and 500 interviews with major figures in the industry. The industrial account often provides a first convenient period marker for the history of video games: the Crash of 1983. Kent places the Golden Age of the medium right before the Crash, Van Burnham's account of classic games range from 1971 to 1984,<sup>25</sup> and *The Video Game Explosion's* first major historical demarcation is titled "The Industry Rebounds (1985–94)." Not surprisingly, the great fathers of the medium are often pioneers of the exploitation aspect: Ralph Baer as "The Father of TV Games"<sup>26</sup> or "Home Video Games,"<sup>27</sup> and Nolan Bushnell (inventor of the first mass-produced coin-operated arcade video game, *Computer Space* in 1971) as the "Father of the Industry."<sup>28</sup> Video games have been put in a crib, and it's the promise of a great cultural industry that seems to call for paternity examination.

The classic paternity dispute between Willy Higinbotham (inventor of a table tennis game displayed on an oscilloscope, in 1958) and Steve Russell (who "hacked" the PDP-1 supercomputer to create *Spacewar!* in 1962) points toward the clearest source of teleological distortion in various video game accounts: technology. Since the original technical principle has been developed, a constant onslaught of seemingly perfected yet constantly perfectible machines has been associated with the medium. The first obvious consequence of this constant technological development is a tendency to give particular attention or significance to the hardware and games that represent a technological breakthrough. Symptomatically, on top of the obvious industry landmarks, the timelines integrated in history books put significant emphasis on the first occurrences of specific technological aspects. The launch of major consoles and computer systems are listed along *important* games: the first game integrating ROM chips to store graphical information (*Tank!*, Kee Games, 1974), the first game to use a microprocessor (*Gunman*, Taito, 1975), the first game to use a laserdisc (Electro Sport's

*Quarter Horse*, 1981), the first full-color game (*Galaxian*, Namco, 1979).

The editor of *The Video Game Explosion* clearly expressed a desire to let the games take center stage. The games are thematically organized in accordance to a technical aspect in many instances: vector games, laser-disc games, CD-ROM games, handheld video game systems, online role-playing games, and so forth. Moreover, the temptation to use the multiple generations of hardware—associations of systems released around the same time frame—as historical period markers is very strong. On the *Wikipedia* account of video game history, generations play a major role: from the Magnavox Odyssey to the PlayStation 3, seven major generations have been outlined. In his 2001 account, Kent dedicates two chapters to “The ‘Next’ Generation” (the mid-1990s competition between the Sony PlayStation, Sega Saturn, and Nintendo 64), and further underlines the relative nature of this “next” phase in “And the Cycle Continues.” *The Video Game Explosion*’s other major period distinction is titled “Advancing to the Next Level (1995–Present)”; Wolf notes that by the end of 1994, “the industry was booming again, providing the revenue to invest in new technological advances, like 32-bit home game systems, that were just around the corner.”<sup>29</sup>

Technical aspects of early games are often described with adjectives such as *basic* and *primitive*.<sup>30</sup> Besides blatantly eclipsing the historical reception of objects that were appreciated as technological attractions, these references to the naive infancy of the medium also points the other way, toward an ideal apparatus. The true offspring of the forefathers, it seems, is not yet completed. To this day, hardware designers, game developers, and gamers have their eyes set on the future of games. In “L’appel de la simulation” (Therrien, 2005),<sup>31</sup> I outlined a game design tendency influenced by the simulation ideal: development of open-ended worlds (The *Grand Theft Auto* series), integration of complex physics algorithms (the Havok engine), refinements to artificial intelligence (*Halo: Combat Evolved*, Bungie, 2001), and so on. The marketing campaign for Nintendo’s Wii console (code-named “Revolution” during its design phase) focuses on the seemingly perfect synchronism between the actual manipulation of the user and the resulting action in the game world. The frequent assumption that better game mechanics involve greater realism already traces a privileged path for the future of games.<sup>32</sup> Writing about immersion and presence in video games, Alison McMahan declares:

A recent shift in computer game design involves a move away from 2-D level design in games like *Prince of Persia* (1992) [*sic*] to 3-D design and a first-person point of view. This shift increases

the sense of immersion by replicating the aesthetic approaches of first-person shooter games in other types of games, such as adventure games, role-playing games, and even strategy games, which previously used 2-D levels or isometric views. *The shift in design is indicative of an overall trend to make desktop video games feel more like virtual reality.*<sup>33</sup>

The ongoing technological evolution generates an overarching narrative that defines the ideal stage of the medium in terms of immediacy,<sup>34</sup> feeding on actual techno-military devices (complex simulations, virtual reality interfaces) as much as fantasized versions of these experiments (the *Star Trek* Holodeck).

With its biological infancy metaphors and presentation of the great fathers, and historical periods chronologically organized and conceptualized in terms of progress, it is clear that video game history integrates the aspects of teleological discourse to a great extent. The focus on technological evolution contributes to the promotion of immediacy as a *telos*, potentially distorting historical inspections into the early days of the medium. What defining aspects of the video game experience are likely to be obscured by such a progress-laden organization of the past? Is there a way to account for the undeniable evolution of the medium while exploring other means to conceptualize its history?

## RECONFIGURING HISTORY

In their 2003 book *Digital Play*, Steven Kline, Nick Dyer-Witheford and Greig De Peuter suggest that a thorough historical examination should address the evolution and interactions of three circuits: technology, industry, and culture. The development of technological innovations and the establishment of the major industrial players that successfully marketed these innovations has taken the center stage so far in the young history of the new medium. But in order to better understand video games and conceptualize its history, the evolution of the cultural circuit, where games are created and consumed for the quality of the experience provided, deserves a lot more attention. Closer inspection reveals that any technological aspect is intertwined in a web of often conflicting design imperatives that go far beyond the fascination with immediacy. At the risk of aggravating the cultural bias toward vision, let's take the visual aspects of games as an example. Dozens of techniques have been developed over time to create in-game visuals, each strongly dependent on technological and production resources. Yet newer techniques don't simply replace those of older games;

rather, they can be classified somewhere between the conflicting imperatives of increasing the representational potential of the image, its malleability (and potential reactivity to the player), and its readability for gameplay purposes. Early video game visuals didn't simply "remediate" older audiovisual media like cinema and television; because of their procedural nature, the visual elements to be assembled and reformulated have long trailed behind the visual realism of their predecessors. Yet this very abstraction is a decisive factor in just how engaging these early games can be. Very little resources are necessary to suggest useful or harmful elements: a few carefully arranged pixels (the scorpion in *Pitfall!*, 1982) or primary colors with culturally reinforced meanings are sufficient. Elements relevant to the goals of the game are clearly detached from the background. The growing proficiency of audiovisual techniques brought with it the question of readability, and game designers have used a wide variety of strategies to address it: cinema-influenced composition and framing, translucent rendering of 3-D objects that come between the player's virtual point of view and her avatar, and sometimes obvious directional arrows or other visual cues to indicate relevant information. In the early 1990s, the development of full-motion video (FMV)<sup>35</sup> represented the pinnacle of visual realism in video game graphics, yet the technique quickly lost momentum because these sequences could not be manipulated as easily as the 2-D bitmaps, and thus came to be seen as a step back in terms of reactivity. Filled-polygon 3-D graphics, a technique that was developed as early as 1983, became the center of interest even though it was a clear regression in terms of visual fidelity.

Finding inspiration in the long history of visual representation has been a great way for games to simply circumvent the fascination with verisimilitude: abstraction has been a recurring visual style (*Tetris*, Pajitnov, 1985; *Rez*, United Game Artists, 2001), and caricature dominates at certain periods and for certain game developers such as Nintendo.<sup>36</sup> Both styles clearly accommodate the readability imperative. The evolution of video game visuals cannot be seen as a simple linear progression toward greater immediacy. Moreover, the influence of previous media, most notably cinema, is clearly visible.<sup>37</sup> Even with the development of 3-D imagery, the visual experience of games, most interestingly, is far removed from the virtual reality utopia emphasized by McMahan: a majority of 3-D games propose to control an avatar from a third-person camera perspective, which can also be controlled to some extent. This highly mediated experience—*hypermediatic*, to use the expression coined by Bolter and Grusin—might have prospered out of the simple imperative to present visual problems relevant to the game's objectives as clearly as possible to facilitate gameplay. Similar

observations can be made about the integration of complex physics, artificial intelligence algorithms, and other simulation elements in games. These developments should not overshadow the defining aspect of gaming experiences; the very nature of a game is to clearly prescribe relevant actions in order to limit the range of possibilities that the player has to consider. The purely conventional nature of certain rules and the qualitative spacing of the experience with regards to reality are major contributors to the incredibly satisfying nature of this experience. Even in simulation-inspired games, conventions abound and clear restrictions and objectives are put forward in order to maximize the potential gratification. Even when they wrap their rules in highly sophisticated and ever more realistic algorithms, games and the immersive journey they propose constitute a highly mediated experience.

Tom Gunning suggested that “every change in film history implies a change in its address to the spectator, and each period constructs its spectator in a new way.”<sup>38</sup> Defining different modes of address requires acute knowledge of the rationales that shape the decisions of game creators at any given time. To define different modes of address and their relative importance at any given time, video game studies would benefit from an extensive account of gameplay mechanics. Academic books discussing gameplay are mostly synchronic affairs; historical accounts of gameplay evolution are hard to come by. *The Video Game Explosion* features a few chapters on specific genres (“Adventure Games,” “Interactive Movies,” etc.), and the development of genre studies might attract attention to the evolution of specific mechanics. In *Half-Real*, Juul outlines two types of games, two ways of creating challenges and regulating success. Emergence involves a simple system of interacting rules that can lead to infinite variations and many satisfying performances, and is said to be “historically dominant”; “progression games are a historically new game form where the game designer explicitly determines the possible ways in which the game can progress.”<sup>39</sup> Yet this historical hypothesis is not developed further.

Similarly, conceptual propositions focused on player attitudes are seldom organized historically. Building on previous distinctions between play/game (Winnicott) and ludus/païdia (Caillois), Bernard Perron defined two major attitudes in the experience of video games: the *gamer* seeks to complete clearly defined objectives in order to win the game; the *player* can define his own objectives with no clear valorization of outcomes.<sup>40</sup> The integration of deeper simulation elements in games would seem to favor the player attitude,<sup>41</sup> yet the development of this tendency doesn’t mean the progressive exclusion of the gamer attitude. In *Man, Play and Games* (1958), Roger Caillois proposed a typology of games based on psychologi-

cal attitudes: competition (*agôn*), chance (*alea*), make-believe (*mimicry*), and vertigo (*ilinx*). The typology has often been criticized for being too broad,<sup>42</sup> and as Juul has argued, all these components can be found in a typical modern video game.<sup>43</sup> The historical dimension of Caillois's thesis is often overlooked, but the author did organize his typology historically by associating the rise of major civilizations with the promotion of chance and competition in games, at the expense of the make-believe and vertigo impulses.

Even if the abstract video games of early days had already strong representational undertones,<sup>44</sup> even if their audiovisual resources could overwhelm the senses to some extent, it is clear that the make-believe and vertigo components have been developed considerably in parallel with the technological evolution of the medium. From Pac-Man to Solid Snake, from the infinitely looping alien invasion of *Space Invaders* (Taito, 1978) to the takeover of Liberty City's criminal world, players are invited to project themselves into specific fictional characters and events that go beyond the arbitrary nature of rules; as Juul pointed out in *Half-Real*, the fictional element of games cannot be ignored. As for the vertigo component, the development of interactive imagery opened the door to vertigo-inducing effects that play a significant part in many genres (such as racing games and 3-D action games). Such an observation is rather trivial and seems to feed on the immediacy *telos* discussed in the context of this essay, with its promise of ever more realistic virtual worlds and ability to address the senses viscerally. Indeed, it should be complemented by another one, regarding the evolution of the agonistic component.

To great extent, early games correspond to Juul's definition of emergence, but his emphasis on a permissive regulation of success can potentially misrepresent the actual challenge of these games. Emergent rule systems in the early days are typically not static; as the player progresses through simple repetitive scenarios, the balance is constantly adjusted to be more competitive. Randomization (chance) did represent a low-cost means of introducing interesting variations from one playthrough to the next, but also played an essential part of increasing the difficulty level. Emergence games all obey the basic "easy to learn, hard to master" principle outlined by Salen and Zimmerman,<sup>45</sup> but early games appear harder to master than contemporary games. The notorious difficulty of titles such as *Donkey Kong* (Nintendo, 1981) and *Pac-Man* (Namco, 1980) encouraged a highly competitive environment where the display of proficiency in arcade parlors became an attraction in itself. As the industry progresses from this highly competitive model—where technological attractions are presented in the context of an arcade parlor in order to maximize the potential "attraction of

the self”—to the domination of home-based entertainment geared toward the gratification of casual gamers, we might have witnessed already a major change in video games’ mode of address that is echoed by the evolution of the industry as a whole.<sup>46</sup>

In order to investigate these aspects, video game historians would greatly benefit from the elaboration of a comparative tool that is precise enough to account for the great variety of interactive encounters, yet abstract enough to avoid listing all the actual manipulations on the various control devices and their effects in the game on a case-by-case scenario. A figure of interactivity such as “combat” can be procedurally implemented in many ways, including the simple combinations necessary to produce a few kicks and punches in *Karateka* (Mechner, 1984) and the impressive roster of blows, multiform combinations, and countering abilities involved in the contemporary fighting game *Dead or Alive 4* (Tecmo, 2005). Depending on the representation of space, “spatial exploration” could be carried out in first- or third-person perspective, by lateral scrolling, square-by-square, or on the depth axis through depth cues and interpolation of 2-D objects, or in a fully realized 3-D world; the world to be explored could be opened in many directions and organized in a linear or even circular fashion. The monitoring of vital resources might involve basic physical or psychological integrity, or each of these categories could be affected by many other variables (as in the ADD-inspired RPGs that include stats on endurance, strength, dexterity, intelligence, wisdom, charisma, etc.); players might be able to accumulate some capital for each variable, and the variation of these variables might affect gameplay in a binary fashion (life/death), through various distinct stages, or in a progressive manner. Along with manipulation complexity, the study of learning curves, satisfactory performance intervals, tutorials, in-game aids, save systems, and check points from a historical perspective would allow a better understanding of the prevalent modes of address at any given time and help refine the conceptualization of video game history.

Shifting the focus from technological evolution to concepts such as attraction, immersion, and mediation, this essay illustrates some of the components glossed over by utopian teleological conceptions of the medium. Most strikingly, the attraction of immediacy that one can observe in the constant evolution of illusion-making techniques and simulation algorithms is clearly counterbalanced by the gratification principle inherent to games; the evolution of game design in relation to player gratification represents a fruitful avenue for historical investigations. To properly lay out the history of the medium, one should also consider Hans Robert Jauss’s call for the inclusion of reception as a way to reform traditional art

history. Prevalent modes of address at any given time certainly help shape users' horizons of expectations, but other contextual information is also relevant.<sup>47</sup> Jauss listed three areas of investigation to define these frames of experience: preliminary experience with the norms of artistic forms/genres; relationship of the work with other works in the reception context; and comparison between the poetic and pragmatic uses of language. On top of prevalent genres/influential games and the evolution of their specific gameplay mechanics, a thorough historical examination will have to consider contexts of usage, reception of these games in specialized press and online communities, statistical information about players' preferences and rituals, and much more. If different modes of address can be largely defined through the study of structural elements such as game mechanics, it is the reception pole which ultimately determines usage. The greatest advantage of video game historians, after all, resides in this simple fact: whereas contemporary researchers of the "century of cinema" don't have a single living spectator of early moving pictures, video game historians still have access to early players. Only a closer inspection of the players through interviews and field studies will lead the way to a proper conceptualization of the medium's history. By integrating field work and theoretical propositions from sociology and psychology to reform the unavoidable techno-industrial account, video game history as a discipline can truly propose a synthesizing point of view living up to the complexity of its object.

## NOTES

The author would like to thank Henry Lowood for his comments and suggestions.

1. Quoted by André Gaudreault on page 115 in "Distance et Historicité: Problèmes de Méthode de la 'Reconstitution' historique," in *Le Cinéma en Histoire: Institutions Cinématographiques, Réception Filmique et Reconstitution Historique*, A. Gaudreault, G. Lacasse, and I. Raynauld, ed., (Québec: Nota Bene, 1999), 107–50. Translated by the author.

2. Ibid.

3. Mark J. P. Wolf, ed., *The Video Game Explosion: A History from PONG to PlayStation and Beyond*, (Westport, CT: Greenwood Press, 2007), 1.

4. "Electronics Conservency," Electronics Conservency Inc., accessed October 18, 2011, <http://www.videotopia.com/ec.htm>.

5. Lowood was also responsible for the academic research project "How They Got Game: The History and Culture of Interactive Simulations and Video Games." The project led to the creation of a website and the course "History of Computer Game Design: Technology, Culture, Business" in the Science, Technology and Society program at Stanford University.

6. Heather Chaplin, "Is That Just Some Game? No, It's a Cultural Artifact," *New York Times*, March 12, 2007, <http://www.nytimes.com>.
7. Kris Pigna, "U.K. Launches First Official National Videogame Archive," *1up.com*, October 5, 2008, <http://www.1up.com/do/newsStory?cId=3170366>.
8. Each release of the same game on a different platform counts as one entry. Multiple box/media art from different countries can be stored for any game.
9. "Arcade History," accessed October 18, 2011, <http://www.arcade-history.com>.
10. See the following sites: <http://www.lemonamiga.com>; <http://www.lemon64.com>; <http://www.pcecp.com>; <http://www.atariage.com>; <http://nindb.classicgaming.gamespy.com>; <http://lucasarts.vintagegaming.org>; <http://www.dragons-lair-project.com>; and <http://www.dragons-lair-project.com>.
11. Which is not to say that the content is not reviewed by a core team member of each website; review procedures do exist, but are limited by obvious constraints.
12. See <http://www.videogamecritic.net>; and <http://www.justadventure.com>.
13. Wolf, *The Video Game Explosion*, xv.
14. Among other features promoted on their respective box art illustrations, *Cruise for a Corpse* lists "Completely interactive in full 3-D vision," the cover of *Axelay* mentions "six graphically shocking 3-D levels," and the SNES version of *Doom* boasts "FX2 Chip for screaming fast, real time 3D graphics."
15. Henry Lowood, "Videogames in Computer Space: The Complex History of Pong," *IEEE Annals of the History of Computing*, July-September (2009): 5–19.
16. Nick Montfort and Ian Bogost, *Racing the Beam: The Atari Video Computer System* (Cambridge, MA: The MIT Press, 2009), vii.
17. As of 2010, the PlayStation 2, GameCube, and Xbox consoles have been emulated to some extent.
18. The file names of the masks, from left to right: Apperture 3x6 Aaron; Apperture 2x4rb Aaron; Scanrez1 Althor; Scanlines75dx\_j4.
19. Dithering is the juxtaposition of two colors in complex patterns in order to give the illusion of a greater color depth.
20. Wolf, *The Video Game Explosion*, 23.
21. The 1978 FIAF conference in Brighton represents a turning point for the history of cinema; it marks the beginning of a critical inspection of traditional accounts of cinema by a new generation of historians.
22. Tom Gunning, "The Cinema of Attractions: Early Film, Its Spectator, and the Avant-Garde," in *Early Cinema: Space-Frame-Narrative*, ed. Thomas Elsaesser, (London: British Film Institute, 1990), 56.
23. *Ibid.*, 58–59.
24. In 2000, Gaudreault and Philippe Marion proposed a complex "birth" scenario to better understand the formation and evolution of media: the "integrative birth" corresponds to the advent of an apparatus and its appropriation

by various cultural series (photography with the Lumière brothers, stage trickery in the case of Méliès, etc.); the “differential birth” refers to the advent of a dedicated institution and a clear hierarchy of practices for which the medium developed specific codes. See André Gaudreault and Philippe Marion, “Un média naît toujours deux fois . . .,” *Sociétés et Représentations*, 9 (2000): 21–36.

25. In the introduction, Burnham nuances the term classic, but refers to the selected era as the “Golden Age”; see Van Burnham, *Supercade: A Visual History of the Videogame Age 1971–1984* (Cambridge, MA: The MIT Press, 2003), 23.

26. *Ibid.*, 18.

27. Steven L. Kent, *The Ultimate History of Video Games* (New York: Three Rivers Press, 2001), 21.

28. *Ibid.*, 27.

29. Wolf, *The Video Game Explosion*, 107.

30. For example, “*Trak 10* had very basic graphics” (62) and “*Tank* had very primitive graphics” (67), in Kent, *The Ultimate History of Video Games*, 2001.

31. Carl Therrien, “L’appel de la simulation: deux approches du design vidéoludique,” in *Le game design de jeux vidéo: approches de l’expression vidéoludique*, ed. Sébastien Genvo (Paris: L’Harmattan, 2005), 175–94.

32. Chris Crawford notoriously defined good game design in terms of consistency and coherence; Janet Murray, in her discussion on agency, proclaims that “the most dramatically satisfying puzzles are those that encourage the interactor to apply real-world thinking to the virtual world.” (Janet Murray, *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (Cambridge, MA: The MIT Press, 1997), 139).

33. Allison McMahan, “Immersion, Engagement, and Presence” in *The Video Game Theory Reader*, ed. Mark J. P. Wolf and Bernard Perron (New York: Routledge, 2003), 67–86. Emphasis mine.

34. The concept of immediacy is central to Bolter and Grusin’s media genealogy; it is one of the two logics of remediation, defined as “the way in which one medium is seen by our culture as reforming or improving upon another [ . . . ] Each new medium is justified because it fills a lack or repairs a fault in its predecessor, because it fulfills the unkept promise of an older medium.” J. David Bolter and Richard Grusin, *Remediation: Understanding New Media* (Cambridge, MA: The MIT Press, 1999), 59–60).

35. FMV is the brand name of various techniques allowing the playback of fully animated sequences created from digitized live-action material or computer-generated assets. It doesn’t stipulate strict norms in terms of frames per second, color depth, compression algorithms, or display size.

36. See Aki Jarvinen, “Gran Stylissimo: The Audiovisual Elements and Styles in Computer and Video Games” in *Proceedings of Computer Games and Digital Cultures Conference*, ed. Frans Mäyrä (Tampere, Finland: Tampere University Press, 2002), 113–28. Thanks to Martin Picard who brought this resource to my attention.

37. See Carl Therrien, “Graphics in Video Games” in *The Video Game Explosion: A History from PONG to PlayStation and Beyond*, ed. Mark J. P. Wolf

(Westport, Connecticut: Greenwood Press, 2007), 239–50.

38. Tom Gunning, “The Cinema of Attractions: Early Film, Its Spectator, and the Avant-Garde,” in *Early Cinema: Space-Frame-Narrative*, ed. Thomas Elsaesser (London: British Film Institute, 1990), 61.

39. Jesper Juul, J., *Half-Real: Videogames between Real Rules and Fictional Worlds* (Cambridge, MA: The MIT Press, 2005), 56.

40. Bernard Perron, “From Gamers to Players and Gameplayers: The Example of Interactive Movies” in *The Video Game Theory Reader*, ed. Mark J. P. Wolf and Bernard Perron (New York: Routledge, 2003), 237–58.

41. The complex physics engine integrated in *Halo: Combat Evolved* (Bungie, 2001) incited many players to experiment with the power of accumulative deflagration on different world objects, for example by trying to catapult vehicles to otherwise unreachable parts of a given map. It is clearly this player attitude that Bungie wanted to cater to with the addition of Forge to *Halo 3* (2007); the map-editor module allows direct control over object placement and can become a game in itself.

42. See Colas Duflo, *Jouer et Philosophe* (Paris: PUF, 1997).

43. Juul, *Half-Real: Videogames between Real Rules and Fictional Worlds*, 10.

44. The first arcade games, *Computer Space* (1971) and *PONG* (1972) had strikingly abstract universes that could nonetheless evoke specific referents (outer space and table tennis). In 1972, color overlays (such as tennis and hockey playfields), sold with Magnavox Odyssey games, added some representational value to the abstract shapes on screen.

45. Juul, *Half-Real: Videogames between Real Rules and Fictional Worlds*, 69.

46. Of course, this proposition should be nuanced by pointing out the tremendous development of competitive gaming in certain regions of the world. *StarCraft* (1998) tournaments in South Korea, to name but one example, have reached the level of professional sport in terms of popularity and sponsorship.

47. The aesthetic of reception is not only a plea for the exhaustive study of the interaction between art and its audience, but a strong case for the reformation of literary and art history. For Jauss, the historical approach should focus on the horizons of expectations that define the reception of art at any given time. See Hans Robert Jauss, *Toward an Aesthetic of Reception* (Minneapolis: University of Minnesota Press, 1982).

## What's Victoria Got To Do with It?

### *Toward an Archaeology of Domestic Video Gaming*

Video games are played by persons, but they are also played by contexts, because we cannot separate ourselves from the cultural, ideological, economic, and social conditions within which we live our lives.<sup>1</sup> Humans mold contexts, but—perhaps to an even greater degree—contexts mold humans. A person pushing a shopping cart through the aisles of a supermarket may feel absolutely free to choose whatever he or she wants, but the shopper's choices have been preconditioned by all kinds of determinants: peer group preferences (including those disseminated by Facebook and other social media), lifestyle issues, educational discourses, promotional strategies, and media feeds (including “product placement” in movies and electronic games). “Personal taste” and “freedom of choice” are largely illusions, at least if treated as absolutes.

In a similar way, wildly waving the Wii Remote in a living room sports session or clutching the Xbox 360 controller on a romp through the badlands of *Red Dead Redemption* (2010) may seem acts of spontaneous fun or liberatory forays into virtual never never lands where everything is possible. Although this may be true on the surface, there is always more beyond it. Like the shopper, the gamer can never fully escape the fact that gaming is rooted in discursive formations and shared codes that are cultural and historical. They inform the experience, whether the gamer is aware of it or not. A media-archaeological approach to gaming will clarify such issues by placing gaming within wider contexts.<sup>2</sup> My 2005 article “Slots of Fun, Slots of Trouble” attempted to do so, focusing on the archaeology of arcade gaming, from mechanical games to electronic games.<sup>3</sup> The present text should

be considered its companion, an extension into the sphere of privacy.

The topic can be divided into three interrelated issues, all of which require their own archaeologies. The first concerns the process through which the home turned into a “media center”; the second, interactivity; and the third, tinkering with media technology. The home’s development into a media center was longer and more complex than is usually thought. It involves the formation of what Richard Chalfen calls the “home mode communication.”<sup>4</sup> Domestic video gaming is one of many media-related rituals repeatedly enacted within the home. It is or has been related with practices such as viewing stereoscopic photographs (a Victorian craze), listening to recorded music or the radio, watching travel slides and home movies, consuming television, text messaging, and surfing the internet. These practices immediately raise a question about the relationship between media that stay within the domestic walls and those that breach them. Of course, the media that are used in the home don’t always remain there; they are also transported to outdoor spaces. The borderline between domestic and mobile media is becoming more and more fluid.

Although gaming is related to other domestic media practices, it is not identical with any of them. One of the issues that separates it is interactivity—the fact that gamers initiate a temporally unfolding active exchange with the game machine and the experiences it provides. The emergence of interactivity has often been simply related with digital computers, but as I have demonstrated in earlier studies, it has a much longer history that goes back far before the era of digital technology.<sup>5</sup> The relationship between “interactive” and “passive” modes of media consumption is often not clear-cut. For early forms of interactivity in the domestic setting, we must turn to “philosophical toys,” board games, and other domestic pastimes.

Interactivity normally involves interactions with prefabricated applications via standardized interfaces. However, it is also closely related with activities in which the user adopts a more active role, turning into a tinkerer, hobbyist, and even a hacker. Such a transformation also points to the nineteenth century. Using instructions published in handbooks for boys and in children’s magazines, countless Victorian children set out to create their own toy theatres, scrapbooks, and even optical motion toys. The widespread culture of radio amateurism and electrical tinkering was built in the early twentieth century on this foundation, influenced by new generations of hobbyist and popular-science publications and better availability of electrical components. Tinkering with technology has always been part of the world of domestic gaming, although the attitudes of the game industry and its publicity machineries are ambivalent toward it.

Beside material and technological developments, I will pay attention

to the ways in which users respond to media, redefine their uses, and contribute meanings that resonate within media culture at large. The public surface of game culture is produced by massive identity machineries operated by software and hardware manufacturers with the willing support of advertisers and popular media outlets. Gamers and enthusiasts add their share as well, circulating information, opinions, and rumors on countless online forums (including “independent” blog sites covertly funded by the media industry). A media archaeology of gaming penetrates beyond this uneven, reflective, and multipatterned surface, looking for symptoms of neglected and suppressed developments behind it. While illuminating the past, media-archaeological excavations also help us question the received truths of contemporary culture.

### BACK TO THE FUTURE, OR PRE-POSITIONING THE VIDEO GAME CONSOLE

In 1978, Magnavox, the American television manufacturer that had reinvented itself as a pioneer of domestic video gaming, released Odyssey<sup>2</sup>, another descendent of its legendary flagship product, the Odyssey (1972). A magazine advertisement promoting the Odyssey<sup>2</sup>, shows a grinning father and smiling daughter staring intensely at each other, clutching joysticks between their fingers (Fig. 2.1).<sup>6</sup> Both are shown in profile, the console and TV-screen game display between them, facing the reader—we are obviously invited to place ourselves within the picture via identification. The projectile shot by the father’s avatar is bouncing from a tree—a *miss!*—whereas the daughter’s avatar is about to make a direct hit at the “father figure”—*bang!* The ad presents Odyssey<sup>2</sup> as a way of bonding—family members, sexes, and generations—but in a playfully subversive and mischievous way. Reversing prevailing social norms, the daughter may humiliate her father without being punished, as long as it happens within the virtual world of the game.

The text presents the console as the “ultimate gift” (probably from the father to the family). The slogan at the bottom sums up Magnavox’s mission: “We make staying home fun.” For the media archaeologist, this is not the whole story or even the full sentence. Its unstated cultural subtext could be formulated as follows: “so that children will never leave their parents, and will stay away from bars, game arcades, and other bad influences.” Underlying the slogan is the implicit suggestion that without the system, staying at home is *not* fun. The “transgression” of social norms the ad hints at serves this purpose: the Odyssey<sup>2</sup>, connected with the domestic television set, provides the daughter a harmless way of releasing whatever pressures

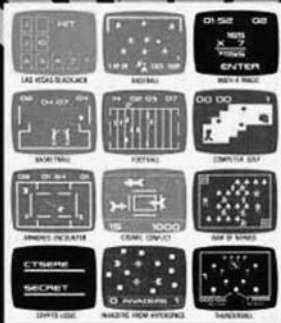


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Fig. 2.2. Magnavox Odyssey<sup>2</sup> advertisement. From [www.retroist.com/2009/04/15/magnavox-odyssey-2-ad-from-1980](http://www.retroist.com/2009/04/15/magnavox-odyssey-2-ad-from-1980).

may emerge within the nuclear family. Beyond the facade of pure fun, the game console is actually a regulator for social-psychological interactions.

The ad we have just analyzed was a variant of a formula Magnavox had used for the original Odyssey; the father faced his son in a similar situation playing in a virtual tennis game (the Odyssey<sup>2</sup> campaign likely emulated the same poses to facilitate product recognition). However, a review of the iconography around early domestic video gaming (ads as well as packaging designs) shows that it was more common to display the entire family gathered around the console and television combination.<sup>7</sup> The situation was derived from all the iconography surrounding the television, which is understandable because early video game consoles were seen as additions to the familiar device. “Turn your TV into the most exciting home video game ever” the previously mentioned ad for the Odyssey<sup>2</sup> declared. Perhaps the television had become too familiar, losing some of its effectiveness as social cement. The game console electrified the situation, but, as we will see, it did more than that.

In its promoters’ minds, the video game console—although touted as a novelty—was placed in a position that already existed. This position was not determined only by interior design or the marketing of new technology; it also concerned the formation and consolidation of social relationships within the domestic sphere. Books like Lynn Spigel’s *Make Room for TV: Television and the Family Ideal in Postwar America* (1992) and Cecelia Tichi’s *Electronic Hearth: Creating an American Television Culture* (1991) provide plenty of evidence about the ways television became rooted within the home and also within the awareness of the culture at large.<sup>8</sup> What these books don’t discuss are the ways in which the roles and meanings of the television were instigated by earlier domestic media practices. A look at these longer trajectories will give us a better understanding of the positioning of video gaming within the home.

#### THE HOME AND THE MEDIA: EARLY CONNECTIONS

“Domestic media devices” first appeared in European homes in the eighteenth century as fashionable novelties for the privileged classes. Fascinating gadgets, like peepshow boxes and camera obscuras, as well as pictures that produced visual surprises such as anamorphic images, alleviated the ennui of the inhabitants and their guests, and at least nominally instructed and informed them. The origins of such objects point to “natural magic,” an intellectual current prevalent among the Jesuits in the sixteenth and seventeenth centuries. For the Jesuits, the interplay between the astonishment created by optical tricks and the explanation of their causes was important.

It influenced the ideology of “philosophical toys,” such as anamorphoses, kaleidoscopes, thaumatropes, and zoetropes, which were meant to amuse and instruct at the same time. Similar ways of thinking can be found from educational works written during the Enlightenment by authors like Abbé Nollet, Benjamin Martin, and William Hooper. The title of Hooper’s *Rational Recreations* (1774) conveys much of their nature. Sir David Brewster’s *Letters on Natural Magic* (1832) continued along similar lines, pointing the way to countless later manuals of “rational” pastimes.

A common way domestic users interfaced with media was peeping. We could speak about “peep media,” or the history of domestic “peep practice.”<sup>9</sup> The images were hidden inside dedicated boxes; to view them, one had to place one’s eye into a hole which often had a magnifying lens.<sup>10</sup> Illumination was provided by candles or by opening and closing panels at the sides of the box, which could also be used to make the images “move.” Peepshow boxes and other related devices such as zograscopes became a fashion among the eighteenth-century nobility, and a veritable industry emerged to produce perspective views (*vues d’optique*) for them.<sup>11</sup>

The emergence of the bourgeoisie transformed the public sphere.<sup>12</sup> The semipublic, social showroom-like nature of the mansions of the nobility was replaced by an emphasis on privacy in the homes of the bourgeoisie. Their salons were very different from those of the aristocracy, as they opened their doors only to the family and an intimate circle of friends and relatives. Houses were divided into private rooms for the inhabitants; the role of open reception areas was diminished. Such a setting inspired intimate domestic pastimes. There was a new emphasis on reading, both reading aloud and silently. New literary genres such as the novel became a fashion, and the ubiquitous habit of letter writing functioned both as a way of passing news and expressing one’s intimate feelings. The growing popularity of magazines and newspapers created a textual connection between privacy and the world at large. The home became a lucrative market for companies that began to produce board games and other pastimes.<sup>13</sup>

This development reached its apogee in the Victorian era. The home became segregated from the outside world. It was defined as a haven, far from the noise, stress, hurry, pollution, and other dangers of the urban outdoors. This reflected developments taking place outside—the intensification of the processes of industrialization and capitalism, and the speeding up of urban life. The industrial proletariat was a new, threatening mass roaming the streets. The Victorian home turned into a microworld, full to the brim of furniture, fabrics, mementos, pictures, and objects of all kinds, all to combat a looming sense of horror vacui and to create a temporary illusion that there was no outside.

Rich arrays of domestic pastimes were developed, including games, handicrafts, and the habit of collecting.<sup>14</sup> Media imagery became more and more widely available, thanks to the invention of lithography and photography, as well as the wide distribution of illustrated magazines. Pictures were cut out and turned into collages in scrapbooks or on folding screens or room dividers (coated with varnish, these became a staple of the Victorian home). The scrapbook in particular was an important private medium for expressing oneself, making sense of the world, and communicating one's ideas to the intimate family circle.<sup>15</sup> The habit of using and even constructing optical devices fitted perfectly within such an environment.

### THE STEREOSCOPE: THE FIRST TRUE DOMESTIC MEDIA DEVICE

Domestic peep media was given a strong impetus in the second half of the nineteenth century by novelties like the Megaethoscope and the stereoscope. The former was a large and elaborate piece of "optical furniture" for the parlors of the bourgeoisie (Fig. 2.2). It was patented by the Italian photographer Carlo Ponti in the 1860s and used for viewing large photographic albumen prints. The Megaethoscope was produced in various finishes, from relatively plain to extremely ornate, and it often stood on a cabinet containing dozens of views. Its operation principles were always the same: the user peeped into a large lens in one end of the device, pictures were placed in a slot in the other end, and the lighting was transformed by opening and closing panels on the sides of the box. The variety of surface designs expressed the owner's social status. *Any* version was beyond the reach of the lower strata of society. Lower-class homes did not even have enough space to house it.

When availability, popularity, and longevity are considered, the stereoscope was the first true domestic media machine.<sup>16</sup> Introduced for the public at the Crystal Palace exhibition in London in 1851, the production of both viewers and stereoscopic photographs soon reached huge volumes; a true mass-market opened. A great variety of models was designed, including elaborate decorated cabinet versions that housed dozens of stereoviews. In the late 1850s, a cheap and practical handheld model designed by the American medical doctor and writer Oliver Wendell Holmes was brought to market and known as the Holmes-Bates stereoscope. The stereoview was placed in an open holder, while the lenses were under a hood. By the late nineteenth century, such simple viewers were found practically everywhere. They were used both at homes and classrooms and given away by companies that used collectible stereocards to advertise their products.

Early stereoviews often depicted Victorian parlors (Fig.2.3). Family



Fig. 2.2. Megaethoscope. From Erkki Huhtamo's *Phantasmagoria* Collection, Museum of the Moving Image, Helsinki, Finland.

and friends were shown engaged in leisure activities such as playing board games, singing, reading, and viewing stereocards themselves. Such views confirmed the importance of new optical instruments. As photographic technology became more easily portable, views of famous cities, landmarks, and distant lands became more prominent. The stereoscope developed into a veritable virtual-voyaging tool.<sup>17</sup> Toward the end of the century, “package tours,” complete with carefully arranged stereocards, guidebooks, and maps, were sold in handsome boxes that looked like books.<sup>18</sup> Although the 3-D illusion of “really standing on the spot” provided by stereoscopic photographs was artificial, the stereoscope was hailed as a device that brought the outside world within the walls of the home.

With the proliferation of cheap stereoscopes and mass-produced stereocards, even lower income households were brought into realm of visual media. In spite (or because?) of the massive cultural presence of the stereoscope, few written testimonies about its uses and reception seem to exist. There is, however, a wealth of stereoviews and other photographs showing users peering into the device. Although these were often produced as marketing gimmicks, they provide us some clues about how their contemporaries saw the device and what kind of meanings they associated with it.

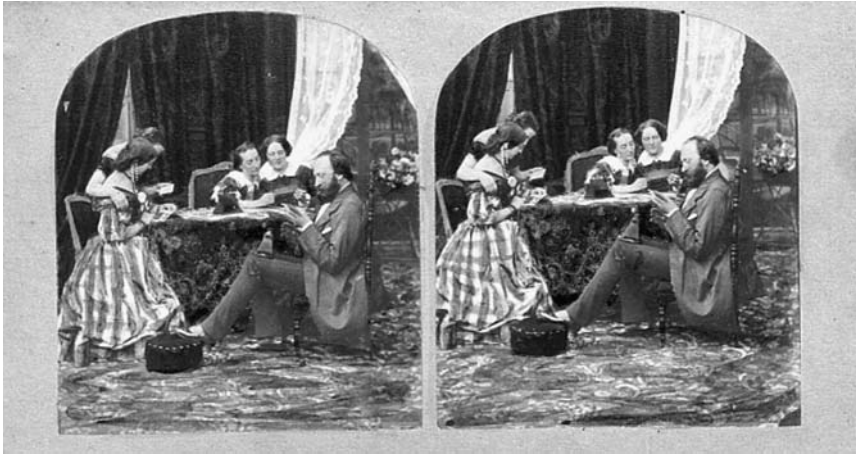


Fig. 2.3. Posed Victorian stereoview showing a group of people in a parlor spending time with stereoviews. Gaudin, Paris, circa 1860s. From the author's collection.

Photographs of interiors where the stereoscope has been accidentally (?) left on the table confirm its established presence in the Victorian home. Stereoscopes and stereoviews were also used as props at photographers' studios, and can be seen in many cabinet-card photographs, associating the sitters with optical technology.

Photographs depicting just a single person immersed in the stereoscope are uncommon compared with images of families or groups of friends spending time together with it. This may be surprising, because the stereoscope—like the peepshow box—seems to encourage solitary immersion. Still, it is common to see views of people sitting around a table, browsing piles of stereoscopic cards, and passing the stereoscope from hand to hand; or sitting in armchairs and sofas, viewing stereoviews. They may be at the same time engaged in other activities, too, such as knitting, reading, or playing chess, while the children are playing with toys. The latter are sometimes depicted peering into stereoscopes without any adults present, even demonstrating its secrets to the family dog.

The iconography identifies the stereoscope as a “conservationist” instrument that holds the nuclear family together and confirms the integrity of the home. In an illustration from a mail-order catalog, a mother is seen happily spending “An Evening at Home With the Little Ones”; stereoscopy is promoted as a good pastime that will keep the mother and the children together.<sup>19</sup> The Keystone View Company often ended its “world voyaging” sets with a view titled “Still There’s No Place Like Home,” showing the fam-

ily sitting together in harmony in the domestic parlor, obviously having just completed its world tour. The potentially disruptive effects of traveling have been defeated, the patriotic family ideology reinstated. As one of the cards states, “At the foundation of all our glory, the best thing under our flag is the true American home.”<sup>20</sup>

However, there were signs that pointed to potential ruptures in the apparent harmony of domestic ideology. A two-page cartoon published in *Harper's Monthly* in 1860 shows what happens when the father brings a stereoscope into the home (anticipating the countless future fathers with boxes of home electronics, from TV sets to game consoles).<sup>21</sup> The rituals of family life are disrupted. Not only are habits like reading abandoned, but the entire family—including the pets—become cross-eyed wrecks! The cartoon demonstrates that the public debates about the effects of media evoked in later contexts, from the television to video games to the Internet, are not without precedents.

The stereoscope's role within the Victorian family anticipated those of later domestic media. Although its apparatus was very different from the television set, it made its users accustomed with the idea of visiting different parts of the worlds, and also enjoying pictorial narratives, without leaving one's home. Although she does not refer to the stereoscope directly, television theorist Lynn Spigel correctly states that “television's inclusion in the home was subject to preexisting models of gender and generational hierarchies among family members—hierarchies that had been operative since the Victorian period.”<sup>22</sup> This issue deserves a more detailed analysis than what can be attempted here.

#### A TACTILE AND INTERACTIVE RELATIONSHIP WITH DOMESTIC MEDIA DEVELOPS

Spectators who attended public performances by touring magic lanternists, peepshowmen, or shadow-theater artists had to accommodate themselves to the role of more or less passive observers. Already by the eighteenth century, however, domestic users who gathered around a small peepshow box, zograscope, or miniaturized shadow theatre could playfully alternate between the roles of showman and audience. The possibility of manipulating a device for the purpose of self-expression was an early instance of the development that led to “personal media machines” such as game consoles, personal computers, and smartphones. It could be considered a manifestation of “touch practice” that has alternated with “screen practice” and “peep practice” for centuries.<sup>23</sup> Long after itinerant showmen had disappeared, “touch practice” flourished in nurseries, where children operated toy peep-

shows and tiny magic lanterns; these were eventually supplanted by other gadgets.

When the Massachusetts-based game and toy manufacturer Milton Bradley developed its first moving panorama toy, *The Myriopticon: A Historical Panorama of the Rebellion* (released in 1866), it imitated the forms of the professional moving panorama shows that were touring the United States. The company's history claims that Bradley drew the pictures himself, although many of them were based on iconographical models appropriated from illustrated magazines and other popular visual sources.<sup>24</sup> The Myriopticon was delivered in a beautifully designed cardboard box with a hand crank, lecture text, a handsome folded broadside (a kind of poster), and sheet of tiny entrance tickets to be cut out by the new owner. In spite of its minuscule size, the Myriopticon reportedly made it possible to reenact a public panorama show in private, if we are to believe a letter purportedly sent to the company by Mr. B. R. Davis from Vermont and published in its corporate history:

DEAR SIR: I have received the new Myrioptican [*sic*] Game [*sic*] and whilst I find it instructive and amusing I must say that it is making changes in our household that are something to think about. Every evening after Supper my wife and five children and I foregather in the parlor and the curtains are pulled and the lamp lit. They have elected me as head of the family to recite the lecture and turn the pictures, which I do every evening.<sup>25</sup>

Davis even claims that he had to perform for a growing number of neighbors as well, which effectively turned him into a domestic moving panorama showman. Davis seems to have followed Milton Bradley's instructions obediently as he "turned the pictures." Confirming the prevailing patriarchal ideology, it was the father who turned the crank and delivered the lecture, while the mother and the children were conceived as spectators.

For descriptions of how optical devices were used in nineteenth-century homes, we often rely on texts and illustrations published by the manufacturers themselves. These only give us an ideal(ized) version, without revealing how the users responded to the product. When it comes to optical toys such as the phenakistiscope, invented simultaneously by Joseph Plateau (in Brussels) and Simon Stampfer (in Vienna) in 1832, it seems that it was originally marketed for adults as a fashionable gift. Months after the invention had been made public in scientific circles, the first sets of phenakistiscope discs were put on the market, sold by fashionable boutiques as novelty items for the wealthy bourgeoisie. As decades passed, and edition

after edition was sold, the device lost its novelty value and the target audience changed to children.

Another “persistence of vision” device, the zoetrope (“Wheel of Life”), was invented around the same time as the phenakistiscope, but only turned into a product in the 1860s (Fig. 2.4). In the United States it was promoted by the Milton Bradley company, which introduced it as “an original, ingenious, and very curious application of a well-known optical principle.” To accompany the device, Milton Bradley released a booklet titled *The Philosophical Principles of the Zoetrope, or Wheel of Life* (c. 1867) that explained its principle and operation in detail, and quoted opinions from both newspapers and well-known scientists (to whom the company had very probably sent samples).<sup>26</sup> Reenacting the age-old tradition of natural magic, professor Joseph Lovering from Harvard College stated outright that he considered it “in every respect worthy of a place in my philosophical cabinet.”

The main target was the family, although the voices quoted in the booklet could not agree whether the zoetrope was meant for both “old and young” or for the children. A lithographic illustration depicted a family with enthusiastic children around the attractive rotating picture drum. The *Hartford Courant* made an important observation, stating that “any number of persons can enjoy it at once.” Whereas the handheld phenakistiscope, like the Holmes-Bates stereoscope, was meant for a single user at a time, the zoetrope accommodated a domestic audience. The illustration on



Fig. 2.4. Family around a Zoetrope. From the booklet *The Philosophical Principles of the Zoetrope, or Wheel of Life* (Springfield, MA: Milton Bradley, c. 1867). Public domain.

the cover of the sheet music partition for Emile Ettling's "The Wheel of Life Polka" (late 1860s) shows the zoetrope spinning by itself on a salon table, while fashionably dressed grown-ups stare intently at the novelty device.<sup>27</sup> Everyone has adopted the role of the spectator, keeping fingers off of the surface of the spinning drum.

There are other visual sources suggesting that people engaged in active tactile interaction with the device, placing new animation strips inside the drum, and trying out different effects by spinning it faster or slower, and in different directions. Milton Bradley's booklet instructed the users to try out different combinations of partly overlapping strips, claiming that this caused surprising transformations. In fact, this practice was an early method of "editing" moving pictures.<sup>28</sup> Although the booklet did not mention it (probably because the company wanted to sell its own "software," sets of zoetrope picture strips), it was not very difficult to learn to create one's own animation strips for the zoetrope; a practice that is still often used in visual education.

The zoetrope can be interpreted as a proto-interactive device, because it allows the user to manipulate it directly and modify its "software." It could perhaps even be called interactive, depending on our requirements for this term. What is essential is the continual and active relationship between the user and the device. Another important aspect is relative size: unlike public spectacles, such as professional moving panoramas or magic lantern projections, the zoetrope was small compared with the human body and was within the reach of the hands. In this sense, it could be compared with doll houses, toy theaters, and other artifacts that encouraged role-playing by projecting situations of everyday life into miniature environments and allowing children to invent their own scenarios.

#### THE BOY SHOWMAN ENTERTAINS THE FAMILY

The active relationship between media machines and home users is a theme that appears often in the nineteenth-century handbooks for domestic pastimes published in the wake of Hooper's popular *Rational Recreations* (1774), an influential work that was reprinted numerous times. Borrowing many things from an earlier French book by Guyot, Hooper provided detailed and easy-to-understand instructions for constructing camera obscuras, magic lanterns, and other devices, as well as tips about experiments and tricks that could be performed with them.<sup>29</sup> For example, *The Boy's Own Book of Indoor Games and Recreations* contained detailed instructions for making peepshow boxes, which could be "about the size of an ordinary cigar-box, or large enough to cover a dining-room table."<sup>30</sup> The book

encouraged the prospective children's room showman: "The following peep shows, if carefully and neatly made—and they are well within the capacity of any handy boy—will form permanent and most interesting recreations, to say nothing of the pleasure to be obtained in their construction."<sup>31</sup>

New gadgets were added to the standard repertory. Countless middle-class boys read such literature eagerly and moved from theory to praxis. One of them was the American John Banvard, who became famous as a moving panorama showman. Articles published about his life in the 1840s recounted an episode supposed to have taken place when Banvard was still a boy living in his family's home in New York. Banvard, so the story goes, created an entertainment for which he even printed little advertising broadsides. The episode would have sounded like a legend had not one of these crudely printed documents survived:

Banvard's Amusements

(To be seen at No 68 Centre street, between White and Walker.)

Consisting of

1st. Solar Microscope

2nd. Camera Obscura

3d. Punch & Judy,

4th Sea Scene,

5th. Magic Lantern.

Admittance (to see the whole) six cents.

The following are the days of Performance viz.

Mondays, Thursdays, and Saturdays.

Performance to commence at half past three P.M.

John Banvard Proprietor.

F. Woodworth, Printer, 521 Pearl street.<sup>32</sup>

Did Banvard exhibit his show publicly or just for family and friends? The latter situation is more likely. The venue was probably the family's home. The program imitates the routines of professional entertainers whose exhibitions Banvard may have seen in New York, yet it is impossible to tell if his devices were professionally made or do-it-yourself concoctions. He may well have read John Babcock's popular *Philosophical Recreations, or Winter Amusements* that appeared in 1820 and was reprinted numerous times. It gave the young hobbyist detailed information about how to construct and use solar microscopes, camera obscuras, magic lanterns, and slides, and many other things.<sup>33</sup>

Both the American lantern-slide painter Joseph Boggs Beale and the famous English showman Albert Smith are said to have constructed and exhibited miniaturized toy moving panoramas as children.<sup>34</sup> These were simplified versions of public spectacles, where a roll of pictures was moved in front of the audience by means of a hand crank, while a lecturer explained the pictures, and music was played in the background.<sup>35</sup> During the American Civil War, a schoolboy named Willie Kingsbury cut out pictures of soldiers and war scenes from *Harper's Weekly*, colored them, and pasted them into a scroll. With his self-made moving panorama apparatus, he gave performances for other boys and girls in the attic.<sup>36</sup> The Milton Bradley company encouraged children to create an active relationship with the moving panoramas it was producing. The booklet that accompanied the *Panorama of The Visit of Santa Claus to the Happy Children* (c. 1870) stated:

After this descriptive lecture may have become old, it is suggested that the young members of the family take turns in preparing original lectures to be delivered at the exhibitions. The great variety of scenes admit of the greatest freedom in the lectures, and nothing can afford a better subject for compositions than these pictures, as thereby two objects are attained; first, the study of pictures, and second, the practice in composition.<sup>37</sup>

All in all, extensive educational efforts were made in the nineteenth century to provide children and adolescents hobbies that would actively involve them and persuade them to stay safely within the walls of the home. Victorian ideology attempted to harmonize the different generations, while keeping traditional gender divisions intact. However, in the late nineteenth century, pressures against the nuclear family and its domestic fortress began to grow. Women requested more freedom to visit the city space with other women and without a male chaperon. As controlled environments that embraced capitalist values, department stores and their display windows became a suitable destination for them, while ladies' camera clubs gave them a pretext to roam to public space and terrorize others by snapping pictures of unwilling subjects.<sup>38</sup> Young men also grew restless, beginning to frequent amusement arcades, pleasure beaches, and nickelodeons, as evidenced by anecdotes about the guilty pleasures they found by peeking inside Mutoscopes and other coin-operated picture viewers. Bicycles and automobiles also increased mobility, encouraging outdoor life and streaks into the unknown. All these trends were threats to the stable system of conservative values centered on the home.

It was also possible to segregate oneself from the rest of the family unit without leaving the home. The Victorian bourgeois home, with its clear separation between public and private areas, usually provided potential hideaways behind closed doors. Devices like the stereoscope could help. As we have seen, however, it was often used in social situations in spite of a form that seems to invite seclusion. A powerful impetus for individual seclusion within the home was provided by the introduction of wireless and radio technology in the early decades of the twentieth century. They provided new ways of bridging the domestic interior with the world outside, and in real time. They did not only encourage passive receivership; it was soon discovered that amateurs could use parts to construct equipment and use it for active communication with other enthusiasts beyond traditional spatiotemporal limits. As Susan J. Douglas demonstrated in her classic *Inventing American Broadcasting 1899–1922* (1987), the emergence of radio amateurism was a widespread phenomenon with ample and often contradictory social and cultural implications.<sup>39</sup>

Radio amateurism led to intense technological do-it-yourself (DIY) tinkering, supported by scores of popular-science magazines that distributed both practical information and outlandish fantasies about the future possibilities of the still rudimentary technology. Radio amateurs gained admiration by their feats, but also notoriety; they were seen as self-made heroes of a new media culture and as prototypical hackers and crackers. For some, they were pioneers exploring an entirely new territory in the “ether”; for others, they were reckless pranksters whose widely reported deeds included sending U.S. warships on phantom missions and supposedly hampering the rescue efforts of *Titanic*’s survivors. The anger raised by such “achievements” made the authorities and the industrial-military complex join forces to limit radio amateurs’ access to the ether. Radio communication was increasingly defined as a closed world of official public messaging. Its public dimension was molded into the broadcasting of music and words for mass recipients, who had been denied the possibility to “talk back.” (Of course, shortwave radio users, who can send broadcasts around the world, continue to flourish.)

On the negative side, wireless and voice-based radio technology was accused of encouraging antisocial behavior among its hobbyists. This belief was captured by the image of the “boy in the attic”—a reclusive figure sitting alone in his chamber, hour after hour, turning knobs and donning headphones.<sup>40</sup> The situation led to a well-known public debate in the 1920s, when the father of a boy named Eric Palmer Jr. asked the authorities to

cancel his son's amateur radio license, because he believed that "the boy will die of undernourishment and lack of sleep and his mother fall a victim to a nervous breakdown" (see Fig. 2.5)<sup>41</sup> Similar concerns about obsessive and uncontrolled psychological immersion have been raised in many media contexts, including the television, the Internet, video games, and text messaging.

The tinkering hobby was also seen as something positive, as a way of uniting father and son, and even as professional training. For example, constructing miniature dioramas, three-dimensional scenes or landscapes (often enclosed in a shadow box that had its front side open for display), were promoted not only as a good hobby, but also as practice for jobs in industry and business. The October 1940 *Popular Science* offered "hints on constructing small dioramas for home decorations, window displays, and advertising or educational purposes."<sup>42</sup> Another article promoted the magazine's own construction kit for assembling a "miniature colonial kitchen." Instead of appealing to the boy hobbyist, assembling miniatures was suggested as a pastime for the whole family: "Father and son can cut out and assemble the furniture. Mother and daughter can help install the fixtures, as well as crochet tiny rugs for the floor and make curtains for the windows."<sup>43</sup>

The ideal of the tinkering family differed from the ideal that became increasing common after World War II, when television broadcasting began its triumphal march, and *automation* became a catchword in the industry

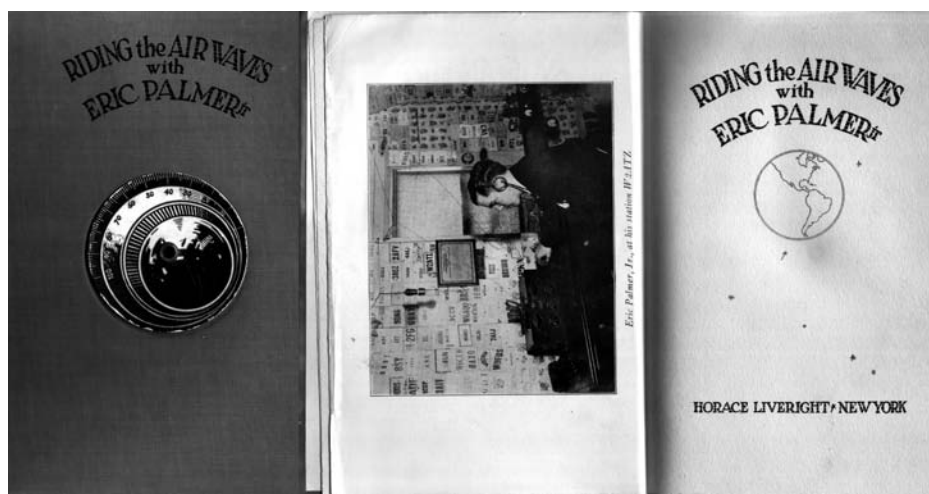


Fig. 2.5. Eric Palmer Jr.'s *Riding the Airwaves*, cover and title page. Author's collection.

and the home alike. Iconic and idealized representations of the 1950s include countless variants of the young nuclear family glued to the TV screen in their brand-new suburban living room, the smiling housewife doing nothing in her wonder kitchen or by her automatic washing machine, men in white coats standing next to huge a mainframe computer, and the fully automated assembly-line. The guiding idea of the epoch was the reduction of human labor. As a consequence, the physical intervention of the human into the workings of the machine was minimized. Although that such a cultural condition promised to increase leisure time, some feared it would lead to alienation and a sense of uselessness. The situation was not particularly favorable for tinkering. Being a couch potato or using psychedelic drugs could be interpreted as a response to the ennui created by the brave new world of automation.

#### CONCLUSION: PLAYING PRANKS ON WINKY

Against this background, the once-popular children television program *Winky Dink and You*, aired by CBS from 1953 to 1957, is intriguing. In the era of automation, it went against the current, anticipating the burst of interactive media that started almost two decades later. Whereas mainstream early broadcasting encouraged spatial separation from the screen and passive spectatorship, *Winky Dink and You* encouraged children to develop an active tactile relationship to the screen. They were asked to use Magic Pens to draw on the television screen (or, rather, on a sheet of transparent plastic attached to it) according to the instructions from host John Barry. Often, the goal was to save Winky Dink from hazardous situations, but the children could also try to solve textual riddles by drawing letters on the screen. Although the interaction between the program and the users was simulated rather than actual, it seems to have led to intense involvement, judging by the reminiscences found on the Internet.

In a particularly interesting comment, a former user describes how he deliberately acted against the host's instructions: "When Winky needed a ladder to get out of a hole, I would draw a cover on the hole. When he needed a parachute, I would draw an anvil to pull him down, etc. . . . I would tease my younger sister and tell her that I was making Winky die! Whenever she left the room crying, I would laugh and laugh. Winky was cool."<sup>44</sup> Such pranks could be interpreted as more than just childhood mischief; they represent an effort to take things literally into one's own hands and to initiate a true dialogue with the program flow, which even in this case was one-directional. Although not correct in a technical sense, it is significant

that one commentator characterized *Winky Dink and You* as “the world’s first interactive video game.”<sup>45</sup>

The participatory model proposed by *Winky Dink and You* never became standard in TV broadcasting, but it has had a long and vigorous life in the world of video gaming. The Magnavox Odyssey, brainchild of engineer Ralph Baer, working in the defense industry, was more than just a clever product, although its producers may not have fully noticed the momentous nature of the transformation they helped to initiate.<sup>46</sup> To Magnavox, the little device may have been just an accessory to the television set, a way to give the TV new uses and solidify their own business opportunities.<sup>47</sup> However, the Odyssey, and all the other game consoles that soon followed in its wake, questioned the dominance of broadcast television that had come to dominate the media landscape; instead of broadcast television’s one-directional feed, the new generation of devices established a much more complex and multidirectional model. They did not, however, break out from the problems and schemes associated with the social forms of media usership. Issues like solitary gaming versus social gaming continued to be debated; they continue to this day. The Victorians already took part in this discussion.

This essay has demonstrated that domestic media, including video games, are intimately connected with the rituals and practices that constitute domesticity. To unravel their operations, one has to approach the issue from at least two directions. On the one hand, it is essential to understand the functioning of the media apparatus, including the predefined modes of looking (and hearing) it imposes on the user; on the other hand, it is equally important to understand the modalities of private life, including the constitution of the home as a site for social interactions. Media is never accepted into homes as such, in prepackaged forms and meanings; rather, its roles and identity are molded through continuous negotiations involving humans, the spaces they inhabit, and the specific codes they have internalized and apply in their daily operations.

## NOTES

1. This essay contains material presented as a lecture given at Kyoto University, December 19, 2008, at the invitation of Professor Hiroshi Yoshioka. It also incorporates, in modified form, material from an earlier essay published in English as “Elements of Screenology: Toward an Archaeology of the Screen” in *ICONICS: International Studies of the Modern Image*, Vol. 7 (Tokyo: The Japan Society of Image Arts and Sciences, 2004), 31–82.

2. Erkki Huhtamo and Jussi Parikka, eds., *Media Archaeology: Approaches*,

*Applications and Implications* (Berkeley: University of California Press, 2011).

3. Erkki Huhtamo, "Slots of Fun, Slots of Trouble: Toward an Archaeology of Arcade Gaming" in *Handbook of Computer Games Studies*, ed. Joost Raessens & Jeffrey Goldstein (Cambridge, MA: The MIT Press, 2005), 1–21.

4. Richard Chalfen, *Snapshot Versions of Life* (Bowling Green, OH: Bowling Green State University Popular Press, 1987).

5. See, for example, "From Cybernation to Interaction: A Contribution to an Archaeology of Interactivity," in *The Digital Dialectic. New Essays on New Media*, ed. Peter Lunenfeld (Cambridge, MA: The MIT Press, 1999), 96–110, 250–56; "Twin-Touch-Test-Redux: Media Archaeological Approach to Art, Interactivity, and Tactility," in *MediaArtHistories*, ed. Oliver Grau (Cambridge, MA: The MIT Press, 2006), 71–101; and "Seeking Deeper Contact. Interactive Art as Metacommentary," *Convergence*, 1, no. 2 (Autumn 1995): 81–104.

6. See "Magnavox Odyssey 2 Ad from 1980," Retroist, accessed July 15, 2010, <http://www.retroist.com/2009/04/15/magnavox-odyssey-2-ad-from-1980/>.

7. See Van Burnham, *Supercade: A Visual History of the Videogame Age 1971–1984* (Cambridge, MA: The MIT Press, 2003), 114–15 (family with Odyssey) and 282 (family with Atari 5200). In the latter, father, mother, son, and daughter are pictured playing together, their mouths open in awe.

8. Lynn Spigel, *Make Room for TV. Television and the Family Ideal in Post-war America* (Chicago: University of Chicago Press, 1992); and Cecelia Tichi, *Electronic Hearth: Creating an American Television Culture* (Oxford: Oxford University Press, 1991).

9. See Erkki Huhtamo, "Toward a History of Peep Practice," in *The Blackwell Companion to Early Cinema*, ed. André Gaudreault, Nicolas Dulac, and Santiago Hidalgo (Oxford: John Wiley & Sons, forthcoming 2012).

10. Richard Balzer, *Peepshows: A Visual History* (New York: Harry N. Abrams, 1998).

11. *Vues d'optique* were produced in great quantities in Paris, London, Berlin, Augsburg, and Bassano in Northern Italy. See Kees Kaldenbach, "Perspective Views," *Print Quarterly*, June 1995, <http://www.xs4all.nl/~kalden/auth/perspectiveviews.htm>.

12. Jürgen Habermas, *The Structural Transformation of the Public Sphere*, trans. Thomas Burger with the assistance of Frederick Lawrence (Cambridge, MA: The MIT Press, 1989), 43–51.

13. Mary Flanagan, *Critical Play: Radical Game Design* (Cambridge, MA: The MIT Press, 2009), chapter 3.

14. Asa Briggs, *Victorian Things* (London: Penguin Books, 1988).

15. Susan Tucker, Katherine Ott, and Patricia P. Buckler, eds., *The Scrapbook in American Life* (Philadelphia: Temple University Press, 2006).

16. The scientific principle of stereo-optical vision had been demonstrated by Charles Wheatstone in the 1830s with an open device that used two angled mirrors to align the two images, drawn from slightly different angles to correspond with the parallax difference of the human eyes. For scientific purposes,

the openness of the structure had both a practical and a symbolic justification. For general background, see Erkki Huhtamo, "Armchair Traveler on the Ford of Jordan: The Home, the Stereoscope and the Virtual Voyager," *Mediamatic* (Amsterdam), Vol. 8, No. 2–3 (1995): 13–23. Useful works on the history of stereoscopy include Edward W. Earle, editor, *Points of View: The Stereograph in America-A Cultural History* (Rochester, New York: The Visual Studies Workshop Press in Collaboration with the Gallery Association of New York State, 1979); and Françoise Reynaud, Catherine Tambrun and Kim Timby, eds., *Paris in 3-D: From Stereoscopy to Virtual Reality 1850–2000* (Paris: Paris Musées/Booth-Clibborn Editions, 2000).

17. That normal photographs of buildings and places could serve this function is confirmed by a quotation from the British author William John Loftie: "It is pleasant to lean back in one's chair and be transported to distant countries at a glance." Quoted in Briggs, *Victorian Things*, 247. Briggs writes about the importance of the stereoscope on pages 132–33.

18. Such sets were sold by American companies like Underwood & Underwood and the Keystone View Company.

19. Reprinted in Earle, *Points of View: The Stereograph in America-A Cultural History*, 82.

20. From the text on the back of the card. There are two versions of the view, both numbered "11917" and copyrighted 1909, in the author's collection (one has the additional copyright date 1903 for B. L. Singley). Although the families and the settings are different, the elements are essentially the same: the children playing in the foreground, the older members sitting in their armchairs, and the storage cabinets for the stereoviews visible at the back. In one of the views, adolescent boys are also seen playing around a table. In one of the views, a lady is looking into the stereoscope, while a young man holds a stereoview; in the other, the ornate stereoscope has been placed on top of the storage cabinet at the back.

21. "Stereoscopic Slides," *Harper's Monthly*, June 1860. Author's collection.

22. Spigel, *Make Room for TV*, 11.

23. See Erkki Huhtamo, "Natural Magic: A Cultural History of Moving Images," in *The Routledge Companion to Film History*, ed. William Guynn (London: Routledge, 2011), 3–15.

24. James J. Shea, as told to Charles Mercer, *It's All in the Game* (New York: G. P. Putnam's Sons, 1960), 80. The book pretends the idea came to Bradley "with astonishing ease" as he was examining a German toy drum! (page 79).

25. *Ibid.*, 81.

26. Milton Bradley Company, *The Philosophical Principles of the Zoetrope, or Wheel of Life* (c. 1867), 16 pages; copy in author's archive (location of the original is unknown).

27. The composition was published with the permission of The London Stereoscopic Company, which held the British patent for the zoetrope. The only known copy is at the Bill Douglas Centre Collection, University of Exeter. It

was accessed August 19, 2010 and is available online at <https://collections.exeter.ac.uk/repository/handle/10472/33>. The picture shows 13 ladies around the device and 17 gentlemen, most of whom are in the background, except for one who is sitting by the table with two of the ladies. A single child, a girl, is standing on a sofa in the foreground.

28. The booklet suggested “much sport may be produced by having some witty person give an exhibition, forming his own original combinations, and giving at the same time suitable descriptions of the several scenes” (page 10). This suggestion about the zoetrope as an instrument for storytelling and performing goes against the nature of the device and has to my knowledge not been tried.

29. William Hooper, *Rational Recreation* (London: Printed for L. Davis, J. Robinson, B. Law, and G. Robinson, 1774).

30. Morley Adams, ed., *The Boy's Own Book of Indoor Games and Recreations: An Instructive Manual of Home Amusements* (London: “The Boy's Own Paper” Office, not dated), 121–28.

31. Ibid.

32. I have seen the only existing copy on microfilm (Banvard Family Papers, Roll 1, Minnesota Historical Society). The broadside has been hand-dated “1820s” by a later hand.

33. John Babcock, *Philosophical Recreations, or Winter Amusements: a Collection of Entertaining & Surprising Experiments [ . . . ] Together with the Wonders of the Air Pump, Magic Lanthorn, Camera Obscura, &c. &c. &c. [ . . . ]* (London: Thomas Hughes, 1830), 164; on magic lanterns, 160–65.

34. According to Boggs Beale's handwritten diary, he built his panorama from January to August in 1856. It was a roll two feet high and 150 feet long, and contained 70 scenes. I have read a copy of his diary at the American Magic Lantern Theatre Archive, East Haddam, Connecticut (made from the original at the library of the Historical Society of Philadelphia). For Smith's toy panorama, see his *The Story of Mont Blanc* (London: David Bogue, 1853), 2. If Smith really did create one, it would have been before the 1820s.

35. See Morley Adams, ed., *The Boy's Own Book of Indoor Games and Recreations: An Instructive Manual of Home Amusements*. The topics include: “How to Make a Diorama,” [moving panorama] 82–88; “Peep Shows: How to Make and Work Them,” 121–28; “Artificial Fireworks: How to Make and Work Them,” 128–34; and “Dissolving Pictures,” 118–21. Another book that contains similar information is A. Rose, *The Boy Showman and Entertainer*, (London and New York: George Routledge & Sons and E. P. Dutton & Co., not dated). The topics include “A Panorama,” 142–47; “Peep Shows,” 36–43; “Artificial Fireworks,” 94–107; and “Shadow Shows,” 176–93.

36. Alice Eliza Kingsbury, *In Old Waterbury: The Memoirs of Alice E. Kingsbury* (Waterbury, CT: Mattatuck Historical Society, 1942), chapter 2.

37. “Directions to the Proprietor of the Santa Claus Panorama” (Springfield, MA: Milton Bradley Company, not dated, circa 1866–70).

38. See Erkki Huhtamo, "Pockets of Plenty: An Archaeology of Mobile Media," in *The Mobile Audience*, ed. Martin Rieser (Amsterdam: Rodopi, forthcoming).

39. Susan J. Douglas, *Inventing American Broadcasting 1899–1922* (Baltimore, MD: The Johns Hopkins University Press, 1987). The following paragraph relies on Douglas's work.

40. William Boddy, "Archaeologies of Electronic Vision and the Gendered Spectator," *Screen*, Summer 1994, 110–11. Boddy also discusses the case of Eric Palmer.

41. Extract from the father's letter to the Radio Commission, quoted in the first-page article by Orrin Dunlap, Jr. in the *New York Times* ("Eric Palmer Jr's Radio License Suspended: Admiral Bullard Sends Him Kindly Advice," October 21, 1927). See also Eric Palmer Jr., *Riding the Airwaves with Eric Palmer Jr.* (New York: Horace Liveright, 1930), 86. A copy of this rare book, which has a turnable radio dial embedded in its front cover, is in the author's collection.

42. Herbert Lozier, "Scenes in Miniature," *Popular Science*, October 1940, 199.

43. "Miniature Colonial Kitchen: You'll find it easy to match this beautiful model by using the materials in our new diorama construction kit," *Popular Science*, November 1940, 207.

44. Reminiscence, quoted by Billy Ingram, "Winky Dink & You," accessed Sept. 11, 2011, <http://www.tvparty.com/requested2.html>

45. Billy Ingram, "Winky Dink & You," accessed Sept. 11, 2011, <http://www.tvparty.com/requested2.html>.

46. Baer and his team developed the Odyssey at Sanders Associates, a military electronics company based in New Hampshire. Steven L. Kent, *The Ultimate History of Video Games* (Roseville, CA: Prima Publishing, 2001), 21–26.

47. Ironically, this worked for others, but not for Magnavox, which soon sold its consumer electronics division to Philips and was sidetracked from the booming video game console business.

## Ball-and-Paddle Consoles

In today's world, watching a video game sometimes awards the viewer with the same experience as viewing a movie. Graphics, especially in sports games, seem to be so realistic that it is sometimes difficult to distinguish between real and imaginary.

As graphics improve, audiences' expectations of games also advance. Some game players in 2012 will not find *Madden NFL 99* (1998) fun because its graphics are no longer state-of-the-art. However, back in 1998, those same players may have felt that *Madden NFL 99* was the greatest game ever conceived. Even if the gameplay between the 1998 game and its counterpart from today were exactly the same, gamers would deduce that the older one was less fun.

Naturally, there are exceptions to this rule. Puzzle games have never had to be graphically sophisticated to succeed (for example, *Tetris*, 1985). But in most cases, people will find a game more fun if its graphics are as technologically advanced as possible. Once the graphics are outdated, interest in the game decreases.

In the beginning, the graphics in games were as simple as possible. Video tennis usually consisted of a vertical line down the center of the screen, two small rectangular paddles on each side of the screen, and a small ball that traveled horizontally. At the time, this was state-of-the-art, and the games were new, challenging, and fun.

When people first played the Magnavox Odyssey, the world's first home video game console, they had fun, despite the lack of graphics. Magnavox

even had to supply colorful overlays for the TV screen to enhance the graphics, but the basic game idea, controlling a paddle on a TV screen, was so innovative that people just had to try it. That was, if they could find it.

Magnavox didn't make it easy for people to check out the Odyssey, let alone buy it. The console was only available in the manufacturer's free-standing retail stores, which weren't as numerous as a Sears or Woolworths. If someone did visit a Magnavox store, unscrupulous salesmen often tried to convey the idea that the Odyssey would only play on Magnavox television sets, in the hope of selling a television as well. In the end, Magnavox managed to sell approximately 350,000 units.<sup>1</sup> Not bad for a system that people viewed—when they could find one—as a curiosity, but not good for the parent of a multi-billion-dollar industry.

Despite its newness, innovation, and uniqueness, the Magnavox Odyssey didn't set the world on fire after it was released in August 1972. Although it was the first home console, it wasn't the first video game. Nutting Associates had released the world's first arcade video game, Nolan Bushnell's and Ted Dabney's *Computer Space* (1971), less than a year earlier, but the Odyssey did not benefit from the arcade game's popularity because even fewer people had heard of that game than those who had heard about the Odyssey. Whereas promotional material for *Computer Space* appeared in amusement trade magazines, Magnavox advertised its new product with print ads in hobbyist and consumer magazines, and television commercials aimed at consumers.

It is not known how many of those 350,000 consoles were sold during the first two months that the Odyssey was available. Normally, the sum of all the units sold is what's really important. In the case of the Odyssey, however, conditions surrounding the first two months of its shelf life were vastly different than the months that followed. If things had been different, the Odyssey might not be remembered at all.

In 1972, Magnavox went on a tour around the United States, showing off its product. It is well documented that on May 24, 1972, the tour stopped at the Airport Marina Hotel in Burlingame, California. Among the people who viewed the new item was Nolan Bushnell, who by that time was no longer associated with Nutting. Bushnell had heard about the Odyssey and wanted to see a demonstration. He had thought that his *Computer Space* was the only game that was played through a television. (Unknown to Bushnell, however, two months before *Computer Space* had been released, Bill Pitts of Stanford University set up his *Galaxy Game* in a Stanford dining hall. Also inspired by *Spacewar!* (1962), the same game that inspired Bushnell, *Galaxy Game* was never more than a prototype.) After seeing the Odyssey demonstration, Bushnell claimed that he was not impressed with

it. Even years later at a 2003 Classic Gaming Expo in Las Vegas, he claimed that by the time he saw the Odyssey it “was already a failure.”<sup>2</sup>

The Odyssey was capable of playing twelve different games, the best known being video tennis, in which a spot of light, the ball, ran across the screen, and players deflected it with rectangular spots of light, paddles. Unlike Bushnell’s *Computer Space*, which the public had deemed too difficult to play, video tennis needed no rules explained.

A little over a month after Bushnell saw the Odyssey on display, he and Ted Dabney started Atari. In the following October, Atari released its first product to the arcades: *PONG*, a game where one or two players controlled a rectangular spot of light (paddle), and had to deflect a spot of light that ran across the screen (ball); in other words, it was video tennis, the same game that Magnavox used to highlight the features of the Odyssey. The same game that did not impress Bushnell when he attended the Odyssey demonstration in May.

Whether or not Bushnell stole the idea of video tennis is not the topic of this essay. Regardless of how the idea came about, the arcade game was a success. People clamored for *PONG*, standing in lines for hours just for a chance to play the game. Bushnell wasn’t taking any chances that people would find *PONG* difficult to understand as they had *Computer Space*. Whereas later games would feature “attract modes” to beckon passersby to play, Bushnell’s new game used a simple tagline on the screen: “AVOID MISSING BALL FOR HIGH SCORE.” The success of this ball-and-paddle arcade game also affected the Odyssey, which was the only ball-and-paddle game available for home use and enjoyed healthy sales following *PONG*’s debut.

There are differences between the Odyssey’s video tennis and *PONG*. The Odyssey couldn’t keep track of the score; *PONG* could. Playing the Odyssey was like watching a silent movie: it was completely devoid of sound. *PONG*, on the other hand, resounded its name every time the ball bounced off a solid object. Odyssey’s video tennis featured an “English” button; when pressed, it caused the ball to bounce off a paddle at an unpredictable angle. In *PONG*, the ball bounced off a paddle at an angle that was determined by the point at which the ball hit the paddle. No, Odyssey’s video tennis wasn’t *PONG*, but it was the closest people could get to having *PONG* in their homes, so it enjoyed a spike in sales.

For three years, the Odyssey was the only home video game in town. In 1974, however, executives at Magnavox and Sanders concluded they couldn’t continue marketing the Odyssey in its current format. Because it had been built from discrete solid-state circuits and was packaged with hundreds of extra pieces, such as poker chips, cards, and screen overlays,

the package was expensive to manufacture and sell at a decent profit. They had to figure a way to reduce costs before someone else came out with a TV game that was less expensive for the consumer. Ralph Baer had recognized this as early as 1973 and had begun researching integrated circuits, which were available but too expensive for practical use when he designed the Odyssey. In the intervening years, the cost of the chips fell substantially. In May 1974, Magnavox reached an agreement with Texas Instruments to design single chips that would reproduce some of the games that were on the original Odyssey.

Although Texas Instruments promised delivery of the new chips by January 1975, Magnavox wanted a contingency plan. The result was the Odyssey 100, a system built around four TI chips that duplicated two simple games from the original Odyssey, *Tennis* and *Hockey*. The controllers, while built into the unit, were reminiscent of the original console: they contained separate knobs for horizontal, vertical, and “English.” Fundamentally, it was the original Odyssey on a few chips, so it had rudimentary sounds and no on-screen scoring. Built into the hardware, however, were two sliding bars that allowed players to manually keep score.

The Odyssey 200, which was released later in 1975, contained two additional chips, which allowed the inclusion of a third game, *Smash*, a video version of squash. The 200 was the first home system that allowed up to four players to compete at once, and it also had a simple on-screen, analog scoring system, which consisted of a series of small rectangles that advanced across the top of the screen whenever someone scored. Baer was not happy that Magnavox was releasing new consoles that contained games essentially the same as those on the original Odyssey. He had hoped for a technological advancement in the games themselves. He was encouraged, however, that Magnavox wasn’t abandoning its video game division.<sup>3</sup>

By Christmas 1975, Magnavox sold all of the Odyssey 100 and 200s that it produced. The company only manufactured 180,000 units, even though its own marketing department recommended they produce four times as many. But Magnavox wasn’t the only company selling home video game consoles that year. In early 1974, two Atari engineers, Bob Brown and Harold Lee, proposed a home version of *PONG*. Bushnell gave them the go-ahead despite warnings from his management team concerning Atari’s lack of experience in the consumer market. Brown and Lee, with the help of *PONG*’s original designer, Al Alcorn, dove into the project. Their goal was not to produce a console similar to the Odyssey but with the *PONG* name on it, even though they believed that such a unit would sell. They decided to take all of the electronic components of the arcade *PONG* and shrink them down onto one chip. By the fall of 1974, they achieved what they had set

out to do. The game on the *Home PONG* unit looked exactly like the arcade version, right down to the sounds and on-screen scoring, a feature that the Magnavox consoles still lacked.

Next, they had to get it into stores. Atari set up a display at the 1975 American Toy Fair in New York. Although they generated a lot of interest, they didn't sell one unit. Afterwards, Bushnell made cold calls to large toy stores, but made no headway. Then he decided to try department stores. The first department store he contacted was Sears; the toy buyer there wasn't interested either. Out of desperation, Bushnell called Tom Quinn, the sporting goods buyer at Sears, and pitched the idea that a computer version of tennis might sell alongside the real thing. Quinn agreed and ordered 150,000 *Home PONGs* with Sears financing the project. In return, Sears obtained the exclusive right to sell the game throughout 1975. The gambit worked. By the end of the year, *Home PONG* was in 900 Sears stores around the country.<sup>4</sup> They were the hottest games during the 1975 Christmas season.

In March 1975, Ralph Baer was invited to the Long Island factory of General Instruments (GI), where he was given a preview of the chip manufacturer's new AY-3-8500 multi-game chip. The GI chip cost only \$5 and had four paddle and two shooting games built into it. Baer was pleased with the chip and saw the potential in it. Because he was becoming increasingly frustrated with the way Magnavox was handling the marketing of its video games, Baer pitched the chip to an acquaintance named Arnold Greenberg, who happened to be the president of Coleco, a Hartford, Connecticut, company that marketed home pinball machines. After seeing the chip, Greenberg placed a large order with GI, and Coleco designed a system around it called the Telstar.

Coleco released the Telstar in time for Father's Day 1976. Like *Home PONG*, the Telstar could only play video tennis. Because it retailed for only \$50, however, it appealed to budget-minded families. Coleco sold over 1,000,000 units that year. A severe chip shortage contributed to Coleco's excellent sales. GI had underestimated by 60 percent the number of chips needed to fulfill the demand from manufacturers wanting to produce video games. Because Coleco had been the first company to place an order with GI, it received its entire order. No other company received a complete order, and many only received 20 percent of what they requested.

Magnavox was one of the companies that had placed an order with GI but didn't receive an entire shipment of AY-3-8500 chips. However, those that were received were used in several new consoles, which Magnavox released in quick succession in 1976. The Odyssey 300 played the same three games as the Odyssey 200 (which didn't employ the AY-3-8500 chip);

it was basically a less expensive model of the same device. The Odyssey 400 was also mostly the same as the 200, but contained an additional chip that allowed for on-screen scoring. That console was followed by the Odyssey 500, which was the first Magnavox console to feature on-screen color. The graphics also surpassed any system that preceded it. Instead of white squares for paddles, the 500 had crude graphics of human characters. This marked the first time human characters appeared in a home video game.

The year 1976 was the first time that several manufacturers competed in the home video game arena. Besides Magnavox and Coleco, Atari entered the fray with its own branded version of *PONG*. This time, it had no trouble getting the game into stores that didn't have the Sears name. Lesser-known companies also flooded store shelves with their own versions of inexpensive ball-and-paddle consoles. Small companies were now able to purchase GI's AY-3-8500 chips and build consoles around them, without employing engineers to design the games. Throughout 1976, consoles from hundreds of companies were released around the world, causing a glut of ball-and-paddle home video games and leading to the industry's first crash (see Wolf's "The Video Game Industry Crash of 1977" later in this volume).

The major companies reacted by moving away from ball-and-paddle games. In 1977, Coleco released *Telstar Combat*, a tank simulator in which two players maneuvered tanks in a maze to shoot each other. Atari also released a couple of dedicated consoles that moved away from *PONG*, for which they were known: *Stunt Cycle* (which gave the player the simulation of driving a motorcycle over a collection of buses) and *Video Pinball*. All of these games were innovative: they were not based on simple ball-and-paddle games, and the hardware also played a part in the game. *Video Pinball* had a button on each side of the console, which when pressed caused an on-screen flipper to react, just like on a real pinball machine. *Stunt Cycle's* controls resembled the handlebars of a motorcycle; to apply thrust, you turned the throttle. And the four built-in joystick controllers (two for each player) in *Telstar Combat* gave players the impression of actually maneuvering a real tank.

No matter how different these consoles were from the ones that preceded them, they all shared the same handicap. After playing the games a number of times, people grew tired of them. To play something new, people had to buy entirely new consoles.

By inserting different circuit boards, people could play twelve different games on the original Odyssey. But the games were all built into the console, and the circuit boards merely acted like keys that unlocked the games that could be played. In later consoles, the interchangeable circuit boards

were replaced by buttons or switches. In all cases, these were dedicated machines. You could play the games that were already built in, but you couldn't add new ones.

This was about to change. In fact, by the time Atari and Coleco released their new dedicated consoles in 1977, they were already obsolete. In 1976, electronics company Fairchild released a new console called the Video Entertainment System (later renamed Channel F). Like the consoles that were already on the market, the Channel F had four games that were built into the system. Unlike any console that preceded it, however, the Channel F also allowed gamers to add new games by inserting software cartridges that resembled eight-track cartridges. The death knell for dedicated consoles had sounded. Programmable consoles were the way of the future.

## NOTES

1. According to Ralph H. Baer, *Videogames: In The Beginning* (Springfield, NJ: Rolenta Press, 2005), 76.

2. According to comments made live by Bushnell at Classic Gaming Expo in Las Vegas in 2003; and in Leonard Herman, "The Untold Atari Story," *Edge*, April 2009.

3. Much information comes from the author's personal familiarity and discussions with Ralph Baer.

4. Leonard Herman, *Phoenix: The Fall & Rise of Videogame* (Springfield, NJ: Rolenta Press, 2001), 18.

## Channel F for Forgotten

*The Fairchild Video Entertainment System*

The Channel F Video Entertainment System occupies an important place in video game history. It comprised several significant milestones in home console technology and culture but remains relatively unknown today, whereas its major competitor, the Atari Video Game System (VCS, renamed the Atari 2600 in 1982), is emblematic of retro gaming nostalgia with an active hobbyist community that still produces new games for the system.<sup>1</sup> The Channel F was largely insignificant only a few years after it stopped production, earning only a brief overview in the inaugural Winter 1981 issue of *Electronic Games*, the first magazine dedicated to video games. Channel F receives similarly short shrift in Van Burnam's *Supercade: A Visual History of the Videogame Age* (2001) and Steven Kent's *The Ultimate History of Video Games* (2001). What are we to make of the Channel F today? What is its value to videogame history and culture? Is the treatment it has received an injustice to a forgotten gem of a system, or is its significance really only relative to the Atari VCS that it directly motivated? Is the Channel F worthy of serious study in its own right? Which is more appropriate, a literary analogy (Channel F is to the Atari as, say, Christopher Marlowe is to Shakespeare) or a technological analogy (Channel F is to Atari as Windows ME is to Windows XP)?

Seeking an answer to these questions, one quickly encounters broader questions of video game historicizing and the relationship between video game history and the culture that produces and consumes it. Thus, the historical significance of the Channel F also implies the significance of history for video game culture. As a story of technological development, video

game history is often expressed as a progress narrative in which each successive generation replaces previous generations through various quantifiable registers of improvement: processor speed, high-definition capabilities, innovative control schemes, killer apps, etc. But the inherent determinism in these narratives risks sidestepping a more nuanced examination of cultural value, or worse, eliminating the Channel F altogether. In his "Brief Biography of Video Games," for example, Henry Lowood begins the story of the second generation of home consoles (which is defined by characteristics the Channel F was the first to introduce) with the Atari (VCS). This omission of the Channel F, which came out one year earlier than the VCS, is certainly understandable in the context of an otherwise very dense and detail-heavy article, but indicates the degree to which priority is not simply a temporal attribute. When the Channel F does make an appearance in such narratives, often its major role is as the catalyst for the Atari VCS since, as Ian Bogost and Nick Montfort suggest in their *Racing the Beam: The Atari Video Computer System*, the Channel F's release in 1976 spurred Warner Brothers into acquiring Atari so it could release a home video game system. Leonard Herman makes the causal relationship even more explicit.<sup>2</sup>

The common thread that emerges here is that the existing historical record around the Channel F places more emphasis on the console's relationship to other consoles than on the console itself or its games. In other words, the VES is noted for what it came before, not what it came after, and this kind of metric for significance, which makes sense in a historical or collector's context, actually works against the grain of other areas of humanist inquiry. In literary studies, one doesn't study James Joyce's work simply because he did things that Samuel Beckett later made more popular; conversely, one does not ignore Joyce because Beckett's body of work has superseded his mentor's.

This essay explores these questions in relation to the Channel F, concluding that it should be examined more closely within game studies, if only for its ultimate failure to be as influential as the Atari VCS. Narratives of video game console design history have tended to privilege successful designs by placing them within a cause-and-effect sequence of evolution, but a technologically unexplored path can often reveal as much or more about the relationship between game design and culture. From elements as mundane or unique as the character-generating ROM chip to the odd push/pull controller (odd from the retrospective view of a joystick consciousness), the Channel F is an interesting piece of hardware, and the affordances and constraints of that hardware influenced its game design in important ways. Tracing this influence entails a transdisciplinary approach,

platform studies, which Bogost and Montfort explore in *Racing the Beam*. What I offer here is a brief platform study of the Channel F. In fact, since few of the games produced for Channel F proved to be widely influential, I argue that a platform studies approach is the best way to make sense of the Channel F's cultural significance. For Bogost and Montfort, the cultural impact of the Atari VCS 2600 is a given, and the agenda of platform studies is to uncover the roots of that significance. A study of the Channel F, however, must begin with the platform in order to answer the question of significance in a different way.<sup>3</sup>

## HISTORY

These facts in the Channel F's time line are relatively easy to find, but a few interesting discrepancies remain among established sources.<sup>4</sup> Based on the relatively brief treatment it receives in the first issue of *Electronic Games* (Winter 1981), it seems that the lack of a clear historical record today owes something to its rapid obsolescence. Only a few years after its release changed (and saved) the game industry, the Channel F was something of an also-ran. At best, it was a recent classic: the Winter 1982 *Electronic Games* article praises Zircon International for reviving such an old system,<sup>5</sup> and the March 1982 issue calls it a "Great Moment in Videogame History."<sup>6</sup>

In any case, the Fairchild Semiconductor began selling a game console in August 1976, calling it the Video Entertainment System (VES). After Atari, its main competitor, released VCS, the VES changed its name to the Channel F to avoid any confusion. It established itself in the fast-moving game console market and ultimately gain something like immortality as the answer to gaming trivia.<sup>7</sup>

The Channel F owes its existence to Jerry Lawson, an engineer and salesman at Fairchild Semiconductor,<sup>8</sup> but its proprietary history began earlier, in a technology patented in 1975 by the Alpex Computer Corporation. This patent, "Television display control apparatus," number 4026555, outlines basic methods for an input device and gaming system to be used with a television set. What sets this system apart from prior patents for game devices (Ralph Baer's, for example), is that it specifies a relationship between a microprocessor and stored ROM data (as "software"). This innovation was significant and specific enough that Fairchild licensed it for their own use in the Channel F. Other competing console manufacturers, such as Atari and, later, Nintendo, opted not to pay licensing fees and were eventually sued by Alpex.<sup>9</sup> Fairchild's patent, "Cartridge programmable video game," authored by Ronald Smith and Nicholas Talesfore, outlines the full details of the Channel F system and makes clear reference to the 555 patent.

This system was, indeed, unique. Besides featuring removable cartridges, many of which played multiple games, it also made use of controllers that were wired into the system, allowing players to sit back from the console while they played. Channel F was not the first to introduce wired controllers (Magnavox's Odyssey, the original home console system, used wired control knobs), but since most of the *PONG*-like systems flooding the market had controller knobs mounted on the front of the console, the ability to sit back was a plus. (At a length of 3 feet, the cords still required close proximity to the TV.) Other features included a sleek, wood-paneled design, with a Plexiglas cover encasing the compartment that stored the Hand-Controllers when not in use.<sup>10</sup> In all, it looked like an eight-track tape player, a look enhanced by the chunky plastic buttons for game settings (including the "Hold" button), and the fact that the Videocarts were about the same size as eight-track tapes. The Channel F was a fine addition to a family's entertainment system, and the branding of the console consistently reinforced the idea that it was more than just a device for gaming. In fact, the box for the original system does not use the word *game* in its elegantly minimalist packaging, and the instruction manual, "The Fairchild Entertainment System: The Best of the Video Games, Explained," reinforces the solidly bourgeois branding. In describing its basic interoperation with the TV set, the manual notes, "although the Game Console is a handsome unit designed to fit nicely into any room décor, it can be just as easily disconnected for storage or reconnected to another TV set somewhere else."<sup>11</sup>

In August 1976, the Channel F first retailed for \$169.95 at JCPenney's,<sup>12</sup> offering a welcome alternative to the *PONG*-like systems, which could only play one or two games. In a 1977 news article on new game systems, Ellen Roseman gushes, "The new games are programmable, meaning you can buy cassette-like cartridges that let you change the action whenever you get bored. Instead of just electronic ping-pong, you now can play at anything from road racing and space wars to math quizzes and artistic doodling."<sup>13</sup> Interestingly, in this article anticipating the 1977 gift-giving season, Channel F is already second-tier to the Atari VCS. Still, the novelty of removable media for these systems is profound enough to merit high praise.

The Channel F system saw decent sales at first, but as the decade drew to a close, and the Atari VCS dominated the market, sales dropped. In 1979, Zircon International purchased the rights to the system as well as its related assets. It began selling the Channel F System II, a streamlined console that had removable Video Command units (previously called Hand-Controllers) and an audio channel to the TV signal. (On original Channel F systems, sound was produced by a speaker inside the console housing.) Not wishing to leave original Channel F consumers behind, Zircon offered

the new console at \$69.95 with the trade-in of an original Channel F.<sup>14</sup> It sold the refurbished original units for \$60<sup>15</sup> and the Channel F System II for \$99.95.<sup>16</sup> Zircon also licensed the Channel F for international sales, which led to five clone consoles: Luxor Video Entertainment (Sweden), Luxor Video Entertainment Computer (Sweden), SABA Videoplay (Germany), Nordmende Teleplay (Germany) and Grandstand Channel F (United Kingdom).<sup>17</sup>

Although too close a comparison is, perhaps, overly reductive, it seems significant that the Atari VCS originally retailed at \$199 in 1977,<sup>18</sup> one year after the Channel F launched for \$30 less; by 1982, Atari 2600s retailed “in the \$140 to \$200” range,<sup>19</sup> while the Channel F had dropped to \$60. Certainly, there are many reasons why one succeeded and the other failed, but the available game library seems to have been a strong factor. In the aforementioned 1977 overview of the games industry, Roseman mentions the availability of 187 cartridges for the Atari system, while Channel F mustered only about 26 Videocarts,<sup>20</sup> including four released by Zircon. Still, historical significance is not necessarily a direct correlation of popularity or priority.

If it is a question of which console did things first, the Channel F’s historical significance is relatively easy to establish, since it was the first console to include a pause button (labeled “Hold”) and the first to play games from ROM data loaded by removable cartridges. More interesting and less well-known, a Channel F Videocart contains what is likely the first instance of a video game Easter egg, predating Warren Robinett’s better-known “created by” credit screen in Atari’s *Adventure* (1979). Despite accomplishing or making possible these rather significant milestones, the Channel F remains relatively unknown outside the community of game historians, collectors, and vintage gaming and computing enthusiasts. Very little scholarship exists that can place the Channel F in some meaningful historicized conversation. Is this a major oversight, or do its accomplishments really only merit a footnote in deference to far more influential consoles like the Atari VCS 2600?

Other than a few exceptions, the games produced for Channel F and its various re-brandings are mostly just platform-specific implementations of then-standard game archetypes. Even if some of the Channel F titles came out first (e.g., *Video Blackjack*, 1976), few stand out as being unique. For example, *Alien Invasion* (1981) is, at a ludic level, a straightforward *Space Invaders* (1978) clone. At a code level, however, *Alien Invasion* contains at least one surprise that sets it apart from many of its contemporaries: the right combination of play settings and winning conditions will display the text “REID-SELTH,” the surname of programmer Bradley Reid-Selth.

Another Videocart by Reid-Selth, *Video Whizball* (1978), also included his name as an unlockable extra, making this (possibly) the first video game Easter egg. As I will discuss later, the fact that *Video Whizball* came first does not diminish the significance of Warren Robinett's Easter egg, mainly because Reid-Selth's was not discovered until 2004, but the very idea that someone in 2004 found enough value in the system to do the digging that unearthed the hidden content indicates its uniqueness as a platform and how well the Easter egg was hidden in the first place. One of the core arguments of platform studies must be that the platforms on which content is created introduce constraints at the level of expression, often in ways that are invisible to us at the time of that content's creation. To consider the aesthetic influence of the Atari VCS 2600 or the aesthetic non-influence of the Channel F is, in one sense, to compare the creative affordances of the MOS 6507 CPU with the Fairchild F8. The following section, looks more closely at the technology underlying the Channel F.

#### CHANNEL F, FROM THE BOTTOM UP

If the Channel F looks and plays very differently from its contemporaries, this is because of differences that start beneath the hood of its faux wood-grain exterior. These differences manifest in some important aesthetic or textural features that define a signature look for Channel F games: an eight-color palette, a 102x58-pixel grid for screen images, and a uniform font of numeric characters which are 4 pixels by 5 pixels for each bitmap.

The core of the Channel F was the Fairchild F8 processor, an 8-bit CPU more powerful than the VCS's MOS 6507. In fact, the F8 is really a series of chips, including the core Type 3850 CPU (central processing unit) and at least one of Type 3851, 3856, or 3857 PSU (programmable storage unit).<sup>21</sup> In the case of the Channel F, two 3851s provide the system's BIOS and game data for the built-in *Hockey* and *Tennis* games.<sup>22</sup> Additionally, four RAM (random-access memory) chips store memory dynamically in a video buffer of 2 kilobytes, which allowed for a screen resolution of up to 128 x 64 pixels. Videocarts load software that updates the data on those RAM chips before it is sent to the screen itself.

These specifications are significant for at least two reasons that set it apart from the Atari VCS. First, the Channel F included a BIOS, or a tiny operating system that loads the game software. From a user's perspective, this handles functions like the on-screen interface that loads and creates settings for each game. From a programming perspective, the BIOS provides recurring functions that are useful in multiple games, such as an addressable list of bitmap numerals. The VCS had no BIOS, and among other

significant differences, lacked such a character set. VCS programmers had to invent their own alphanumeric-rendering kernel for each cartridge. Channel F programmers simply needed to refer to the built-in imagery to create their game's score display. The result is that, with very few exceptions, numeric characters are identical in each Videocart.

The presence of a screen buffer is a second major feature that, again, distinguishes the Channel F from its major competitor. Though small, this array of data allowed the Channel F to treat the entire screen as a series of tiles, so programming imagery and movement was a matter of switching on and off specific pixels by assigning them one of eight available colors. The VCS, on the other hand, could only generate images one scan line at a time through its Television Interface Adapter. This unusual chip, which is the focus of much of Bogost and Montfort's platform studies analysis of the system, also handled the audio output and moved imagery horizontally and vertically by manipulating a group of bitmap sprites. The number of graphics present on the screen at any time was limited by the set of available sprites. One way around this problem was to take advantage of the properties of cathode-ray tube (CRT) phosphors and "flicker" sprites from one screen refresh to the next.<sup>23</sup> The Channel F, conversely, had no such limitation and could theoretically move as many distinct images as could be displayed on a single screen.

A recurring theme of platform studies is to identify attributes of constraint that lead to greater creativity in expression, so it is interesting to look at these elements here as leading to something different. That is, it is a recurring argument in Bogost and Montfort's *Racing the Beam* that the creativity of the game programmers working on VCS games overcame those constraints, but clearly the limitations were different for the Channel F. Whereas the Channel F could process imagery in a somewhat more straightforward manner than the VCS, the grid system employed by the Channel F limited its color palette to eight colors. Although talented artists can do some interesting pixel art with such a limited range of difference,<sup>24</sup> other artists can do even more interesting things with a total color range of 128 colors, even if those are limited to only four per line.

The implications are that the mechanics of constraint imposed by the Channel F were less productive than those for the VCS, but since the critical pairing of aesthetics with constraint in a videogame context does share some conceptual affinity with artistic movements based on constraint (for example, the 12-tone serialist compositions of Arnold Schoenberg, where the composer had to use each note at least once before repeating it), the political implications of these art movements may also relate to platform study. The paintings by members of De Stijl group, for example, often lim-

ited their colors to two or three and employed repeating geometric shapes (triangles, circles, rectangles) in place of representational art. This practice was consonant with expressed political views about the relationship of the individual and the universal in the fields of cultural expression.<sup>25</sup> What is stake here are the discourses of representation in artistic practice. Similarly, the difference between 128 colors and 8 colors is one where the discourses of representational practice are at stake. A single-color sprite is hardly less photo-realistic than a two-color sprite image, so the operative difference is over which alternative to photo-realism is preferable. In the context of video game nostalgia, it is impossible to view Channel F imagery without looking through the lens of Atari VCS imagery, but significantly, this naturalization is merely historical. Inherently, both offer unique and uniquely flavored visions of game worlds. Considering the Channel F inferior in graphical terms risks taking for granted the intervening history of later Atari VCS games without recognizing how different the Channel F was from what came before it. Similarly, the Channel F Hand-Controllers may seem odd today, but that oddness is mostly historical, since the Atari joystick is no less arbitrary as a signifier of control and presence in video games.

#### PARADIGMS OF CONTROL

The Channel F Hand-Controller, conceived by Jerry Lawson and built by industrial designer Nicholas Talesfore (Patent #D247754), offered eight-way digital directional control in the top knob, which could also be pushed in or pulled out. In an alternate history in which the Channel F succeeded where the VCS failed, the iconic joystick of the Atari VCS 2600, which is commonly used in video game-related iconography to refer to video games and players, would likely not have become so ubiquitous. In this parallel universe, where the Channel F Hand-Controller became the symbol of intuitive interface instead of the joystick, we might not be reading websites like joystiq.com, and J. C. Herz might have titled her book *Hand-Controller Nation* instead. Of course, as with any case of historical perspective, it becomes impossible to assess the relative intuitiveness or awkwardness of either the Channel F controller or the Atari joystick without the influence of intervening decades of experience with the latter and those input devices it influenced. We may speculate, however, that video game consumers of the 1970s were not particularly alienated by a triangular control rod that one pushes, pulls, and rotates to send control signals to the screen—what today seems like an odd contraption—because it was simply one among many and, after all, it was a significant improvement over potentiometer knobs

built into the console itself. However, some contemporaneous reviewers of the Channel F did note the novelty of its controller. For example, Buchsbaum and Mauro, writing in 1979, describe the system as “a cartridge-based, microprocessor-controlled TV game featuring unique, hand-held joystick-type controllers.”<sup>26</sup> Ken Uston, on the other hand, notes simply in 1982 that the “multifunctional” controllers perform the “conventional functions of the standard joystick.”<sup>27</sup> Interestingly, both of these reviews compare the Hand-Controller’s function to that of a joystick, even though the controller input is managed by rotating the head of the device. Some advertising even refers to the Hand-Controller as a kind of joystick. This is significant because the joystick is a control scheme borrowed from the cockpits of jet fighters; its unavoidably phallic nomenclature suggests a naturalization of the one-to-one relationship between the player and that which he controls on the screen. The Channel F’s Hand-Controllers, on the other hand, which usually require two hands to operate, are more likely to engender alienation or a feeling of displaced control and authority.

More recent commentators have, indeed, indicated greater alienation on their part by employing slightly different descriptions. Participants in a Channel F discussion thread on the popular AtariAge.com forums employ terms like “weird” and “funky” to note that the controllers were among its most distinctive features.<sup>28</sup> Reaching for a metaphor to convey their difference from other control types, Leonard Herman compares the action on the control knob to “plungers on bomb detonators.”<sup>29</sup> This may be a bit of an overstatement, since it only requires one hand to push down the knob, but Herman’s description does convey the relatively high degree of force required to push and pull the knob into action positions. At least it acknowledges that players would use one hand to hold the shaft and another to manipulate the knob. Brett Weiss describes them as “handgrip joysticks with a thumb-operated fire-button that doubled as a paddle.”<sup>30</sup> Certainly, the rotation function of the knob does superficially resemble a paddle controller (the Hand-Controller works digitally, in contrast to Atari’s analog potentiometer paddles), but most players would find it very difficult to manipulate the knob using a thumb. It is possible that Weiss is basing his description on later versions of the Hand-Controller, some of which included an extra trigger button and a more pistol-styled grip,<sup>31</sup> but it is also conceivable that Weiss attempts to make sense of the Hand-Controller through the lens of established experience with game controllers that involve moving an analog joystick or two with one’s thumbs.

Gamester81, the narrator in a series of YouTube videos on classic game consoles, also plays it with one hand. Although he describes the thumb action as one of his favorite features of this console, it’s clear from how he

performs in his demo of the *Hockey* game that he's not playing correctly.<sup>32</sup> In a commentary on the MobyGames website, Ronald Diemicke ranks the Channel F as the worst in his list of the Top 10 Worst First-Party Controllers of All Time.<sup>33</sup> Like Gamester81 and Weiss, however, Diemicke only describes single-handed gameplay, declaring that such a system is actually painful to play. Diemicke also incorrectly describes its functionality as "limited to four directions and one action button" (the controller had eight-direction capability).

What is significant about one-handed versus two-handed gameplay is how each supports a temporally framed assumption about game control. From the present looking to the past, the Hand-Controller is limited because of its odd, one-handed design. From the past looking forward, the Hand-Controller is innovative because of its directional control nuances and its support for either one-handed or two-handed play. Either case indicates the diachronic nature of the human-computer relationship through which utopian visions of transparent control exist alongside retro-fetishist nostalgia for controllers that didn't live up to those promised visions.

#### EASTER EGGS

In video game parlance, an Easter egg is a hidden element in a game that constitutes a kind of wink to the players, often left by programmers to call attention to or take credit for a particular feature. As Ruffin Bailey defines it, Easter eggs are metaleptic digital artifacts with a specific property of intentionality.<sup>34</sup> Unlike code errors or hacks, Easter eggs break the frame or "fourth wall" of a game's narrative world or diegesis, often in ways that closely relate to the specific technology of their platform and the textual authority of the game's programmer.

Perhaps the most well-known Easter egg is Warren Robinett's signature in the *Adventure* cartridge for the Atari VCS. By accessing a hidden room within the dungeon of the black castle (usually after neutralizing the bat and defeating the red dragon), the player can retrieve a tiny dot that is the same gray as the walls. If the player succeeds in bringing the dot and two more items into a specific room (which is made much more difficult if the bat is still roving), a formerly solid wall will become traversable, and the player can move into a new space. In this newly accessible room, the player finds the words "Created by Warren Robinett" emblazoned across the screen.

The story of how Robinett came to leave his mark in this way has been well documented in several sources. This story is a crucial anecdote in the broader picture of video game history.<sup>35</sup> In fact, this Easter egg was, for

many years, considered the very first video game Easter egg. For example, *Supercade*, edited by Van Burnham, includes a video game time line that places *Adventure* on the year 1979 with the note, “Warren Robinett codes the first documented Easter Egg into *Adventure*, a game for the Atari VCS.”<sup>36</sup>

That changed in 2004 when programmer and collector Sean Riddle, researching some Channel F games, noticed some unusual data blocks in certain Channel F cartridges: *Videocart-51: Demo 1* (unpublished), *Videocart-20: Video Whizball* (1978), and *Videocart-26: Alien Invasion* (1981). His discovery led to another Channel F footnote in an otherwise Atari-dominated video game time line.

As Riddle eventually discovered, pressing the right combination of buttons after completing the Videocart’s demonstration caused part of the screen text to be replaced with the name of the programmer: MICHAEL K GLASS (see Fig. 4.1). The Demo cart is not technically a video game, since one completes it simply by following on-screen instructions and performing prompted tasks like pushing upward on the Hand-Controller. Also, although it existed as early as 1976, it was never released for sale, either by Fairchild or Zircon. The fact that it is not a video game is most probably the most important factor that keeps it from dislodging Robinett’s place in history. After a hint and more digging,<sup>37</sup> Riddle discovered two more pieces of hidden graphical content: one in *Video Whizball* and another in *Alien Invasion*. Accessing either of these Easter eggs requires the player to set up a rather obscure series of starting conditions for a game, both of which result in a screen that displays the programmer’s name: REID-SELTH (Bradley Reid-Selth) (see Figs. 4.2 and 4.3). In both of these cases, the programmer’s name appears on the screen within a video game; because *Adventure* was first sold in 1979, *Video Whizball*’s Easter egg predates it by at least one year.<sup>38</sup> Still, some confusion may yet exist over which programmer deserves credit, since Reid-Selth claims to have gotten the idea because of reports that programmers at Atari were already doing it,<sup>39</sup> and Robinett had completed at least some of the code for *Adventure* as early as 1978. Furthermore, coin-operated Atari games include programmer initials,<sup>40</sup> and beyond the world of video games, the idea of hiding content by disguising it as meaningless or different information dates to antiquity in the practice of steganography. Nevertheless, Riddle’s discovery is significant because it raises some important questions about the relationships among video game Easter eggs, platforms, and culture.

First, the relatively quick discovery of *Adventure*’s Easter egg (compared to *Video Whizball*’s) contributed the idea of hidden content to the culture of video gaming during the 1980s. *Adventure*’s hidden content was known



Fig. 4.1. Revealing the hidden text, “MICHAEL K. GLASS” in Videocart 51: Demo 1 (*unpublished*). These images and those that follow were captured by running a Channel F emulation in MESS (Multiple Emulator Super System).

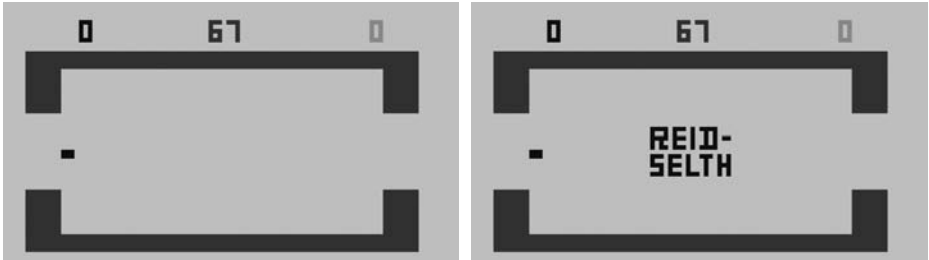


Fig. 4.2. Screenshots showing the game display state immediately prior to and immediately after unlocking the Easter egg in *Video Whizball* (1978). The image indicates the name of the programmer, Brad Reid-Selth. To access this image, one must first complete a game, then start a new game set to variant 43 with an initial score setting of 67.

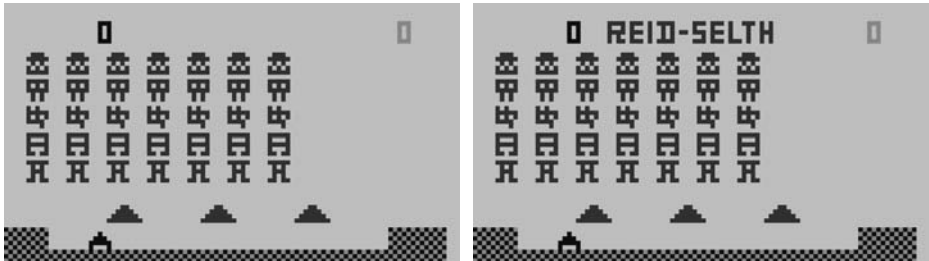


Fig. 4.3. Screenshots displaying the Easter egg in *Alien Invasion* (1982). Again, the image reveals the programmer’s name.

to the gaming community only a year or two after the game's release. Uston mentions it in his review of the game,<sup>41</sup> and *Electronic Games* includes the following statement in its "Electronic Games Hotline" section:

Atari confirms rumor; secret messages exist!

Sources at Atari have confirmed one of arcading's most persistent [*sic*] wild stories. If a gamer sends the hero to a certain room in the VCS Adventure and performs a specific action, a secret message revealing the designer's name will appear on the screen. Many had scoffed at the notion, citing the fact that Atari doesn't credit designers, but it turns out to be true. Although the programmer in question didn't see fit to let his employer in on the joke, Atari is evidently taking the whole thing with good grace. In fact, it gave Steve Wright an idea for the future. "From now on," he told EG in an exclusive interview, "we're going to plant little 'Easter eggs' like that in the games. Eventually, we may have a real treasure hunt with, with the clues hidden in various game cartridges!"<sup>42</sup>

This brief passage contains several striking details, the most ironic of which is that the editors here refer to the rationale that led Robinett to leave the Easter egg in the first place, but then do not actually mention his name. Also, the reference to this rumor as something that has existed for some time as a "wild" story speaks to a gaming community that was robust and social enough to sustain such knowledge, even before a publication like *Electronic Games* could act as clearinghouse and repository for this kind of information. Finally, the fact that Wright (whom Robinett has elsewhere credited with first using the term *Easter egg*) is so eager to pick up the idea and run with it in a coordinated treasure hunt indicates the power of the engagement this kind of interaction created.

The *Video Whizball* message has very similar origins, since Channel F programmers also were not credited. Ironically, the same issue of *Electronic Games* also includes a favorable review of *Video Whizball*, making no mention of the Easter egg (of course), but referring to the programmer in similarly elliptical phrasing:

*Video Whizball* was one of the last—and best—cartridges Fairchild produced before for abandoning its programmable videogame system. Now that Zircon is marketing the Channel F, *Video Whizball* may finally get the acclaim it richly deserves. The concept is astonishingly unique, the audio and visual effects are adequate, and play value is excellent. . . . This is really a good game, especially in light

of the limited graphics capability of the Channel F system. There is no similar limit on the inventiveness of the designer who created *Video Whizball*, and Zircon should be thanked for resurrecting this excellent cartridge.<sup>43</sup>

Like the discussion of the Easter egg, which speaks favorably of Warren Robinett's effort without naming him, this review includes glowing terms about Brad Reid-Selth's work on *Video Whizball* without including his name. Ken Uston regards *Video Whizball* with similar praise, and even points to the programmers—again, with no mention of Reid-Selth by name. What this demonstrates is that game players and enthusiasts were interested in programmers, and in the case of both *Adventure* and *Video Whizball*, an Easter egg stands to fill in an authoritative lacuna of intentionality. Appropriately, Robinett describes the message as his signature; it does inscribe the trace of his textual authority into both the game world and the game's software. Reid-Selth's signature works in very much the same way, though it is less explicitly directed toward authorship.

Two remaining factors serve to distinguish these two Easter eggs and explore how they each relate to video game culture: the games' diegetic space and ludic structures. Although "Created by Warren Robinett" and "REID-SELTH" both exist within the playable space of the game, game-play does not coincide with the presence of these textual signifiers. In other words, the player reads these messages but does not play with them or use them to accomplish tasks specific to their respective games' magic circles of play. The messages do, however, appear on the game screen within the diegetic space of play. "REID-SELTH" appears in the middle of the *Video Whizball* playfield, and "Created by Warren Robinett" appears inside a room that is as much a room as any other in the game's world. In this sense, both Easter eggs are coherently aligned with each game's narratological conditions. In contrast, the appearance of "REID-SELTH" in *Alien Invasion* places the programmer's name in the marginal screen space between the score displays for each player. Thus, the textual insertion relates to the game's diegesis through the displaced semiotic mode of paratext.<sup>44</sup> As such, the hidden *Alien Invasion* content is less inherent to the game's diegesis. As Mark J. P. Wolf puts it, an "individual game's worldview . . . determines how the game's diegetic world is constructed and represented on screen, and *what it means*."<sup>45</sup> The production of meaning through the representation of space is really what is at stake critically in these hidden messages. By signing their names to their works, and by making it possible to view that signature on the TV screen, Reid-Selth and Robinett scrawl their graffiti on the wall of the game's world. By completing the steps required to view that

signature, a player becomes complicit in this act of vandalism, as the text displays on her TV screen.

Furthermore, the Easter egg in *Adventure* fulfills a ludic role as the object of the ultimate objective of the game's quest: the player gains access to esoteric knowledge by retrieving a mysterious object and using that elixir to pass into a realm of greater understanding. Jeff Howard, who has usefully explored the poetics of quest structures in gameplay, argues that quests speak to "the relationship between meaning and action."<sup>46</sup> And in the case of the quest for Atari's Easter egg, achieving this goal has both semantic and ludic value—semantic because the player must interpret the message ("Who is Warren Robinett? Why is his name here?"), but ludic because the accomplishment results from carrying out activities that are functionally and symbolically the same as they are during the purported play of the game. Since *Adventure* is an adventure game based on spatial exploration and inventory management, it is ludically significant that the Easter egg's appearance coincides with having exhausted every possible game space and recovery of every existing item. The signature even strobes in marquee color, using the same animation technique that adorns the chalice the player seeks throughout gameplay.

*Video Whizball* takes place in a single playfield, and exploration and questing are not part of the game experience. Therefore, it would make little sense to "hide" the content in the diegetic space of the game world. Instead, the programmer credit is hidden (or displaced) in the Videocart's ludic paratext. The player must create a very specific sequence of conditions for the name to appear. Even given the large number of settings available, it is somewhat surprising that no one stumbled across the correct settings until Sean Riddle found it in the game's disassembled code and then reverse-engineered the method for unlocking it. This location and provenance provide a crucial distinction that sets it apart from the *Adventure* Easter egg; the *Video Whizball* secret content is not the logical or ludic result of successful gameplay. The fact that the player begins the sequence by first completing a game against the computer and *either winning or losing* demonstrates that the gameplay itself is, just like the diegetic content, indifferent to the location or interpretation of Reid-Selth's signature.

A further distinction exists at the code level, where "REID-SELTH" is further obfuscated. Robinett stored the image of his signature in the game code as a simple 8-bit-wide bitmap image. Just like other images, which in 6507 assembly code are stored in binary data, Robinett's signature is visible in the disassembled game ROM data, as illustrated in Figure 4.4. Channel F games stored graphics through a similar method. Although the F8 processor used different assembly code than the 6507, both are 8-bit proces-

sors and both retrieved images based on 8-bit-wide rows of binary data. One might, therefore, expect “REID-SELTH” to be similarly visible in the game ROM. However, this is not the case, as Figure 4.5 illustrates. “Created by Warren Robinett” is visible as a standard 8-bit word image, but “REID-SELTH” is only visible if one prints the data in rows of 15 bits each. The difference here at the code level seems consistent with the intentionality exhibited at the ludic level. In other words, “Created by Warren Robinett” seems to want to be found, whereas “REID-SELTH” remains hidden, even to someone (a supervisor at Fairchild, for example) who had access to the source code of the game.<sup>47</sup> Therefore, the fact that *Video Whizball*’s Easter egg remained hidden is not necessarily a historical accident; so even though it bears some of the same originary properties, most importantly, that it asserts authorship despite management policies to the contrary, Bradley Reid-Selth’s Easter egg is significantly different from Robinett’s. Reid-Selth certainly deserves credit for getting his Easter egg published first, but in the final analysis, Robinett’s message has had far more influence and is a more important artifact within the history of gaming.

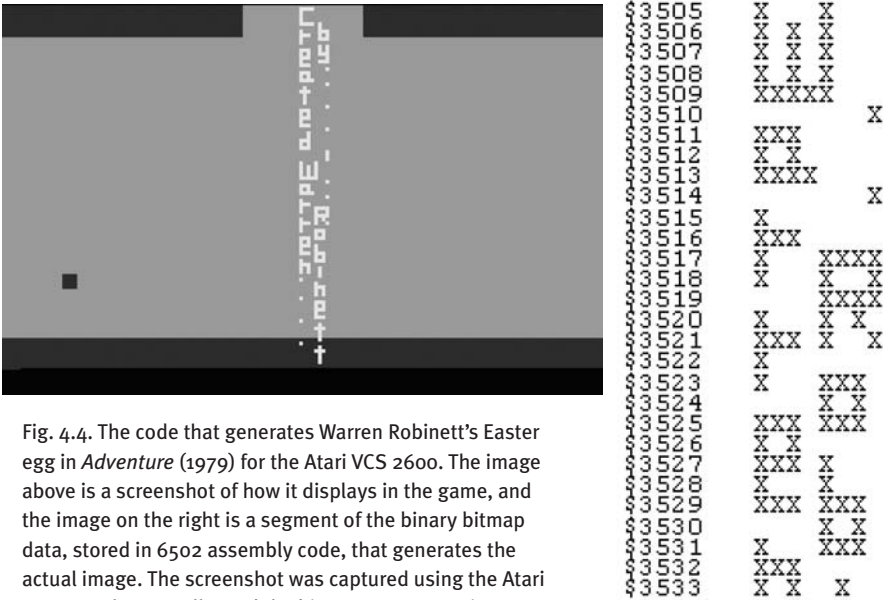


Fig. 4.4. The code that generates Warren Robinett’s Easter egg in *Adventure* (1979) for the Atari VCS 2600. The image above is a screenshot of how it displays in the game, and the image on the right is a segment of the binary bitmap data, stored in 6502 assembly code, that generates the actual image. The screenshot was captured using the Atari 2600 emulator, Stella, and the bitmap representation was generated from a simple Perl script that reads and prints binary data as text.

|        |          |                   |
|--------|----------|-------------------|
| \$0079 | XXXX XXX | XXX XXXX XXXX X   |
| \$0080 | X XXXX   | XXX XXXX XXX X X  |
| \$0081 | X X X    | X X XXXX XXXXXX X |
| \$0082 | X X      | XXX XXXX XXXX XXX |
| \$0083 | X XXXX   | X XXXX XXX X XXXX |
| \$0084 | XXX X    | X X X X X X       |
| \$0085 | X X XXX  | XXXX XXX X X X    |
| \$0086 | X X X    | XXX X X X X X     |
| \$0087 | X X      | X XX XXX X XXXX   |
| \$0088 | X XX XXX |                   |
| \$0089 | X XXXX   | XXX XXX X XXX X   |
| \$0090 |          | XX X X X X X      |
| \$0091 |          | XXXX XXX X X X    |
| \$0092 | XXX XXX  | XX X X X X X      |
| \$0093 | XXX X X  | XXXX XXX XXX X X  |
| \$0094 | XX X XX  | X XXXX XXX XXXXX  |
| \$0095 | X X      | XXX X             |
| \$0096 | X X X    | X X X X X X       |
| \$0097 | XXX XXX  | X XX XXX X X X    |
| \$0098 | X X X    | XXX X X           |
| \$0099 | XX X X   |                   |
| \$0100 | X X      |                   |
| \$0101 | X XXXX   |                   |

Fig. 4.5. The code that generates the hidden message imagery in *Video Whizball* (1978). The image on the left displays the game code as it is stored in binary data. Unlike Robinett's Easter egg, this message is unreadable when viewed as printed code. To read the name in this manner requires printing it at 15 bits per line, as illustrated in the second image.

### CONCLUSION

This essay began by raising the question of the Channel F's significance, wondering whether its place in history is only relegated to a few noteworthy technological advances or whether its inherent value superseded its also-ran status in most narratives of video game history. I to have called into question the deterministic assumptions underlying such generational narratives. Whether or not I have accomplished this, the historical (deterministic, narrativized) significance of the Channel F owes much to the innovative visions of its designers, like Jerry Lawson, and programmers, like Bradley Reid-Selth. The fact that Channel F had less success than the Atari VCS might have led to its having less historical influence, but studying the Channel F as a platform still reveals much about gaming culture in

the 1970s and early 1980s. Studying it as a historical platform reveals much about the culture of retro gaming in the 2000s.

## NOTES

1. There is an active Channel F homebrew community, but it has not been quite as active. Still, there are some impressive works, including a remarkably faithful *Pac-Man* port. For a current list, see <http://www.classicdev.org/VES/Homebrews>.

2. Leonard Herman, "System Profile: The Atari Video Computer System (VCS)," in *The Video Game Explosion: a History from PONG to Playstation and Beyond*, ed. Mark J. P. Wolf, (Westport, CT: Greenwood Press, 2007), 63–64.

3. "Significance," here and elsewhere, is a potentially dangerous or slippery term, but I want to bracket that for now. In the context of a poststructural approach to media content, "significance" is an arbitrary and localized artifact of a specific discourse. Following this logic, valuative claims immediately become fraught with circular logic. In this essay, however, I avoid that approach by simply assuming there is a specific sense in which significance can be identified as influence over later consoles and game texts. The Atari VCS demonstrates this to a high degree; the Channel F, not much at all.

4. Many sources are relatively consistent, but, interestingly, Leonard Herman's apparently exhaustive text, *Phoenix: The Rise and Fall of Home Video-games*, in its second edition, incorrectly places the date of the Zircon buyout and the subsequent release of the System II in 1982, when extant data and all other corroborating sources place this event in 1979.

5. Staff, "Zircon Revives Channel F," *Electronic Games*, Winter 1981, 43.

6. Staff, "The History of Video Games," *Electronic Games*, March 1982, 23.

7. Ian Bogost, "Guru Meditation Trivia Contest Answers," blog entry by Ian Bogost, June 4, 2009, [http://www.bogost.com/blog/guru\\_meditation\\_trivia\\_contest\\_1.shtml](http://www.bogost.com/blog/guru_meditation_trivia_contest_1.shtml).

8. Benj Edwards, "VC&G Interview: Jerry Lawson, Black Video Game Pioneer," *Vintage Computing and Gaming: Adventures in Classic Technology*, accessed June 3, 2009, <http://www.vintagecomputing.com/index.php/archives/545>.

9. Steven L. Kent, *The Ultimate History of Video Games: From PONG to Pokemon: The Story Behind the Craze That Touched Our Lives and Changed the World*, 1st ed., (New York: Three Rivers Press, 2001), 392.

10. Following the practice of the Channel F Owner's Manual, which specifically avoids the term, "joystick," I am treating their term, "Hand-Controller," as a proper noun.

11. *The Fairchild Video Entertainment System: The Best of the Video Games, Explained* (Palo Alto, CA: Fairchild Consumer Products).

12. See the *Commercial for Fairchild Channel F video game system at JCPenney*, <http://video.google.com/videoplay?docid=-7639213472647728205>. Also, a

1977 full-page ad in the *New York Times* suggests a retail price of \$169.50 (“Display Ad 174—No Title,” *New York Times*, December 18, 1977). And another ad by the retailer, Lectro-Media Ltd., offers the console for sale at \$150 (“Display Ad 192—No Title,” *New York Times*, December 18, 1977).

13. Ellen Roseman, “Video games are back with new wrinkle,” *The Globe and Mail*, Toronto, November 26, 1977.

14. Staff, “Zircon Revives Channel F,” *Electronic Games*, Winter 1981, 43.

15. Ken Uston, *Ken Uston’s Guide to Buying and Beating the Home Video Games* (New York: Signet, 1982), 19.

16. Bill Kunkel and Arnie Katz, “The Videogames: How they Rate,” *The New York Times*, November 21, 1981, Late City Final Edition, Style Desk.

17. Fredric Blåholtz, “Fredric’s Fairchild Channel F Mania,” January 20, 1999, <http://w5.nuinternet.com/s660100106/channelf.mania.html>.

18. Nick Montfort and Ian Bogost, *Racing the Beam: The Atari Video Computer System* (Cambridge, MA: The MIT Press, 2009), 12.

19. Uston, *Ken Uston’s Guide to Buying and Beating the Home Video Games*, 19.

20. Fairchild produced 21 Videocarts, but catalogs refer to several more in progress that were never released, including three that required a (non-existent) keyboard controller. Zircon released an additional four games, promising more, and at least one version of a demonstration cart was in circulation but never actually for sale.

21. Christian Bassow, “F8 (3850),” *CPU Museum*, November 25, 2004, [http://www.cpu-museum.com/F8\\_e.htm](http://www.cpu-museum.com/F8_e.htm).

22. Walter H. Buchsbaum and Robert Mauro, *Electronic Games: Design, Programming, and Troubleshooting* (New York: McGraw-Hill Book Company, 1979), 294.

23. Montfort and Bogost, *Racing the Beam: The Atari Video Computer System*, 73.

24. Cf. Fredric Blåholtz, *Fairchild Channel F art competition*, 2009, <http://www.youtube.com/watch?v=F6f3RWGV7jQ>. Video. In this video, Blåholtz showcases pixel art created for and displayed on a Channel F console.

25. Manifest I of “The Style” (De Stijl), from *De Stijl*, November 1918, 4.

26. Buchsbaum and Mauro, *Electronic Games: Design, Programming, and Troubleshooting*, 292.

27. Uston, *Ken Uston’s Guide to Buying and Beating the Home Video Games*, 14.

28. Wickeycolumbus, “Fairchild Channel F,” *AtariAge Forums*, July 19, 2009, [http://www.atariage.com/forums/topic/147468-fairchild-channel-f/page\\_\\_hl\\_\\_fairchild](http://www.atariage.com/forums/topic/147468-fairchild-channel-f/page__hl__fairchild).

29. Leonard Herman, “Early Home Video Game Systems” in *The Video Game Explosion: a History from PONG to Playstation and Beyond*, ed. Mark J. P. Wolf (Westport, CT: Greenwood Press, 2007), 56.

30. Brett Weiss, *Classic Home Video Games, 1972–1984: A Complete Reference Guide* (Jefferson, NC: McFarland, 2007), 203.

31. Robert A. Vinciguerra, "Fairchild Channel F Video Entertainment System: The first modern game console," *The Rev. Rob Times*, May 31, 2007, <http://www.revrob.com/sci-a-tech-topmenu-52/66-fairchild-channel-f-video-entertainment-system-the-first-modern-game-console>.

32. *Vintage Fairchild Channel F System*, 2009, <http://www.youtube.com/watch?v=AORfkwiYKP8>. Video.

33. Ronald Diemicke, "10 Worst 1st Party Controllers of All Time," *Moby Games*, November 27, 2006, [http://www.mobygames.com/featured\\_article/feature,30/section,204/](http://www.mobygames.com/featured_article/feature,30/section,204/).

34. Ruffin Bailey, "Hacks, Mods, Easter Eggs, and Fossils: Intentionality and Digitalism in the Video Game," in *Playing the Past: History and Nostalgia in Video Games*, ed. Zach Whalen and Laurie N. Taylor (Nashville: Vanderbilt University Press, 2008), 79.

35. Montfort and Bogost, *Racing the Beam: The Atari Video Computer System*, 61.

36. Van Burnham, ed., *Supercade: A Visual History of the Videogame Age, 1971–1984* (Cambridge, MA: The MIT Press, 2001), 62.

37. On his webpage, Riddle cites correspondence between Channel F collector, Fredric Blåholtz and Reid-Selth himself.

38. For these specific dates, I am relying on data (which is supported elsewhere) found in *Classic Home Video Games 1972–1984* by Brett Weiss.

39. "Easter Eggs," *Digital Press Online*, February 8, 2010, <http://www.digitpress.com/eastereggs/>.

40. According to Digital Press, programmer Owen Rubin included his initials in Orbit and Skydiver, both coin-operated games from 1978. Currently, these are only visible in the code because the method for displaying them on screen has not been isolated (see <http://www.digitpress.com/eastereggs/>).

41. Uston, *Ken Uston's Guide to Buying and Beating the Home Video Games*, 37.

42. Staff, "Electronic Games Hotline," *Electronic Games*, Winter 1981, 14.

43. Bill Kunkel and Frank Laney Jr., "Programmable Parade," *Electronic Games*, Winter 1981, 55.

44. The function of score display as paratext (in contradistinction to diegetic screen space) is a topic I have discussed elsewhere in some length (cf. Zach Whalen, "The Videogame Text Typography and Textuality" [PhD diss., University of Florida, 2008]).

45. Mark J. P. Wolf, "Space in the Video Game," in *The Medium of the Video Game*, ed. Mark J. P. Wolf (Austin: University of Texas Press, 2001), 51.

46. Jeffrey Howard, *Quests: Design, Theory, and History in Games and Narratives* (Wellesley, MA: A. K. Peters Ltd, 2008), 19.

47. In this sense, REID-SELTH is similar to another type of hidden message, present in the source code of *Video Whizball* (1978). As Sean Riddle discovered, the last 5 bytes of the ROM encode the binary notation equivalent for the name TRACY, the programmer's daughter ("Easter Eggs," *Digital Press Online*, Febru-

ary 8, 2010, <http://www.digitpress.com/eastereggs/>). I have excluded this and similar hidden messages from my discussion of Easter eggs because of how far removed they are from the diegetic space of play. They also exist at a programmatic level so deep that they cannot be accessed at all while the game is being played. In fact, they only yield to forensic analysis and as such are aimed at a researcher, not a player. Chris Covell's ROMSearcher software is an excellent tool for finding these and similar hidden messages (Chris Covell, "ROMSearcher," <http://www.disgruntledesigner.com/chris/romsearcher.html>).

MARK J. P. WOLF

## The Video Game Industry Crash of 1977

Though the Great Video Game Industry Crash of 1983 is well known, it was not the first time the industry experienced a crash. The crash of 1977, although not as big or long-lasting, was the first to test the home video game industry. In some ways, it was a warning to the industry and was predictive of the Great Crash of 1983, with which it shared similar conditions: burgeoning commercial success encouraging high expectations, cheapened product glutting the marketplace, tough competition forcing the slashing of prices, and technical advances resulting in a new generation of technology that quickly outmoded older systems and sent them into obsolescence. Based on the patterns of other electronics industries, some foresaw the 1977 crash. To understand why it happened, we must first look at the conditions that preceded it and the context in which it occurred.

### EARLY RAPID GROWTH

The first coin-operated video games, *Galaxy Game* and *Computer Space*, appeared in 1971, and the first home video game system, the Magnavox Odyssey, and the first hit game, *PONG*, appeared in 1972. Video games caught on, and by mid-1975, the Odyssey had sold over 350,000 in three years.<sup>1</sup> Seeing the Odyssey's success, Atari followed up its arcade *PONG* (1972) with a home version of *PONG* in 1975, and both had a growing number of imitators. More arcade video games began appearing, and in 1975, Magnavox further released two new home game systems, the Magnavox Odyssey 100 (model 7010) and Magnavox Odyssey 200 (model 7020). By

the end of 1975, an industry boom was underway. “TV’s hot new star: The electronic game,” in the December 29, 1975, *Business Week*, described the enthusiasm:

“It’s a sell-out item,” crows a spokesperson for Sears, Roebuck & Co. stores in the San Francisco area. “We can’t get enough of them,” says a representative of Bloomingdale Bros. in New York. “I don’t know how many we could have sold if we had them in stock,” wails a buyer for a major West Coast department store chain.

The object of these retailers’ holiday cheer is yet another consumer product from the high-technology workshops of the electronics industry—the video game. But consumers’ eagerness to pay \$100 and up to convert their television sets into miniature athletic fields virtually guarantees a rush of competition next year. “The toy and game market is limited only by our imagination,” says Scott Brown, consumer marketing director at National Semiconductor Corp. “It can be as big as the calculator market is today.”<sup>2</sup>

In addition to giving a sense of the optimism of the time, the article compares the game market to the calculator market, a good reminder that home video games appeared as a part of the larger home electronics industry and must be understood in that context. Video games were just one of many innovative products that emerged in the years following the appearance of large-scale integrated (LSI) circuits and microprocessors, such as pocket calculators, digital watches, and later, home computers. The same article even goes on to speculate about the home video game industry’s near future: “A big question is whether the entry of National and other semiconductor makers will create the same cut-throat price competition that has bloodied the calculator industry.”<sup>3</sup>

The question was an apt one. In the early 1970s, calculator prices dropped rapidly as more and more models entered the marketplace. LSI circuits allowed thousands of circuits on a single chip, enabling electronic devices to be made smaller and smaller. As an article in the October 9, 1971, issue of *Business Week* recounted,

Just three years ago it was unfeasible to make a battery-powered calculator designed to fit in the operator’s hand. The first “pocket” calculator, which was made in Japan, did not appear until 1969. Requiring dozens of integrated circuits, it was bulky as a large paperback book and was priced at a hefty \$400.

But late last month Bowmar Instrument Corp. of Ft. Wayne, Ind., began shipping the first of its new cigarette-pack-sized calculators. They are made entirely in the U.S. with the TI chip, and at \$240 are the lowest-priced and smallest portables on the market.<sup>4</sup>

Less than a year later, a *Newsweek* article reported that “the world market for calculators will total about 700,000 this year,” and “with prices settling as low as \$39.95, next year’s market could reach 10 million.”<sup>5</sup> By autumn of 1972, more than two dozen Japanese companies and 50 U.S. firms were making calculators. With a price drop from \$400 to \$39.95 in less than four years and intense competition from so many companies, many went out of business, and those that stayed in business were forced to accept meager profits despite the high volume of production. The crash, then, was not due to lack of consumer interest; calculator demand led to chip shortages. The large number of competitors, severe price drops, and the lack of profits, especially for smaller companies that could not withstand huge losses, were the causes of the crash. As some foresaw, a similar scenario would soon occur in the nascent video game industry.

#### A SYSTEM ON A CHIP

By 1975, the video game industry was well underway, but it was the AY-3-8500 chip, produced by General Instruments (GI) in early 1976, that was the catalyst for an onslaught of new systems. The AY-3-8500 chip had all of the circuitry necessary for a video game on a single chip, making the production of video games much easier. As *PONG* historian David Winter writes,

A complete video game system could be built with this chip and a few additional components. Since the chip was available to every manufacturer at low cost, it was no longer necessary to design a whole and expensive electronic circuit (GI provided the schematics for using the chip). This drastically changed the video game industry. Between 1976 and 1977, hundreds of manufacturers released their video game systems all over the world, and other chips appeared, some with color graphics, some with more games, and so on. The period of early video game history was over and the market was open to everybody.<sup>6</sup>

Coleco was the first customer to order the AY-3-8500 chip, and many other companies followed, as the rush to get cheap home game systems

into stores and consumers' homes began. According to Jerry and Eric Eimbinder's 1980 *Popular Electronics* series of articles, which was a history of video games up until 1980 (and the first history of video games to appear), "For companies thinking about going into the TV-game business, the GI chip was the convincer. . . . The cost of the GI chip ranged from \$5 to \$6, depending on the volume involved. It promised total system costs of \$25 to \$30 and retail prices in the \$60 to \$75 range. . . . The GI chip made it possible for companies to establish simplified production lines and build lower-cost games."<sup>7</sup>

In the rush to cash in on the home video game craze, dozens of companies produced second-rate products to try to beat their opponents to market. Some systems, like the Wonder Wizard by General Home Products, did not even bother to have a copyright notice on their boxes. Even systems that have long since been forgotten by the public found success initially; National Semiconductor's Adversary home game system, for example, sold over 200,000 units in 1976.<sup>8</sup> Around 70 companies were among the competitors, and one of the most successful, Atari, was bought by Warner Communications for \$28 million; not bad for a company whose modest start had been only four years earlier.

The 1976 Christmas season would be the best yet for the home video game industry, with estimated retail sales of around \$150 million.<sup>9</sup> Demand was such that many stores experienced shortages of home game systems. The enthusiasm continued into 1977, and an article in the March 16 edition of *The Chicago Tribune* stated that

there's every reason to believe the boom is only beginning. Video game sales in 1976 totalled an estimated 3.5 million units (10 times the 1975 figures), and they are expected to double and redouble within the next two years, and should top 16 million annually by 1980.

It's no wonder that the makers of these teletronic competitions exuded nothing but gleeful optimism last January during the Consumer Electronics Show at the Conrad Hilton Hotel.<sup>10</sup>

The article lists 22 systems produced by 14 different companies, and over half the systems listed already featured color graphics. After summaries of the games and game systems listed, the article's cheery optimism suddenly ends with a note of warning:

A brief, cautionary word. Despite the variety of electronic games available, some industry observers are convinced the future lies

not with limited option dedicated games, but with programmable systems that can be expanded indefinitely. Only Fairchild has such a game on the market today, but others are near. It may pay to wait. RCA, for example, will have its "Studio II" ready by mid-year. It promises five built-in games with three cartridges available initially and others to follow.

A programmable video unit, with its ability to create virtually any imaginable kind of visual display, has the potential to offer much more than just entertainment. It could be the first step toward a true home computer, useful as an instructional tool and as an information storage and retrieval device. As these applications are refined, the price of new program cartridges should drop, perhaps by as much as 50 per cent.

All this, of course, still is some time away. Meanwhile, there are plenty of electronic games with which to occupy our leisure time.

Television anyone?<sup>11</sup>

Cartridge-based home game systems and home computers would indeed become the two new directions the industry would be heading, and the two worst threats to the older entrenched order that had so far seen astonishing success. In August 1976, Fairchild Camera and Instrument Corporation introduced the Video Entertainment System (VES), the first cartridge-based home video game system (described in detail in Zach Whalen's essay in this volume). By the end of the year, the VES was on back-order as the company was unable to keep up with demand, and Fairchild announced they would come out with a new cartridge every month.

Home computers were also finally arriving in the home, and soon after, in stores. Micro Instrumentation and Telemetry System's Altair 8800 had been sold as a mail-order kit for hobbyists beginning in 1975; in July 1976, Steve Wozniak began selling his handmade Apple I computers, which still required buyers to add a power supply, case, and keyboard. But by 1977, fully assembled home computer systems, many using televisions as monitors just as the home video game systems did, were on the market as consumer items. The Commodore PET 2001 was announced at the Consumer Electronics Show in January 1977, and came out the following October. The Apple II was announced in April 1977 and came out in June. In August, Tandy announced its TRS-80 Microcomputer, which also appeared later in the year.

As the promise of cartridge-based systems and home computers loomed on the horizon and the dozens of nearly-identical tennis, soccer,

and hockey games of dedicated systems lost their hold of the public's imagination, an industry crash and reorganization became inevitable.

## THE CRASH

By January 1977, GI had shipped over 7 million AY-3-8500 chips and planned new series of chips that could do even more. In addition to competing with each other and Fairchild's new programmable system, home game systems also had to compete against non-video electronic handheld games, which also made use of the new microprocessor technology and offered the first portable electronic gaming. Texas Instruments, one of the major companies producing chips for handheld games, released the Little Professor, an electronic handheld learning aid, in 1976 and Data Man in 1977. In late 1976, Mattel released the handheld games *Auto Race* and *Football*, both in the \$25 to \$35 price range. Over the next two years, they released several more, including *Basketball* and *Baseball*, all with LED-based displays. With their success, handheld games from other companies, such as Tomy, Bandai, and Milton Bradley, would soon follow.

With video games up against the new industries of home computers and handheld games, and with a surge of new games entering the market while consumers waited for better and cheaper products to come, the market finally collapsed. According to the Eimbinders,

Despite the shortage of TV games during the Christmas 1976 season, the market collapsed in 1977.

Allied Leisure went bankrupt before it could deliver its backgammon games. National Semiconductor stopped development of its improved version of Adversary; Magnavox cancelled its top-of-the-line 24-game system. Atari, thanks to a fresh infusion of money by Warner Communication, hung in. So did Coleco, somehow surviving losses of \$30 million for 1977. One by one, most of the video game manufacturers dropped out. The casualties included the three semiconductor companies who were building games with their own chips: Fairchild, National Semiconductor, and RCA.<sup>12</sup>

Among the earliest analyses of the 1977 crash was the one-page editorial "TV Electronic Games Grow Up" in the September 1977 issue of *Popular Electronics*, written by the magazine's editorial director, Arthur P. Salsberg, which stated:

The sale of home TV electronic games peaked during the Christ-

mas season of 1976, followed by a severe decline in 1977. Was the estimated 3-million video games sold in '76 just a passing fancy of the American public? Obviously not, since manufacturers are now producing with the expectation that 1977 sales will easily be twice those of 1976. And nonvideo electronic games will certainly make their mark this year, too.

Home TV games did not move as well as anticipated during the first half of '77 for a variety of reasons: (1) Christmas doesn't last all year (though interest in games should be year-round); (2) reduced selling prices on games disheartened many retailers, who placed them on the back shelves; (3) programmable games are just around the corner. Concerning the latter, there are two companies already marketing them—Fairchild, who can't seem to keep up with consumer demands at \$170 a game [system] plus "cartridges," and RCA, just really entering the market with a \$150 program-mable model.<sup>13</sup>

The editorial goes on to say that the future for home video games is "extraordinarily bright" and that programmable video games are expected to account for 20 percent of unit sales in 1979 and 33 1/3 percent by 1980. But the editorial, which appeared in September 1977 and must have been written earlier, did not anticipate or even mention the system that would be released the following month, the Atari Video Computer System (VCS), which would be renamed the Atari 2600 in 1982 and would far outsell every system that had come before it.

#### THE INDUSTRY BOUNCES BACK

The crash certainly was not due to any lack of interest in technology. The American public's fascination with technology received a boost in 1977: the first space shuttle, the *Enterprise* (changed from the *Constitution* to the name of the *Star Trek* starship after a write-in campaign) was undergoing flight tests during the summer, lasers were used for the first time to initiate fusion reactions, the VHS-format videotape was introduced in July, and *Star Wars* (1977) was playing in theaters and wowing audiences with its numerous fictional technological marvels, including a video game-like technology for a holographic chess set with animated pieces.<sup>14</sup>

Fairchild and RCA had cartridge-based systems out before Atari did, and this spurred Atari into releasing their system before the market was flooded again. The VCS appeared in October and sold for \$189.95. Atari's superior system helped revive interest in video games and also meant the

obsolescence of RCA's system and Fairchild's system (though Fairchild, later owned by Zircon International, tried unsuccessfully to make a comeback with its Channel F System II in 1979). The technological advances of Atari helped revive interest in video games. Unlike Fairchild and RCA, Atari was already known for its successful arcade games, many of which it would port to its home system. Atari was also quick to license other arcade hits, most notably *Space Invaders* (1978), which became its first hit cartridge. The fact that Atari allowed third-party developers to make games for its system encouraged the start-up of many small game companies, some of which, like Activision and Imagic, were begun by disgruntled former employees of Atari. Third-party game development and production, eventually resulting in over 1000 different cartridges made for the system, would also keep the Atari 2600 in production until its official retirement in 1992, making it one of the most successful consoles in video game history.

Ironically, while the system helped the home video game industry bounce back after the 1977 crash, the flood of cartridges for the Atari 2600 and its competitors, many of which likewise allowed third-party game production, contributed to the greater industry crash of 1983. When the industry rebounded from this crash with the success of the Nintendo Entertainment System (NES), Nintendo would be far more careful regarding third-party game development for its system.

Although the crash of 1977 had less of an impact than the Great Crash of 1983, it provided a warning and demonstrated how unbridled enthusiasm within the industry would not necessarily be followed by consumers, who were becoming more careful and looking ahead to what technology was on the horizon, rather than adopting every new system and advance as it appeared. Continuing miniaturization and the rapidly dropping prices of calculators and other electronics industry products led many to expect that further technological advances would happen, making them seem less impressive or at least less surprising. In this sense, then, the crash of 1977 was an important turning point in the history of home video games, and one that would influence its later development.

## NOTES

1. See David Winter, "System Profile: The Magnavox Odyssey," 51; and Leonard Herman, "Early Home Video Game Systems," 54. Both are in *The Video Game Explosion: A History from PONG to PlayStation and Beyond*, ed. Mark J. P. Wolf (Westport, CT: Greenwood Press, 2007).

2. See "TV's hot new star: The electronic game," *Business Week*, December 29, 1975, 24.

3. Ibid.
4. See "Calculators slim down in size and price," *Business Week*, October 9, 1971, 50.
5. See "Calculated Boom," *Newsweek*, October 2, 1972, 86.
6. David Winter, "Video Games in Europe: The Early Years," in *The Video Game Explosion: A History from PONG to PlayStation and Beyond*, ed. Mark J. P. Wolf, 51.
7. Jerry and Eric Eimbinder, "Electronic Games: Space-Age Leisure Activity," *Popular Electronics*, October 1980, 55.
8. Ibid.
9. According to Roger Verhulst, "The future—playing now on your TV," *Chicago Tribune*, March 16, 1977.
10. Ibid.
11. Ibid.
12. Jerry and Eric Eimbinder, "Electronic Games: Space-Age Leisure Activity," *Popular Electronics*, October 1980, 55. Although the Eimbinders give \$30 million as the amount of Coleco's losses in 1977, two other sources ("Coleco's New Video Challenge," *New York Times*, November 11, 1982; and "The Strange Cabbage Patch Craze," *Time*, December 12, 1983, 122), give the figure of \$22 million as the amount. Either way, the point is made that Coleco's losses were enormous due to the crash. I would like to thank P. Konrad Budziszewski for pointing out these two sources.
13. Arthur P. Salsberg, "TV Electronic Games Grow Up," *Popular Electronics*, September 1977, 4.
14. Though it wasn't the first; a holographic chess set had also appeared in *Futureworld* (1976) a year before.

## A Question of Character

*Transmediation, Abstraction, and Identification  
in Early Games Licensed from Movies*

In recent years, the production processes, aesthetic possibilities, and commercial goals of cinema and video games have become so intertwined that the promotional build-ups surrounding most video games licensed from movies boast of their ability to create digital avatars that nearly duplicate the photorealistic appearance and behavior of their cinematic counterparts. For example, according to its press release, the game *Iron Man 2* (2010) features “a cast of characters that transports fans into a deeper and more authentic cinematic video game experience.”<sup>1</sup> And prospective gamers are informed that high-resolution digital scans and the motion-captured movements of the cast of the Matrix trilogy ensured the highest degree of continuity between the films and video games.<sup>2</sup>

For all this promotional bluster, however, the reception of such figures has been mixed. In contrast with the acclaimed believability of the computer-generated Na’vi characters featured in James Cameron’s movie *Avatar* (2009), the Na’vi characters that anchor *Avatar: The Game* (2009) were faulted for being “stiff and awkward.”<sup>3</sup> A review of the character animation in *Fantastic Four: Rise of the Silver Surfer* (2007) observes that “it’s not easy to make Jessica Alba look unattractive, but (game developer) Visual Concepts has done it.”<sup>4</sup> Although the rendering power of the latest generation of PCs and gaming consoles may enable a strong visual correspondence between cinematic characters and their interactive incarnations, this correspondence seems to highlight the remaining disparities between the two media forms or invite accusations that movie tie-in games do nothing but slavishly ape the primary, cinematic text from which they are derived. As a

result, these properties fail to become, in Henry Jenkins's terms, successful transmedia franchises, which succeed through their strategic distribution of key fictional elements (including characters, settings, and storylines) across multiple media channels with the intention that each medium will add its own, unique contribution to a larger franchise story world.<sup>5</sup>

Movie tie-in games have a long, storied history of disappointing film and video game fans alike, to the extent that the circa-1983 industry Crash has been widely (and, in many ways, fallaciously) attributed to the now-legendary failure of one of the earliest and highest profile spin-offs: Atari's hastily developed version of *E.T.: The Extraterrestrial* (1982).<sup>6</sup> However, for all that movie-licensed games have come to be viewed as a blight on both the film and video game industries at the time, this essay seeks to at least partially recuperate one facet of them: namely, their necessarily abstract approach to in-game player-character representation, the various diegetic and extratextual strategies employed to supplement this abstraction, and the resultant effect on both player identification and expansion/elaboration of the franchise story world as a whole. Mark J. P. Wolf has productively suggested that video games can be interpreted in terms of where they fall on the spectrum between two extremes, abstraction and representation:

To *abstract* something is to simplify it, reducing it to a few essential basic forms instead of trying to reproduce it. *Representation*, which seeks to create resemblances and reproduce something, is the polar opposite of abstraction (and is sometimes conflated with *realism*). Most artwork falls in the spectrum between the two extremes, since even very representational art falls short of fully reproducing its subject.<sup>7</sup> [italics in original]

Abstraction was a necessary strategy in pre-Crash games, since, as Wolf points out, "the video game began with perhaps the harshest restrictions encountered by any nascent visual medium in regard to graphic representation."<sup>8</sup> As this essay demonstrates, although the technologically imposed need for a high level of character abstraction limited developers' choices in creating appropriately cinematic player characters, it may have also freed early movie-game tie-ins from some of the challenges associated with translating more representational characters into the realm of the video game—challenges that even the most graphically sophisticated, latest generation of movie games are still dealing with as they seek to reproduce the photorealistic character aesthetics and behavior found in cinema. After all, while the drive to create ever more realistic game characters suggests that the ongoing refinement of avatar appearance and behavior is the key to

greater player enjoyment of and investment in these figures, video game history suggests otherwise, especially when it comes to movie-licensed games.

Building on Scott McCloud's assertion that cartoon characters function as a kind of vacuum into which our identities can be pulled—"an empty shell that we inhabit which enables us to travel to another realm"<sup>9</sup>—Wolf suggests that abstract game characters may perform a similar function for their users, creating a necessary gap between in-game character image and realist representation for players to inhabit, and thus "become" their character.<sup>10</sup> Abstraction can become something that aids identification rather than alienating the player. As this essay shows, the marked gaps between early movie-game characters and their cinematic source material, in terms of both appearance and behavior, may have ultimately been crucial to naturalizing player engagement with them. Forced to strike a delicate balance between serving as an in-game stand-in for the player and bearing the visual and narrative associations demanded by their source medium, movie-licensed video game characters are avatars twice over—that of their operator and that of their film character. Pre-Crash movie-game characters succeeded because they were typically forced to prioritize the former over the latter.

These pre-Crash games and their characters can teach us about the pervasive convergence between cinema and video games that has come to define our contemporary moment. As a kind of first wave of convergence between cinema and video games, these titles suggest that *technological* convergence—evident, for example, in the shared digital-imaging processes that have all but removed the aesthetic distinctions between film and game characters—may not be the ultimate determinant of successful converged *content*. If, as Jenkins argues, successful transmediation allows each medium to do what it does best, these early game characters may have been allowed to do what they do best by virtue of their necessary difference from, rather than their representational resemblance to, their cinematic counterparts. This essay's primary focus on movie-licensed games developed for home gaming systems reflects the marked prevalence of such titles for home consoles—evident, for example, in the extensive library of tie-ins developed for the Atari VCS console between 1978 and 1983.<sup>11</sup> This was in part due to the greater re-playability of home games, as well as the lavishly illustrated manuals that accompanied them and "filled in" the meanings of their abstract graphics, which facilitated their depiction of the more complex characters and gameplay scenarios originating from film.

Although the term *convergence* has been mobilized as a uniquely 21st-century trope, strongly linked to widespread digitization as the technological driver enabling content to flow readily across media platforms,<sup>12</sup> the convergence of cinema and video games dates back to the ostensibly pre-digital era prior to the 1983 industry Crash. The type of converged, horizontally integrated ownership structures now prevalent in our age of media conglomeration had their precursor in the Warner Communications acquisition of Atari in 1976 for \$28 million. It was a move calculated to cash in on the financial success of the emerging medium while providing the would-be media conglomerate with a means to expand their most successful film franchises across other media platforms. For example, the first film-licensed game for the Atari VCS, *Superman* (1979), was created when Warner wanted to follow their film *Superman* (1978) with a prompt video game tie-in. Its middling success was at least in part responsible for the relative dearth of movie-licensed titles until 1981, but by the early 1980s, video game companies began to turn eagerly to licensing.<sup>13</sup>

Game developers looking to carve out space in an increasingly crowded market became keen to tie their games to the kind of established and heavily promoted intellectual property represented by big-budget Hollywood blockbusters. At the same time, the rapid growth of the video game industry caught Hollywood's attention, prompting Universal, 20th Century Fox, Disney, Lucasfilm, and Paramount to make their own forays into game development and licensing. Video games, in turn, made their first impact on film content, fueling the storylines and computer-generated aesthetics of such high-profile releases as Disney's *Tron* (1982), MGM's *WarGames* (1983), and Universal's *The Last Starfighter* (1984). Judd Ethan Ruggill points to this early period of cross-pollination between cinema and games, followed by its distinct lapse into period of dormancy following the Crash of 1983, as exemplary of how, "while the process of convergence often seems smooth, even inexorable, it tends to be 'glacial' instead—irregular, with (often simultaneous) surges and retreats."<sup>14</sup>

This pre-Crash surge toward film-game convergence was clearly articulated on the covers and in the pages of the special interest magazines and promotional publications that proliferated around video games before the Crash. *Atari Age*, a Warner Communications–owned magazine created for Atari Club members, was understandably at the forefront of promoting this newly converged media content; for example, despite debuting on store shelves several years prior, the Man of Steel occupied a place of honor on the top left-hand corner of *Atari Age*'s first cover in May 1982, while the

wizened, iconic hand of E.T. from *E.T.: The Extraterrestrial* (1982) stretched across the cover of the November/December 1982 issue to alight its magic touch on the tip of an Atari VCS joystick, underlined by a movie ticket-shaped banner that heralded the release of “Two New Movie Games! ET and Raiders of the Lost Ark.” But this focus on the crossover between film and games was not limited to those publications with a clear promotional mandate; *Videogaming Illustrated* twice put Bruce Boxleitner’s title character from *Tron* on its cover, first with a film still on the August 1982 issue that included a feature about the film (“Tron: Life Inside a Videogame!”) and then with an artist’s rendering of Tron on the April 1983 issue touting the strategy guide to beating the Intellivision game *Tron: Deadly Discs* (1982), one of several home and arcade games based on sequences from the Disney feature. Both the recurring “Eye On” section of *Videogaming Illustrated* and *Atari Age*’s “Sneak Peeks” charted the hefty list of upcoming movie, television, and comic book licenses on the docket for release (“Good grief! Charlie Brown is coming to Atari!”), while *Videogaming Illustrated*’s monthly column “Star Words” featured such film stars as Kirk Douglas and Charlton Heston sharing their thoughts on the subject of video games. (Douglas confessed that, as much as he was amazed by computers, “I just wish I didn’t have to ask a twelve-year-old how they worked.” Meanwhile, after his first and only game of *PONG*, Heston admitted that he found video games interesting, but not totally captivating. The future NRA president rejected the notion that video games were a negative influence on young players. “They said the same thing about rock music, and God knows, if the kids can survive that they can survive anything.”)

#### A QUESTION OF CHARACTER: ABSTRACTION AND IDENTIFICATION

Well-known, iconographic characters that could be readily translated from film to game were crucial to this early period of movie-game convergence, since, in theory at least, these figures were typically the easiest way to tap into preexisting brand awareness and set new titles apart in a marketplace on the brink of being saturated by the releases of third-party developers. This character-driven motivation for game licensing was typified by toy and game maker Parker Brothers’s foray into video games in the early 1980s, drawing on the well-known heroes of such prominent licenses as James Bond, Spider-Man, and *Jaws*, to name a few. As the industry-focused “Eye On” section of *Videogaming Illustrated* observed at the time, “Recognizing they were wading into heavily populated waters, Parker Bros. decided that going with ‘famous faces’ was the best way to go. ‘Licensing is a factor which sets you apart to begin with,’ (Parker Bros. Director of Marketing Richard)

Stearns notes. 'It gets you recognition in the consumer's mind, and if you can back that edge with very good gameplay, you're on your way.'<sup>15</sup>

Similarly, the announcement of Lucasfilm's planned collaboration with Atari promised that the filmmakers' "unforgettable characters" would make the transition from movie to video game screen, touting these figures as just as crucial to an authentic adaptation of film to game as setting, visual effects, and visceral action sequences:

Where do you look for dramatic new video game ideas? If you're Atari you turn to the top creative teams in filmmaking . . . and form partnerships to develop tomorrow's breakthrough video game concepts. Lucasfilm, Ltd. is the producer of the *Star Wars* series and the incomparable *Raiders of the Lost Ark*—films combining fantastic action sequences, unforgettable characters, and spectacular visual effects. *Now the same kind of thrilling action, character, and visual effects* will be combined in home video, coin video and home computer games produced by the Lucasfilm creative team in cooperation with Atari's experienced game programmers.<sup>16</sup> [emphasis mine]

In sharp contrast to the derision heaped on most contemporary licensed video game characters, before the Crash, licensed characters tended to be both highly anticipated and well received: "Licensed characters seem to bring out the best in game designers. Doubtless they are 'inspired' by having their licensors looking over their shoulders, making sure the game is faithful to the character in question."<sup>17</sup>

Part of this favorable reception can be attributed to different contemporaneous expectations of what constituted a "faithful" character adaptation—and indeed, what even constituted a "believable" game character. As Wolf observes, video games of this era faced such substantial obstacles to convincingly representing the player in the game world that the earliest player characters tended to either be implied (a camera-controlling presence offscreen) or function based (spaceships, tanks, guns/gun turrets, etc.), thus circumventing the challenges of depicting the more detailed shapes and articulated movements of human or anthropomorphic characters.<sup>18</sup> As Bob Rehak notes of these early, function-based avatars, the controlling human agent is always implied, if not depicted: "Suggestive of a human ensconced within a mechanical shell, the rocket-ship imagery of the first avatars harkened to the external reality of the player seated at the terminal, hands on the controls."<sup>19</sup> The possible actions and behaviors of these

function-based characters were ideally matched to limited inputs afforded their user, whose button tapping and joystick twirling yielded a pleasing correspondence of shooting and swiveling from their on-screen stand-in.

Alongside the rise of licensing in the early 1980s, character-based player surrogates—the first avatars to possess an identity separate from that of the player controlling them—became increasingly common, in part due to their apparent potential for heightening player engagement. However, unlike the first named characters *not* licensed from another medium—Pac-Man and his ghost-monster enemies, for example—licensed character-based player surrogates were still constrained by the representational limitations of game hardware and software. For example, Parker Brothers marketing manager Bill Bracy recalls being presented with a convincing rendering of Darth Vader's mask during the development of *The Empire Strikes Back* (1982) for the Atari VCS, only to be told by the game's programmer that, due to the platform's limited memory, the character was nothing more than a pretty face: "When I asked him what can we do with it, his response was: nothing! I've used up all the space."<sup>20</sup>

As Montfort and Bogost point out, in the end, none of the Parker Brothers *Star Wars* games featured a detailed close-up of a character face or mask; *Jedi Arena* (1983), one of the few to feature identifiably human characters—Luke Skywalker included, or so the game's packaging would have you believe—depicts them from a top-down, God's eye perspective, so that they are both faceless and motionless, but for the swinging of their light sabers. Developers relied instead on a more abstract, function-based approach that took advantage of "the unique technologies and situations of the *Star Wars* universe"<sup>21</sup>—most famously, the snowspeeder sequence from *The Empire Strikes Back* film (1980), which was ultimately used as the foundation for the game of the same name. Both the original film character and the human player operator are implied but not obviously "present" in this function-based approach to player-character construction, a fact acknowledged in the game's enthusiastic critical and popular reception at the time. In one of the earliest examples of a video game walkthrough, a home video series titled *How to Beat Home Video Games*, the host describes the successful projective relationship players form with their snowspeeder avatar: "This translation of the Imperial Walker scene from the film shows that Parker Brothers still has what it takes to please the public. The player, *who can imagine himself or herself to be Luke Skywalker*, pilots a Snowspeeder ship against an army of Imperial walkers, who show up on this radar on the bottom of the screen" [emphasis mine].<sup>22</sup> The simple, function-based avatar of the snowspeeder allowed the users to *imagine* themselves as Luke Skywalker, and perhaps more importantly, it allowed them to successfully

project themselves into gamespace through clear, decisive action, zipping nimbly back and forth across a sparse, 2-D version of the ice planet Hoth to do battle with an endless onslaught of Imperial Walkers. Jesper Juul suggests that unlike films, which require human actants or their approximations for viewers to identify with to become vested in the text, video games require no such actant—the player’s *activity* and the game’s evaluation of and response to that activity, not their graphical representation within gamespace, ultimately guarantees their investment and presence in the game.<sup>23</sup> Game characters, Juul contends, can therefore be more abstract because they involve the player in such a direct way, allowing the player to stand in for human actant-character.<sup>24</sup> In the case of *The Empire Strikes Back*, the obvious gap between game avatar and film character Luke Skywalker allows the player to “become” the in-game character, emphasizing character function and action within gamespace—those factors controlled by the player—over character form and appearance—those traits controlled by the designer, and, to a certain extent, the licensor. Character abstraction, necessitated by technical limitations, thus eased the challenge of the “doubled” avatarial obligations of the movie-licensed character, since the snowspeeder can stand in for both player and film character without highlighting the constant slippage and realignment of these subject positions demanded by gameplay. In this case, the licensed character, implied through viewer familiarity with the cinematic backstory (Luke pilots the snowspeeder in the film), provides a context for gameplay, rather than functioning in excess of it. In so doing, the game functions as a kind of early transmedia success, translating the kinetic energy of the film sequence to game form without visually reproducing it, and creating an interactive experience that expands the franchise rather than being redundant within it. In this sense, *The Empire Strikes Back* succeeds where many of the later, more technologically advanced *Star Wars* games that sought to emulate the look and feel of the films—such as *Star Wars Episode One: Racer* (1999), based on the film’s prolonged pod-racing sequence—ultimately failed.

We can better understand the “excessive” potential of movie-licensed game characters and how abstraction could at least partially mitigate this excess, by examining several early movie-licensed games that featured more clearly human or anthropomorphic characters rather than strictly function-based ones. As two of the most heavily promoted and widely release movie-licensed game titles before the Crash, *Raiders of the Lost Ark* (film, 1980; Atari VCS game, 1982) and *E.T.: The Extraterrestrial* (film, 1982; Atari VCS game, 1982), share a common lineage in more ways than one: both took big-budget, Steven Spielberg blockbusters as their source material, and both were created by high-profile Atari developer Howard

Scott Warshaw. (Warshaw was chosen for the *E.T.* job by Spielberg after the director played and enjoyed Warshaw's adaptation of *Raiders*.) Both games also have a recognizable "star" character at their center—dashing archeologist Indiana Jones in the case of *Raiders*, and the heart-warming eponymous alien at the center of *E.T.* In both cases, translating these figures from film to game risked exacerbating the constant slippage players experience between treating their avatar as an extension of self within the game's world and viewing them instead as a discrete, fictional "other."

As Rehak observes, the video game character provides the gamer a sense of diegetic embodiment and involvement in the game world, making it the locus of player agency and subjectivity; however, when that character comes to be graphically represented—and thus, visible—within the game world, it also becomes an object for their scrutiny and contemplation.<sup>25</sup> The gamer therefore experiences a highly fluid relationship with their avatar, constantly shifting from participant to spectator and back again and, at times, even occupying both roles simultaneously. As I've suggested, game characters licensed from other media further complicate this relationship because they must function as avatars two times over—that of the user and that of a famous fictional character—and the assorted "baggage" of visual and narrative associations they bring with them into the game world.

Promotional materials for both *E.T.* and *Raiders* demonstrate how their central characters came to the video game screen loaded with such excess baggage. For example, the urgent chalk scrawl across the top of a print ad for *E.T.* implores the prospective gamer that "E.T. NEEDS YOUR HELP!"

He's three million light years from home. His friends will come back and rescue him, if E.T. can "phone home." But he can't do it alone. E.T. needs help from his human friend—and that's you, in Atari's exciting new E.T. video game cartridge. E.T. and you have plenty of problems to overcome before he can rejoin his fellow extraterrestrials. There are the government men chasing him, and the scientists who'll do heaven knows what if they catch him! Play with quick reflexes and sharp strategy, though, and E.T. is safely on his way home—until the next game, that is!<sup>26</sup>

Although *E.T.* was the only playable character in the game, its promotional materials emphasized the alien's identity as clearly distinct from that of his player operator. The advertisement addresses the prospective player as the "human friend" who must help E.T., implying that the user play as Elliot, E.T.'s human-child companion in the film, or a similar human surrogate. Instead, Elliot appears only as one of several human non-player characters in

the game, and we must play as E.T.; the “human friend” the ad addresses is the real-world player sitting at the console, for whom E.T. doesn’t just function as a film character brought to the video game screen for our spectatorial contemplation—he also serves as a representative of that player in the world of the game. This tendency to address the player as the human helpmate for the E.T. character, rather than his operator, was similarly picked up in a piece for *Atari Age*’s “New Cartridge Report,” which informed players that, “for E.T. to reach his home, you must first *help him to find* the 3 pieces of his interplanetary telephone to call his ship. Then *our extra-terrestrial friend* has to reach the landing pad in time to be rescued” [emphasis mine].<sup>27</sup> This treatment of E.T. as star-character “other,” rather than a clear extension of player agency, also surfaced in the game’s strategy guide: “Atari has made E.T. a star for the second time in the most eagerly awaited video game cartridge since Pac-Man. As in the movie, E.T. is brought to earth by his spaceship and is stranded in the woods. The object, as if you didn’t know, is to bring E.T. home.”<sup>28</sup>

Similarly challenged by excess star-character baggage was *Raiders of the Lost Ark*’s avatar-protagonist, the newly interactive Indiana Jones, although, in this case, promotional materials emphasized the active role of the player operator who would be donning Indy’s hat. “*Raiders of the Lost Ark*: STARRING YOU!” proclaims the text above a realistic artist’s rendering of Harrison Ford’s Indy:

It doesn’t matter who you are—when you play Atari’s sensational *Raiders of the Lost Ark* cartridge, you’re transformed into Indiana Jones, one of the great swashbuckling heroes of all time! . . . You find yourself in Egypt, land of enchantment . . . and treachery. Your mission—to find the fabled lost Ark of the Covenant. There are mysterious clues and dangerous obstacles around every corner. It’s not going to be easy—not even for you, Dr. Jones!<sup>29</sup>

By explaining the player’s transformation into Jones when they play the game, and then directly addressing them *as* Jones thereafter, the ad emphasizes the participatory facet of the gamer-avatar relationship over the established spectatorial relationship with Jones as film character. (The game’s strategy guide similarly foregrounds user agency as Indy’s operator: “Surprises like snakes, thieves and loot lurk around every corner as *you walk Indiana* through all kinds of adventure scenes you remember from the movie”; emphasis mine.)<sup>30</sup> Although their strategies differ, both films’ promotional campaigns reveal how the excessive nature of the film-licensed game character as “double” avatar must be carefully managed.

In contrast to the more richly developed personas of successful film characters, which are staunchly tied to the ostensibly “realistic” representation of the actor playing them, successful video game characters are defined first and foremost by their *functionality* within gamespace. James Newman contends that the player’s sense of presence and being in character depends primarily on their character’s capacity—what they are capable of within the game, and the “suite of characteristics” they provide their operator.<sup>31</sup> The abstract appearance and behavior of both E.T. and Indiana Jones in the context of their respective game worlds may have ultimately helped subordinate their “otherness” as film-licensed characters, since, rather than highlighting the character as an object for aesthetic contemplation, this abstraction allowed each character’s capacity (or lack thereof) to come to the foreground. In video games of this era, to be visually “faithful” to a character licensed from an ostensibly “realistic” medium such as cinema was simply to ensure that, in terms of appearance, the character in question possessed at least one trait recognizable from their source medium. Similarly, character behavior depicted from a removed, top-down or side-scrolling perspective necessarily relied on the most obvious movements and gestures to evoke familiarity. The most basic iconography of character thus became key to player recognition, boiled down to one or two essential traits that could be ported across media—Indiana Jones’s hat, defiant, arms-akimbo stance and undulating bullwhip; E.T.’s telescopic neck and unexpected speed; The Man of Steel’s billowing cape. With character appearance linked clearly to character capacity, the avatar’s function, not form, becomes key to guaranteeing player involvement. In the lead up to its release, the developers of *Raiders of the Lost Ark* shared their secret to “faithfully” adapting Indiana Jones to a video game character: not by devising the means to create a convincing Harrison Ford clone for players to admire, but rather by creating a character that functions convincingly—for example, by finding an authentic bullwhip on which to base the in-game movement of Indy’s weapon of choice. The game’s promotional materials further emphasize this functionality: “You have everything Indiana Jones had in the movie—your trusty whip and revolver, your uncanny strategy and cunning—plus several magical objects which provide mysterious powers, if you can find them. And you’ll need all the help you can get, between the thieves and the giant spider and the deadly snakes.”<sup>32</sup> The positive critical and popular reception of *Raiders* suggests that the game succeeded in creating a “functional” film-licensed character for players to identify with and operate in the game world, which was deemed both complementary to and suitably different from its cinematic source material. However, in the case of E.T., those recognizable traits that were translated with a view to ensuring character functionality turned out

to be anything but—E.T.’s extendable neck, used in-game to levitate out of wells he repeatedly falls into while searching for pieces of his intergalactic telephone, became the centerpiece of one of the most famously frustrating gameplay dynamics before or since the industry Crash.<sup>33</sup> Furthermore, the game’s title screen—a highly representational bust-like portrait of E.T.’s face and neck—pointed toward a future of game character design where the spectatorial component of the gamer-avatar relationship—forced by a relentless drive toward the tropes of “realism” and “immersion”—would come to threaten the primacy of participation.

#### CONCLUSION: A QUESTION OF CHARACTER, AFTER THE CRASH AND BEYOND

Especially in the decades since the 1983 industry Crash, the history of the video game character has been defined by an inexorable march from abstraction to representation as the technical means became available, a telos that seemed to suggest expanded possibilities for the convergence of cinema and games. As Bob Rehak observes,

video games have evolved toward ever more complex simulations of corporeal immersion, subsuming economic, social, and technological determinants under an overarching goal: to confront players with detailed and lifelike “doubles.” As the avatar took on character, history, and presence within increasingly detailed story worlds, the coded representation of sensory immersion represented by the FPS brought video games into dialogue with the dominant representational system of Hollywood filmmaking.<sup>34</sup>

In theory, this growing dialogue between film and video game form and aesthetics—aided by their ever-converging technologies, ranging from motion capture to virtual set creation—should have also yielded a growing number of transmedia characters which productively expanded their franchise story worlds through their “starring roles” in both films and games. However, this has not been the case, as this elision of technological boundaries between media seems to have instead problematically prioritized how game characters can function as avatars of their film characters, rather than their real-world player operators. Since, in live-action cinema, a star’s image is always, to some extent, carried into the role they play, game characters forced to be “digital doubles” of their filmic incarnations are similarly bound to the expectations and constraints of that image. Not only does this force the game character in question to function more as object for

aesthetic contemplation rather than locus of player agency and subjectivity—it also leaves minimal space for users to form a successful *projective identity*, James Paul Gee’s useful term for the type of identification players experience with digital avatars as both an extension of self—into which they can project their own values and desires—and an often super-empowered other.<sup>35</sup> While the creation of realistic characters has always been—and, for the foreseeable future, will continue to be—one of the greatest drivers for improving the graphical capabilities of home video game consoles, as this survey of several prominent early movie-licensed games suggests, the clear technological *divergences* between film and video games and their characters prior to the industry Crash may have ultimately been responsible for the limited success they achieved as converged content.

## NOTES

1. IGN.com, “Iron Man 2: The Video Game Blasts into Stores Everywhere,” news release, May 4, 2010, <http://xbox360.ign.com/articles/108/1087612p1.html>.

2. See, for example, John Gaudiosi, “Hacking the Matrix: An Exclusive Look at the Technology Behind the Game,” *Wired*, March 2003, <http://www.wired.com/wired/archive/11.03/play.html>.

3. Erik Brudvig, “Avatar: The Game Review,” *IGN.com*, December 1, 2009, <http://xbox360.ign.com/articles/105/1050817p2.html>.

4. Aaron Thomas, “Fantastic 4 Rise of the Silver Surfer Review,” *GameSpot.com*, posted June 21, 2007, <http://www.gamespot.com/ps3/action/fantastic4-riseofsilversurfer/review.html>.

5. Henry Jenkins, *Convergence Culture: Where Old and New Media Collide* (New York: New York University Press, 2006), 93–130.

6. In actual fact, to pin the Crash on one single factor—let alone the failure of a single game—is as reductive as it is inaccurate. An excessive focus on licensing existing properties (including film, television, and arcade games) instead of developing original intellectual property was but one precipitating factor in the Crash, which was also preceded by market saturation with cheap, uninspiring console games from third party developers, by a steep decline in arcade revenues, and by a rise in home computer and computer game use. See, for example, Nick Montfort and Ian Bogost, *Racing the Beam: The Atari Video Computer System* (Cambridge, MA: The MIT Press, 2009). See also Mark J. P. Wolf, “The Video Game Industry Crash,” in *The Video Game Explosion: A History From PONG to Playstation and Beyond*, ed. Mark J. P. Wolf (Westport, CT: Greenwood Press, 2008), 103–6.

7. Mark J. P. Wolf, “Abstraction in the Video Game,” in *The Video Game Theory Reader*, ed. Mark J. P. Wolf and Bernard Perron (New York: Routledge, 2003), 48.

8. Wolf, "Abstraction in the Video Game," 47.
9. Scott McCloud, *Understanding Comics* (New York: Harper Collins, 1993), 36.
10. Wolf, "Abstraction in the Video Game," 51.
11. These Atari VCS titles included cartridges for such high-profile blockbusters as *Superman* (1978), *The Empire Strikes Back* (1980), *Raiders of the Lost Ark* (1981), and *E.T.: The Extraterrestrial* (1982), which I discuss in greater detail herein, as well as such other, more likely candidates for game tie-ins as *Dragonslayer* (1981), *Jaws* (1975), *Star Trek II: The Wrath of Khan* (1982), and *Tron* (1982). However, VCS games were also released for a wide range of seemingly unlikely properties during this period, including *48 Hours* (1982), *9 to 5* (1980), *China Syndrome* (1979), *Halloween* (1978), *Marathon Man* (1976), *The Texas Chainsaw Massacre* (1982), and *The Trail of the Pink Panther* (1982).
12. See, for example, the following: Jenkins, *Convergence Culture*, 2006; Barry Ip, "Technological, Content, and Market Convergence in the Games Industry," *Games and Culture*, 3, no. 2, 99–224; Tanja Storsul and Dagny Stuedahl, eds., *Ambivalence Towards Convergence: Digitalization and Media Change* (Göteborg: Nordicom, 2007).
13. Montfort and Bogost, *Racing the Beam*, 124.
14. Judd Ethan Ruggill, "Convergence, Always Already, Already," *Cinema Journal* 48, No. 3 (Spring 2009): 106.
15. "The Force is With Them," *Videogaming Illustrated*, August 1982, 10. In the same interview, Stearns also acknowledged how Parker Bros.'s corporate ownership was ideally structured to maximize the cross-media potential of licensed characters; "Licensors are always thrilled to do business with a company owned by General Mills, especially with the potential for cross-promotion on back of cereal boxes."
16. "Creators of Raiders and Sesame Street to Design New Atari Video Games," *Atari Age*, September/October 1982, 7.
17. "Conquering Spider-man," *Videogaming Illustrated*, April 1983, 30.
18. Wolf, "Abstraction in the Video Game," 50–51.
19. Bob Rehak, "Playing at Being: Psychoanalysis and the Avatar," in *The Video Game Theory Reader*, ed. Mark J. P. Wolf and Bernard Perron (New York: Routledge, 2003), 109.
20. Quoted in Montfort and Bogost, *Racing the Beam*, 120.
21. Montfort and Bogost, *Racing the Beam*, 120.
22. "The Empire Strikes Back," *How to Beat Home Videogames: Volume One*, Vestron, 1982.
23. Jesper Juul, "Games Telling Stories?" *Game Studies* 1, no. 1 (July 2001), <http://www.gamestudies.org/0101/juul-gts/>.
24. Juul's argument reflects his desire to highlight the differences between narrative and interactive media, a viewpoint that was common within the ludologist camp of game studies at the time. Although the opposition between "ludology" and "narratology" as approaches to game studies has all but disap-

peared, Juul's assessment of the different relationships audiences have with film and game characters remains highly relevant to any discussion of film-licensed game characters, which bring together the codes and conventions of these still-disparate media.

25. Rehak, "Playing at Being," 111.

26. Atari, "E.T.: The Extraterrestrial," *Atari Age*, print advertisement, November/December 1982, 3.

27. "New Cartridge Report," *Atari Age*, November/December 1982, 7.

28. "E.T.: The Extraterrestrial," *How to Beat Home Video Games: Volume 2*, Vestron, 1982.

29. Atari, "Raiders of the Lost Ark," *Atari Age*, print advertisement, November/December 1982, 9.

30. "Raiders of the Lost Ark," *How to Beat Home Video Games: Volume 2*, Vestron, 1982.

31. James Newman, *Videogames* (London: Routledge, 2004), 134.

32. Atari, "Raiders of the Lost Ark," *Atari Age*, print advertisement, November/December 1982, 9.

33. Even the most diplomatic assessment of *E.T.: The Extraterrestrial* acknowledges how frustrating its gameplay dynamic can be: "To retrieve (the piece of telephone), simply fall into the well and touch it, and then raise E.T.'s neck to levitate him. Careful not to fall right back into the same well! There are only four scenes containing wells, two of which you have to navigate fairly slowly. . . . Getting out of a well can be troublesome, and there's not much else you can do besides try again." From "E.T.: The Extraterrestrial," *How to Beat Home Videogames: Volume 2*, Vestron, 1982.

34. Rehak, "Playing at Being," 118.

35. James Paul Gee, *What Video Games Have to Teach Us About Learning and Literacy* (New York: Palgrave Macmillan, 2003): 55.

SHEILA C. MURPHY

## Every Which Way But . . .

*Reading the Atari Catalog*

We may be through with the past, but the past ain't through with us.

—BERGEN EVANS, as quoted in the film *Magnolia* (1999)

I remember the arrival of the Atari 2600 game system into my life quite clearly. I was fascinated even then by how its black plastic ridges echoed the black plastic grill on the TV set—the one that “protected” such fine controls as the knobs to adjust tint or saturation. Like the television set, the Atari also bore a faux wood-grain pattern across it: both of these plastic, electronic devices clearly wanted to reference some earlier moment in interior design when wooden objects were highly valued. As an eight-year-old, I didn’t control the purchase or acquisition of cartridges for the Atari, but I longed to play whatever games I could—I even recall spending countless hours attempting to levitate E.T. out of his hole in the notorious video game adaptation of the film. But, as a girl with two lively brothers, more often than not I watched the games and partook in my other favorite activity: reading.

Reading the Atari catalog in the early 1980s was an exercise in consumer anticipation and technological promises: what could one play next? What would the game do, enable, or allow? Although Nintendo is widely known for cultivating its audience through secondary publications like *Nintendo* magazine and the Nintendo telephone hotline, Atari’s published game catalog set the precedent for such later promotional publications. As an early home video game developer, Atari’s published catalog also delimits and

sets gamer expectations, determining, in fact, what one could expect from a game company at the time. Once packed in and shipped with systems and cartridges, these ephemeral game catalogs are now valued sources for understanding the history and development of game genres. As the pages shown in Figure 7.1 indicate, the Atari Video Computer System (VCS) catalog described the Atari game software titles with a tripartite approach: imaginative, hand-drawn illustrations depicting a game's content, a text description of the same elements along with basic gameplay info, and finally, with a screenshot from the actual game itself. These pages promote three of Atari's most successful cartridges: *Asteroids* (arcade game, 1979; home version, 1979), *Missile Command* (arcade game and home version both 1980), and *Space Invaders* (Taito's arcade game, 1978; Atari's licensed home version, 1980). They are typical entries from the Atari catalog, though the illustration style did shift somewhat over time, moving from line-drawn, cartoon illustrations that were also used in other Atari advertisements to the style seen here, which clearly borrows from the look of pulp fantasy and science fiction illustration. Each title's full-color illustration depicts its individual narrative universe, but the visual style is consistent throughout the catalog as a whole, promoting the idea that each title is or could become another cartridge in a gamer's library. Later pages in the catalog promoted cartridge storage systems that also played on the idea of developing a collection or library of home video games. The Atari catalog, though primarily designed to sell cartridges, also instructed gamers about how to imagine, play, store, and display their newly acquired systems and games. Reading it can tell us much about early video game culture and its modes of address.

Fig. 7.1 Pages 18–19 of the 1982 Atari Video Computer System catalog, red graphic cover edition.



This essay represents a different kind of reading than I did as an eight-year-old girl who just wanted a turn at *Circus Atari* (1980). Instead of reading the catalog as a would-be gamer, I read it as a historian of games, performing cultural analysis of its discourse in retrospect, with all the advantages and distance (as well as disadvantages) made possible by the passage of time.

Reading the Atari catalog in 2011 is a different task, one that requires the reader to both imagine the games themselves as they are presented within the catalog, and that also entails using one's historical imagination to recall the moment when video games were new, were a central cultural trend or fad, and hadn't yet experienced the tremendous decline of popularity that came when the industry later crashed. Contemporary online users and fans' comments indicate just how easily one can nostalgically slip back into that earlier moment, proclaiming: "Dear God, I slept with this catalog under my pillow for several months leading up to Xmas, '82."<sup>1</sup> Or, as another user commenting on the 1981 Atari catalog art for *Yar's Revenge* (1981), which foregrounds an attacking silver-winged, red-eyed insect in front of a tangerine sunset, puts it, "I'm old—I remember this picture more than I remember the game."<sup>2</sup> This sentiment, revealing that the catalog art is as engrained in our memories of the time period as much as—or even more than—the games themselves, exemplifies the reason for revisiting how Atari and other early video game manufacturers used catalogs and advertising imagery to create a horizon of expectations for gamers, one which surely did not match the technology of the time but contributed to the culture of gaming.

#### NOSTALGIA, EPHEMERA, AND THE CULTURES OF GAMING

Within video games, the logic of the fetish object typically dominates: from crystals imbued with secret powers to the ultimate game-narrative-driving fetish "object," the princess who must be rescued in order to complete the game. As Christian Metz put it, "The fetish, too, means both loss (symbolic castration) and protection against loss."<sup>3</sup> During a game, interaction is often motivated by the acquisition of objects or by their loss. Acquire the correct item or set of items and one can proceed. In contemporary gaming, this emphasis on the virtual collection, acquisition, and trading of objects has resulted in complex HUDs (heads-up devices) so a gamer may keep track of his or her inventory of items, munitions, abilities, and so forth. Before the video game industry Crash, early HUDs also indicated what items were needed or left in a player's inventory.

Outside of video games themselves, a veritable cottage industry has arisen around fetishized video game–related items that play on a nostalgia for (and loss of) an early historical moment in (video game) history. Arcade cabinets and inner workings like ROM sets, motherboard sets, switches, controllers, and so on can be easily purchased by merchants who specialize in arcade games—video game collectors and memorabilia dealers who sell, trade, circulate, and are themselves the living memory of the early history of video games. Aficionados and collectors of home video gaming systems also have their own set of collectible, valued objects ranging from game cartridges, rare games or controllers, special edition releases of hardware or software, advertising, ephemeral evidence of gaming crazes—*Pac-Man* television episodes, the 45 RPM record of *Pac-Man Fever* (1982), jewelry, or movie posters and promotional items. (What I wouldn't give for some genuine, movie-set cabinet art for *Space Paranoids*, the faux *Space Invaders* game Flynn invents in the film version of *Tron*, 1982!). Included in the long list of popular culture detritus picked up and collected by gamers and gaming fans are the items that ship with a system—manuals, original boxes, pack-in cartridges, and the fetish object of this essay, catalogs of games produced by or for a system.

My methodology here is largely influenced by a strategy that has been extremely successful and influential within television studies. This approach, pioneered by scholar Lynn Spigel in her groundbreaking book, *Make Room for TV: Television and the Family Ideal in Postwar America* (1992), considers how popular technologies were “accommodated” by and in the discourses surrounding them, from women’s magazines to department store catalogs. Spigel, writing about postwar television and domestic culture, looked not to television programs or the industry’s broadcast history for her primary sources, but instead examined secondary sources like magazines, newspapers, and other elements of material culture that produced a discourse about television during the era. Reading the Atari catalog is a similar activity to reading *Good Housekeeping* articles on where to place the television set or how to clean it.<sup>4</sup> While the Atari catalog both predates and promotes fan publications (the Atari catalog did promote the “Atari Fan Club”), it extends the company’s imaginary universe beyond the actual texts of the games themselves. Catalogs could be pored over for hours (or slept up or kept under one’s bed) in ways that the games could not be frozen on the screen or captured and studied. The interactivity of reading has a slower pace and process than that of gaming, with its pacing, time pressures, and moving images.

For example, take Figure 7.2, the catalog entry for the Atari 2600 version of *Superman* (1979), a game adapted from the DC comic book and

also known through the series of blockbuster Superman films that began in 1978. Placing the reader directly in the role of Superman as the “man of steel,” this catalog entry also mentions classic known elements of the Superman story (Lex Luthor, Metropolis, x-ray vision, kryptonite, Lois Lane) as promised elements of the game itself. The illustration for the game is a DC-authorized vision of the hero flying high above some buildings. An inset image of a screenshot shows that Atari’s *Superman* indicates that the game will have skyscrapers, the flying caped crusader, and bad guys, albeit in blocky, graphic style.

In truth, I don’t recall the Atari catalog that came with our 2600 system when I was a child. I was much too entranced by the system itself—its molded black plastic case, joystick controller with the alluring orange button, and its “wood veneer” (on the version sold between 1980–82). But when I purchased my second 2600 system, in 2004 from an online retailer who specializes in selling older game hardware and cartridges, I was delighted to find an original copy of the Atari catalog packed with my purchase. The catalog, an added bit of marketing wizardry, was clearly designed to encourage future purchases of Atari software by the new owner of the video game system and not necessarily intended to be perused by a video game scholar who bought an Atari for both its ability to run Atari game software and as a historical and cultural object whose status as key early gaming system is now sacrosanct.



Fig. 7.2. The page for *Superman* (1979) from the 1981 Atari Video Computer System catalog.

In the early 1990s, film theorist Vivian Sobchack attempted to capture the synthetic nostalgia one feels in relation to digital “objects.” In her case, she described a not-yet-but-nearly-felt nostalgia for software that would soon be updated and eclipsed. With each new patch or update, a software or game program becomes a new object and its “original” form is lost to us, leaving behind only nostalgia for earlier, more “pure” versions of a program, even if those earlier, nostalgic versions contain bugs or program errors. When historicizing such a definitive industrial break as the Great Video Game Industry Crash, it is easy to look to games from “before” as earlier, more earnest versions of what came later, though the opportunistic game titles released just prior to the crash make it harder to imagine games produced by U. S. Games, the briefly operational video game division of Quaker Oats, as “pure” incarnations of video gaming. And yet, flagrantly opportunistic, poorly produced, fad games often end up as highly collectible objects despite, or perhaps because of, their poor quality as video games. These nostalgic objects remind me of Jean Baudrillard’s work on the precession of simulacra, or how images shift from operating on a representational register to signifying only as simulations. If an arcade cabinet is nostalgic object, it is because of its direct representational and actual ties to the game it contains. Whereas a copy of Purina’s *Chase the Chuck Wagon* (1983), is valuable less for its semiotic connections to what dogs chasing chuck wagons would look like or what its gameplay would be like, but because, as a famous failure and demonstrable example of why the video game industry crashed, *Chase the Chuck Wagon* is a valuable object that has a perverse, inverted relationship to that which it represents (video games). Indeed, even Wikipedia declares *Chase the Chuck Wagon* to be “the Holy Grail of Atari 2600 video game collecting.”<sup>5</sup> We are nostalgic not just for what was lost but for the unexpected ways that video game industry developments are uneven, bizarre, and hard to fit into academic histories.<sup>6</sup> We want the unbelievable stories from the past—the strange games like *Custer’s Revenge* (1982) with its comically grotesque, emasculated naked rapist or the tales of landfills overflowing with unwanted video game cartridges.

Today, the Atari catalog fuels such nostalgia, while in its era it promoted the idea that there was a plentitude of game titles for the Atari system. Shown in Figure 7.3, one image produced for a 1982 version of the catalog even shows a television set floating above an Atari video computer system and its controllers that is centered on a black-and-white grid. Above the 2600 and receding into the page, as if they would converge on the television screen itself, are flying game boxes from the Atari library. Each game is

depicted by its consumer packaging and cover art and two rows of games—approximately forty games are shown in the image—an astounding number of titles for 1982, all produced by Atari for their system. Floating above all of this, in the black background, is the Atari logo, rendered in a silvery white. On screen is a game that, ironically, would later be seen as an indicator of the video game industry’s overexpansion and of executive’s poor decision making, Atari’s port of *Pac-Man* (Atari’s licensed home version, 1981). Looking absolutely cutting edge, this image is a money shot of the Atari 2600, its game library and the company as a whole. The image places us, the catalog reader, inside the Atari universe, which itself appears to be inside the white-hot grid of the computer, like a leftover animation shot from *Tron* (1982). This image surprisingly reminds me not just of 1982 but also of 2010 and new questions that have emerged about how to “read” computer hardware and software within video game studies.

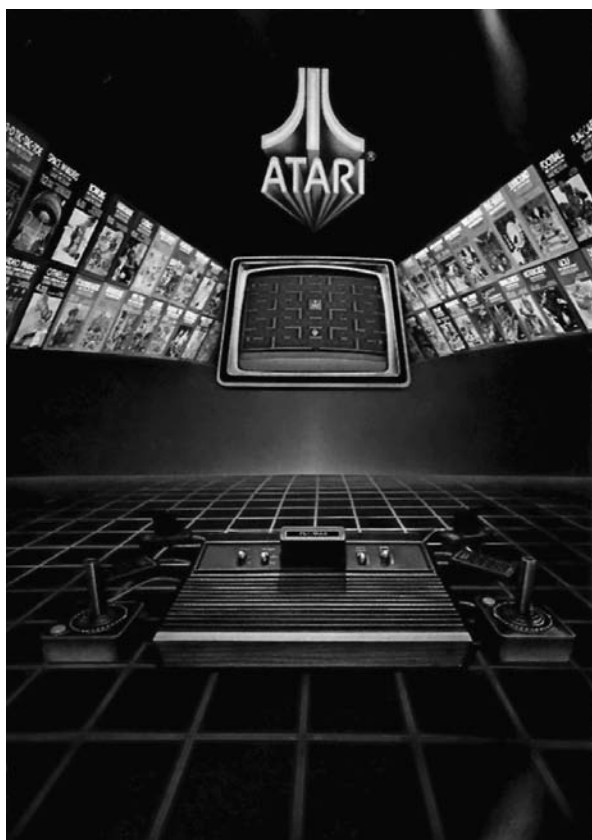


Fig. 7.3. Illustration from 1982 Atari catalog.

There is a new kind of formalism emerging in both video game studies and its slightly older sister-discipline, new media studies. Scholars are emphasizing a return to technological precision, a deeper understanding of how code operates and of hardware specifications. From computer platforms to programs that read machine code, critical analysis has extended beyond the “culture layer” and reached deep inside the machine. This is not a bad thing but it does raise certain questions: Is attention to code-level and machine-level formal elements part of a retreat from cultural politics? Or are such moves, such machinations, an attempt to shore up a fledgling critical discourse and provide it with its own grammar and set of analytical tools? How does the privileging of code and coding, with attendant expertise, limit the discourse to certain participants? What and who are enabled to speak in this dialogue about what matters, where meaning is located within games?<sup>7</sup>

As a humanities scholar with extremely limited coding expertise who has worked around, with, and through computers for the better part of two decades now, I find myself on alert when discussions about disciplinarity become discussions of transdisciplinarity—where scholars must transcend their own backgrounds and prove themselves adept at not *just* decoding but also coding the objects of which they write and study. It would be a great act of hubris for me to declare my years in IT and moments of Unix expertise to be on par with my skills earned through years of scholarly training. And yet . . . understanding how representations—specifically those that are, or are about, the digital—are constructed is my business. That said, while I may look at software tools, interview game designers, and visit production facilities, I can’t claim that *I code*. When I was writing about Andy Warhol, I didn’t dig deeply into finding out the component elements of the medium he used for silk screens or what brand of filmstock he bought to shoot *Empire* (1963–64) on (I mean, c’mon, he was a name-brand American guy in the 1960s. He shot on Kodak.). Film scholars may recognize a long shot with high-key lighting, but they cannot all light a shot like that themselves. Yet, within the terrain of the digital in fields like new media and gaming studies, the ability to code has become treasured as a deeper and more intimate knowledge of the digital. Just what do the scholars of the digital have to prove that those of cinema or painting don’t? And why?

The ease with which digital objects evade and mix up semiotic systems is one reason for a turn to the stable meaning found in lines of code. At the same time, the fluidity and changeability of digital systems make it harder to locate the provenance and origination of digital representa-

tions, in which the digital “brushstrokes” in a work are the result of the manipulation of software, not the direct and literal transfer of paint onto canvas via a brush held in a singular artist’s hand. Instead, digital objects like video games are typically the result of collaborative production process that conceals the labor and, often, the “signature” of those who produced it.<sup>8</sup> So how can humanists approach and understand objects made of code? One answer, evident in series like MIT’s “platform studies” books, is to look more closely at hardware and better understand software. Hopefully, this essay provides another tactic for taking on digital objects by looking at the stream of (analog and material) objects that circulate, promote, and develop around them.

The danger here, of emphasizing the derring-do of code writing or hardware components, is both that it is very rare for scholarly expertise to be so vast and that the meanings of video games, before and after the Crash, may start with code or hardware but they extend much further. Consider the first cabinet for *Computer Space* (1971). The game inside may have been a bust, but that fiberglass frame and its shimmery coat of paint evoked the birth of universes, exploding stars, spaceships, and wormholes. And so it is that I turn to a part of video game history that operates nearly entirely free from memory constraints, input devices, or code limitations. And yet, this aspect of video game history, the history told on packaging, in catalogs and advertisements, tells us a great deal about what companies imagined video games to be, how the public saw games in their first great heyday, and how a great chasm could emerge between the representations of video games *on screens* and their representations in the public imagination—for better or for worse.

Then again, there’s the rub. When Warhol painted in his studio or, for that matter, James Joyce wrote *Ulysses*, his “code” of representation could be, however briefly, disentangled from the medium in which he worked through our understanding of those formal systems of painting and writing. With digital objects, such separation of code and content is more difficult. One’s paintbrush is part of the code, and the code itself is the platform on which the work is positioned, especially while playing the game itself. Yet we experience video games beyond just those moments when we play them, and here game imagery, cartridge art, and packaging all contribute to our experience of the game—or, as media studies scholars have argued of late, part of a game’s paratext.<sup>9</sup> Our temporal experience of the game as a work that is continuously represented is literally encountered through such secondary channels as the cartridge itself, box art, and promotional materials like the Atari catalog. These “para” (or “side by side”) texts do not just support the original work (the game) but become our experience of the

game outside of the time spent actually playing it. Hence such recollections as “I remember the [catalog] picture more than I remember the game.” And there is text, telling the consumer what an excellent gaming system he or she has purchased, and photographs, a beauty shot of the system perhaps, or several depicting its multitude of uses. Thus it begins: the second order of video game representations is never far from the first. Cartridges themselves have designer logos and fonts, usually in full color, while cartridge packaging depicts game narratives or, in the Atari-era, video game narrative aspirations.

So, what to do? Should video game studies become a field for hard-core coders entranced by how an eloquent line of code can unleash the zombie apocalypse?<sup>10</sup> Or should the archivists and culture hounds, each hanging on to their pristine, never-been-played copies of *E.T.: The Extraterrestrial* (1982) dominate the field? With all due respects to both groups, I have to say that while both approaches have their merits, neither must lose sight of the other.

Over a decade ago, when new media studies started to gain traction in the academy, they too emphasized code’s place at the forefront of the field. Scholars who could boast their ability to code in HTML were seen as more credible than those who hadn’t yet fired up their Internet Explorers. This embrace of the formal by video game scholars is but one approach to understanding how games make meaning. Rather than retreat from technology, one must seek to understand it, yet is it necessary to read or produce code to understand and analyze a piece of software?

If we look at the Atari catalog, one answer to these questions is presented, as we can read Atari, the company and its history, through the catalog itself: its structure, illustrations, and discourse all contribute to our understanding of the Atari brand, circa 1979–82. Without ever digging into lines of code, we can find an encouraged and productive way of reading the intermedial text of *Superman* as it travels from comic to television screen to video game screen. A full-color, line-drawn illustration of the Man of Steel conjures up a notion that the video game will closely reproduce the comic’s aesthetics. This image is echoed by the screenshot from the game, depicting the Metropolis skyline, criminals, and Superman flying above the buildings. Alongside catalog text describing the game, these images promote a certain set of expectations regarding Atari’s *Superman*, even if the disparity between the screenshot and the comic image is gaping.

Beginning in 1982, Atari’s catalog was briefly supplemented by *Atari Age* magazine, published until 1984, when Atari was sold to Jack Tramiel. Designed for gamers who were already fans of the system or members of

the Atari Club, *Atari Age* relied on similar graphic illustrations and photography but presented game cartridges and Atari products through a discussion of gaming topics, tricks, and fixes (e.g., issue 1.1 contained the article, “*Atari Age* interviews Pac-Man,” issue 2.1 took gamers “Inside Trak-Ball-Controller”). Like the Atari catalog, *Atari Age* encouraged deep interaction with the company’s products and the emerging Atari culture. Later game companies, perhaps most notably Nintendo, would further develop such strategies that reached out to gamers with the publication of *Nintendo Power* starting in 1988. Publications such as these also supplement and enhance our understanding of video game history, just as women’s magazines take us deeper inside television’s history.

It is absolutely necessary to formally study video game elements—the sounds, images, effects, methods of interaction, and all that occurs on screen and through controllers—in order to understand video games as objects of study. Yet this study of the formal must not be about the emergence of a certain “class” of elite scholars who code, nor about a retreat from the cultural politics games engender, are surrounded by, and participate in. What game scholars know—and what others are just beginning to appreciate—is that the field of video games is both vast and deep. There is room for multiple approaches and methods to studying games, though we are smart to pause and question what methods are most suited to this new field. The first round of such metadiscourse took place in the extensive ludology versus narrative discussion of the first few years of the century.<sup>11</sup> Video game methodology remains an open question: one we should keep debating as video game studies continues to grow and gain respect in the academy. From narrow, “textual” approaches to those that are more interdisciplinary—for example, combining humanistic methodologies with quantitative research on gaming effects—much is at stake in how video games become part of the academy.

### . . . BUT LOOSE?

In 1978, movie icon Clint Eastwood, fresh off such tough guy roles as Confederate rebel Josey Wales, his signature police inspector “Dirty” Harry Callahan, and about to portray prisoner Frank Morris in *Escape from Alcatraz* (1979), took a role that departed from those he had come to be known for throughout his career. Taking a shot at broad comedy, Eastwood appeared as trucker Philo Beddoe in *Every Which Way But Loose* (1978), a road movie in which his costar was an orangutan named Clyde. A critical failure but a box office success, the film played upon regional and class dif-

ferences, much like other box office hits of the era, *The Cannonball Run* (1981) or *Smokey and the Bandit* (1977), which *Every Which Way But Loose* has more than a passing resemblance to, as both feature outlaw truckers and quirky Southern characters. The film's title, referring to how a woman turns a man, "every which way but loose," takes on a double meaning here in this essay.<sup>12</sup>

Although I wouldn't characterize the video game industry of the 1970s to early 1980s as being like a freewheeling man still stuck on his woman, as Eddie Rabbit does in his presentation of the movie's themes in the film's title song, there is some sense of chaos and possibility, of uncontained desires and hopes in both video games and the road movies of the era. Video games were still new forms, and the industry was still figuring out how to sell them to gamers. The place of video games in popular culture was largely underdetermined at the time: video games were, indeed, "every which way but loose" before the Crash. They were imagined as fully visualized worlds and stories although the technology of the era could only depict basic graphics and sounds. That genres and modes of interaction emerged at that time that still inform video game design today, is a startling technological and cultural feat. When video games emerged—as home systems and in arcades—they attempted to reach out in every which way they could—as educational systems, as programming tools, as emulators of sports, movies, comics, and other media. In doing so, they laid the foundation for the video games that would come later, establishing how we would imagine gaming as part of our lives and in our homes. The Atari VCS 2600 catalog, advertisements in print magazines and newspapers, and other gaming software catalogs (like the Activision catalog), significantly contributed to our horizons of expectations about video games, helping us imagine and collect games, and fueling our desires to engage and interact with these new virtualities.

The Atari catalog, as both text and metatext, offers us much evidence in this regard. As text, the catalog is a straightforward account of Atari's early game cartridges—their genres, modes of interactivity, and the capability of the system to entertain and educate both young and old. Quickly, this text becomes more specialized, just as the gamer community itself first emerges, through fan clubs and enthusiasts and emphasis on certain kinds of games over a more kaleidoscopic appeal to all audiences. Visually, the Atari catalog was in sync with its other advertising imagery: from box art to cartridge labels and print advertisements, Atari's early aesthetic combined pulp imagery from comics and science fiction with hand-drawn illustration and animation. From 1977–83, the Atari catalog provided key textual evidence of how Atari addressed potential gamers beyond its game

system and cartridges themselves. The catalog's multiple forms of address: screenshots of games depicted inside television "shaped" frames; detailed, full-color illustrations and cartoonlike drawings, as well as textual descriptions promote the system as fun and filled with a wide range of possible entertainment options. As the 1981 catalog puts it, "It does not interfere with normal television viewing . . . The ATARI Video Computer System is designed to provide your family with years of satisfaction." Of course, the video game industry crash would radically change how consumers and gamers would use or not use their Atari systems, as the depressed video game industry in the United States created an ideal environment for new video game systems to enter the market. And yet, over 20 years since Atari has published a catalog, its pages and copies have been lovingly reproduced and distributed online by fans of the Atari system, catalog, and games.

## NOTES

1. See Flickr comments for Jason Santa Maria's photostream: <http://www.flickr.com/photos/jasonsantamaria/193694184/>.

2. See Flickr comments for Jason Santa Maria's photostream: <http://www.flickr.com/photos/jasonsantamaria/193690262/in/set-72157594205133472/>

3. See Christian Metz, "Photography and Fetish," *October* 34, 1985, 85.

4. Or indeed, reading the *Sears* catalog, a document in which early Atari systems appeared.

5. See Wikipedia, "Chase the Chuck Wagon," accessed June 16, 2010, [http://en.wikipedia.org/wiki/Chase\\_the\\_Chuck\\_Wagon](http://en.wikipedia.org/wiki/Chase_the_Chuck_Wagon).

6. See Raiford Guins, "In Memoriam, Concrete, and Clay: The Life and Afterlife of *E.T. The Extraterrestrial* for the Atari 2600," *Design and Culture* 1.3, 2009, 345–64.

7. See Lawrence Lessig on computers, code, and the computer layer's connection to the culture layer in *Code Version 2.0* (New York: Basic Books, 2006).

8. How game developers are credited within video games and in the industry is an important part of video game history—from the formation of Activision by a group of disgruntled former Atari employees to the rise of game auteurs like Will Wright and Shigeru Miyamoto.

9. See Jonathan Gray, *Show Sold Separately: Promos, Spoilers and other Media Paratexts* (New York: NYU Press, 2010).

10. Yes, I know I'm being polemical but there is a point—digital media studies lost years to this elevation of the "scholar that codes." I do not want video game studies to lose time to such a debate or to become a field divided between those who code and those who do not code.

11. Mark J. P. Wolf has smartly pointed out to me that many gaming scholars see the ludology versus narrative "debate" as a false dichotomy. This may indeed be true, yet much ink was spilled and passionate discourse took place that was,

as much as it may be a false dichotomy, about defining the terms and terrain of video games and their analysis.

12. The film's title also has other resonances, particularly as the phrase appears in Zora Neale Hurston's *Their Eyes Were Watching God* (1937), in a passage about a knife fight.

KAREN COLLINS

## One-Bit Wonders

*Video Game Sound before the Crash*

The sound of the early video game arcades is probably embedded in the consciousness of everyone who was a child during the late 1970s and early 1980s. To walk into an arcade was to experience an overwhelming onslaught of crashes, laser guns, synthesized speech, and electronic beeping music, all competing for our attention. There have been several attempts to recreate the video game arcade atmosphere (such as Andy Hofle's Arcade Ambience Project<sup>1</sup>), and the few existing soundscape recordings have been so popular that they were released on CDs.<sup>2</sup> A website selling the CDs describes, "We will never hear such beautiful chaos quite the same way again." On a *Wired* magazine blog entry about the site, a fan posted, "This is the greatest audio archive ever. I nominate that guy [who put together the collection] for the Nobel Prize."<sup>3</sup> Judging by the popularity of these arcade soundscape recordings, sound played a critical role in the enjoyment and success of early video games, and plays a powerful role in the nostalgia for the time.

It is difficult to completely separate the sound of the early electronic video game arcades from the arcade industry that existed prior to the development of digital (solid-state) games. It was the electromechanical and slot machine gambling industry that gave birth to video games as commercial products. Most of the companies entering the video game market in the late 1970s already had a strong footing in the pinball and novelty arcade machine industry, as well as in slot machines. Bally Manufacturing Company, for instance, began in the 1930s with *Bagatelle*, a French parlor game similar to bumper-billiards that they adapted and developed into the first

pinball machine. Midway Games, who worked closely with Taito to bring popular video games to the American market, was a subsidiary of Bally. Although Bally no longer creates video games (after selling the video game portion off to its rival, Williams), the company continues to create slot machines and electronic lottery machines. Williams Manufacturing had been around since the creation of 1934's *Contact* game, perhaps the first pinball game to have sound, and entered the video game industry with a clone of *PONG* (1972) in 1973. Sega and Gottlieb likewise began as pinball and mechanical arcade companies and eventually entered the video game market.

Pinball and other electromechanical arcade games included sound in the machines very early on. At first, this was bells and buzzers; later, mechanical ball-bearing chimes created simple musical tones, such as those in 1976's *Bally Freedom*.<sup>4</sup> It was not until the late 1970s that pinball machines used electronic sound components. Some electromechanical arcade games (pinball, gambling race games, shooting games, etc.) had four-track and later eight-track tape player units incorporated into them to play music and sound effects. One archivist describes the tapes:

Some of the tapes are simply used for background music and/or sound effects. Others had audio tracks dedicated to particular game functions. For example, the *Wild Kingdom* tape just has the same jungle sound effects on every track. But the *Haunted House* gun game has four discrete audio tracks: one for the background and the other three for specific target sounds. Also, some Chicago Coin gun games offered an optional 8-track player but did not include a tape. They expected the operator to supply a pre-recorded 8-track with whatever music they wished. The flyer for Funland put it this way: "Musical background can be changed to fit the mood of its locale."<sup>5</sup>

Hybrid electromechanical/solid-state games also existed, combining eight-track tapes with analog or digital sound. For instance, in Atari's *Triple Hunt* (1977),

the 8-track tape is used for background sound effects only. The game's microprocessor generates all other game sounds. *Hit the Bear* and *Raccoon Hunt* use the same background sounds: 30 seconds of nighttime forest sounds—crickets, frogs and lots of background noise. *Witch Hunt*, on the other hand, was a much more elaborate production. [It is] 3 minutes and 26 seconds of spooky sound effects: wind, blood-curdling screams, creaking doors,

pounding heartbeats, wolves, and even some speech playing backwards. It's no wonder most *Triple Hunt* games on location were set up for *Witch Hunt*.<sup>6</sup>

The early game companies—Bally, Williams, Gottlieb, Sega, Midway, and others—had well understood the importance of sound in attracting players to the machines and keeping them interested when they entered the video game market. The very first (un-marketed) video games had no sound, but the games that were commercially developed and marketed for the arcades included sound and marketed it as a key selling point.

This essay describes sound in video games up until 1983 and is divided into three parts: “How Sound Was Made” explains the technology that was being used to create sound effects and music in games in the early days; “How Sound Was Used” describes the ways in which sound was commonly employed in games; and “Key Influential Games for Sound up to 1983: A Series of Firsts” outlines some of the key sound innovations during the time period before the Great Video Game Industry Crash of 1983.

## HOW SOUND WAS MADE

Sound waves are described using three properties: wavelength, frequency, and amplitude.<sup>7</sup> The *wavelength* is the distance from one peak of a wave to the next, or the distance between maximum compressions. *Frequency*, the technical name for pitch, is a measure of the number of pulses (waves) in a given length of time. It is measured in hertz (Hz) or cycles per second (CPS). For example, a wave with a frequency of 440 Hz (the musical note “A”), means that in one second, 440 pulses occur. Shorter wave lengths result in higher frequencies. *Amplitude* is the measure of the amount of energy in a wave (technically, the amount of compression the wave is under), typically described as intensity or loudness. The more energy a sound has, the more intense, or loud, the sound results.

Most sounds, in addition to their fundamental frequency, have extra harmonic frequencies that are a ratio of the fundamental frequency, which give the sound its character or timbre. Pulse waves contain only odd harmonics and are rectangular waveforms with “on” and “off” slopes, known as the *duty cycle*. When the duty cycle is of equal length in its on and off period, it is known as a *square wave*. Changing the duty cycle options (changing the ratio of the on to off) of the pulse wave alters the harmonics. At 50 percent (square wave), the waveform is quite smooth, but with adjustments, a pulse wave can be “fat,” or thin and “raspy”). Pulse waves are often

referred to as “hollow” sounding, or slightly “rough,” and were the most common sounds for video games of this early era.

Sound in video games before the mid-1980s commonly used one of two technologies: beepers or programmable sound generators. Although driven by digital technology, beepers were analog sound generators. Analog sound records and produces the electrical output of sound waves as they occur, whereas digital sound breaks the information down into a series of 1s and 0s (on and offs) and stores that numerical information to later reproduce the sound.<sup>8</sup> Although early games used analog circuitry, this sound was typically controlled and manipulated digitally, and was nearly always some form of pulse wave.

### *Analog Sound: PC Speakers and Piezoelectric (Beeper) Audio*

Beepers are simple speakers, and in the early days were typically “on board,” meaning they were attached directly to the motherboard of a computer. Early video games and electronic toys sometimes used what is called a piezoelectric speaker—colloquially referred to as a beeper, since a “beep” was about all they could handle, and they were often found in simple appliances to use to make warning beeps. *Piezoelectricity* is the term used when mechanical stress is placed on a material—in this case, ceramic—generating electricity and mechanical resonance. Piezoelectric microphones are commonly used in pick-ups for guitars, and piezoelectric technology is used in a variety of speaker systems, such as portable radios and watches. Piezoelectric speakers have a limited frequency range and are typically used today in only very inexpensive devices, for example, a sonar or sensor. They are, however, cheap, small, and thin, so can be useful in a variety of toys and small electronic devices.

Sound is made on a piezoelectric speaker by the piezoelectric diaphragm, a small ceramic plate with electrodes on both sides, attached to a metal plate (see Fig. 8.1). A DC voltage is applied between the electrodes, causing a mechanical distortion that bends the diaphragm back and forth, causing a sound wave. Sound can therefore be generated by turning the piezoelectric speaker on and off in rapid succession, bending the diaphragm many times a second. A 2000Hz tone, for example, requires the speaker to be turned on and off 2000 times per second. For 11kHz tone, the wave would need to be toggled at 11000 times per second.

Early handheld video games commonly used piezoelectric technology. Mattel’s LED-based *Auto Race*, which came out in 1976 and was the first all-electronic handheld video game, used a simple piezoelectric speaker. The game was programmed by Mark Lesser, who noted in an interview, “The sound was implemented using a single output and a piezo-ceramic

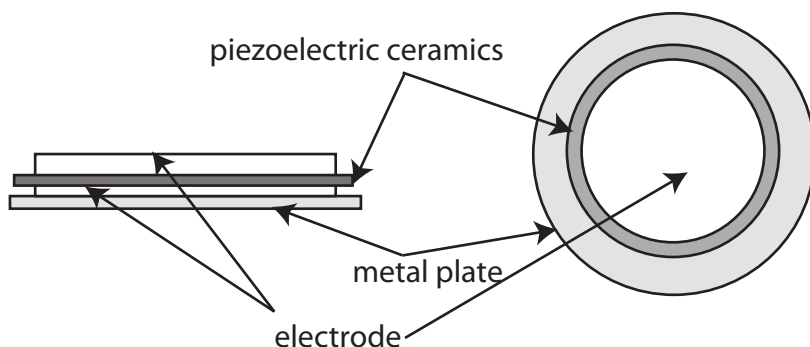


Fig. 8.1. Piezoelectric diaphragm, side and top view.

speaker—one output line to generate sounds and music, such as it was, without any sound driver hardware. The toggling of the speaker had to occur within the program loop, with variable timing to produce tones”<sup>9</sup> Although *Auto Race* may have been the first, *Football*, released June 1977, was probably Mattel’s most popular seller. Right from these early days, sound was nearly always used as a selling point. A description in the 1978 *Toy Fair* catalog advertised, “Cut back, avoid tacklers, run for daylight! Score and hear the Victory Sound!”<sup>10</sup> Mattel’s *Football II*, released the following year, boasted: “Simulated game sounds include whistle and the victory tune for those hard-fought touchdowns and field goals.”<sup>11</sup> Although these early Mattel LED games primarily had just simple sound effects, at least one had music: *Missile Attack* (1976, later released as *Battlestar Galactica Space Alert*) played “Taps” when the player lost.

Home computer internal speakers were also referred to as beepers, since they, too, often emitted no more than a simple beep. At best, a home computer speaker was a simple one-channel, square wave tone that could play at different frequencies through its 2-inch speaker cone. These were electromagnetic speakers, in which two magnets create a repulsion and attraction, pushing and pulling the speaker cone in a similar fashion to a piezoelectric speaker’s diaphragm, with the frequency and amplitude of the input wave dictating the rate and distance that the speaker voice coil moves. The speakers would commonly have just two levels of output: they were, in other words, 1-bit sound.

This 1-bit sound could be improved slightly by using what is known as pulse width modulation by controlling the analog circuit with the digital computer timer. In other words, it was possible to digitally encode the analog sound through the use of high-resolution counters. Since the speaker

could produce two sound levels (on and off—the cycle of on to off representing the frequency of the pulse wave), it was possible to carefully time the pulses of sound waves so that the speaker left in the “off” position for a fraction of a millisecond emitted sounds in between the on and off levels, thereby increasing the possible frequencies.

In the analog days of electromagnetic and piezoelectric sound technology, the sounds that were available were dependent on the hardware circuitry. The *PONG* sound—like many early games successes—was a bit of an accident, as creator Al Alcorn recalls:

The truth is, I was running out of parts on the board. Nolan [Bushnell, Atari’s founder] wanted the roar of a crowd of thousands—the approving roar of cheering people when you made a point. Ted Dabney told me to make a boo and a hiss when you lost a point, because for every winner there’s a loser. I said “Screw it, I don’t know how to make any one of those sounds. I don’t have enough parts anyhow.” Since I had the wire wrapped on the scope, I poked around the sync generator to find an appropriate frequency or a tone. So those sounds were done in half a day. They were the sounds that were already in the machine.<sup>12</sup>

A 1976 game machine programming guide described how audio was driven by the hardware and vice versa: “Sound circuits are one of several areas which show little specific similarity from game to game. This is a natural result of designers needing very different noises for play functions of games where the theme of the machines varies greatly. For example, a shooting game requires a much different sound circuit design than a driving game.”<sup>13</sup> This hardware specificity changed somewhat with the development of dedicated sound chips, or programmable sound generators.

### *Programmable Sound Generators*

Programmable sound generators (PSGs) are sound chips designed for audio applications that generate sound based on the user’s input. These specifications are typically coded in assembly language to engage the oscillators. An oscillator is an electrical signal that generates a wave form, and sine waves are the most common form of oscillator. An oscillator is capable of either making an independent tone by itself, or of being coupled cooperatively with its neighbor in a pairing known as a tone generator. The tone generators produce the tones, typically as a square wave. In the late 1970s and early 1980s, PSGs generally had three separate tone generators (see Fig. 8.2). There was also typically a noise generator, usually a pseudo-random

pulse-width square wave output. Mixers combined the tone and noise generators. Amplitude controls gave the digital-to-analog converter a fixed or variable amplitude pattern. An envelope generator produced an envelope pattern to shape the sound. Instrument sounds are typically created with both a waveform (tone generator) and envelope generator.

Various effects, such as vibrato (frequency modulation) and tremolo (volume modulation) could be simulated or created using different techniques. Frequency sweeps could be used for lasers, whistling bombs, race cars, and so on. Doppler and noise sweep effects were useful for racing games, and the noise channel could be used for gunshots, explosions, and other sound effects.

The programmable sound generator chips, however, were primitive by today's standards, and the accuracy of frequencies varied, meaning they were commonly slightly out of pitch. The 1979 General Instruments (GI) manual for the AY-8910/8912 series, for instance, explained: "The nature of the PSG divider scheme produces a high degree of accuracy for low frequencies, less for high frequencies."<sup>14</sup> They even go so far as to provide a chart of ideal frequency and actual frequencies. The AY-8910 (and deriva-

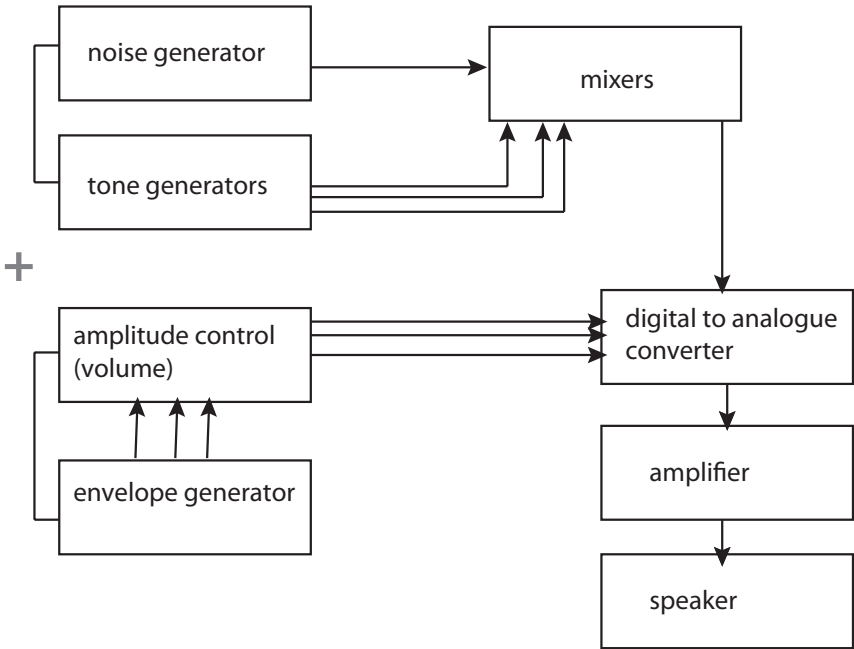


Fig. 8.2. The Programmable Sound Generator.

tives) found its way into a variety of home computers and games consoles including the Sinclair ZX Spectrum, Amstrad CPC, Mattel Intellivision, Atari ST, and Sega Master System. Many video game PSGs were created by GI or Texas Instruments, but some companies, such as Atari and Commodore, designed their own sound chips in an effort to improve sound quality.<sup>15</sup>

### *Programming Sound*

Sound had to be created by the game's programmer, a very time-consuming process. Early games were typically programmed in assembly language. A simple beep, for instance, would take nearly 20 lines of code.<sup>16</sup> An understanding of programming was essential for any game audio personnel, however, since software sequencers and MIDI did not yet exist for composers. According to Hitoshi Sakamoto, "The priority for Japan[ese] game companies was to hire people based around this level of computer literacy, as opposed to their composition skills . . . The process of composing was 10 percent notes, and 90 percent programming those notes."<sup>17</sup> Mark Turmell, a game designer for Sirius and later Fox Video Games and Activision, creator of *Fast Eddie* (1983), *Turmoil* (1984), and others, explained that sounds involved a lot of testing: "It's an intricate process . . . Sounds are made up of numbers in a computer. It often starts on a random basis."<sup>18</sup> Nintendo composer Hirokazu "Hip" Tanaka elaborates: "Most music and sound in the arcade era (*Donkey Kong* and *Mario Bros.*) was designed little by little, by combining transistors, condensers, and resistance. And sometimes, music and sound were even created directly into the CPU port by writing 1s and 0s, and outputting the wave that becomes sound at the end. In the era when ROM capacities were only 1K or 2K, you had to create all the tools by yourself. The switches that manifest addresses and data were placed side by side, so you have to write something like '1, 0, 0, 0, 1' literally by hand"<sup>19</sup> Rob Hubbard, a well-known composer of Commodore 64 games, noted, "Basically you had to learn assembly language programming to get anything done on these machines . . . very, very low-level assembly programming to get it all to work. There were no high-level tools or methods of being able to get the music in."<sup>20</sup>

The fact that composers had to be programmers often meant that the music—typically just theme songs—was created by programmers with little or no training in music. In some cases, songs were translated from sheet music into code, often with errors.<sup>21</sup> Rob Hubbard describes his entry into the industry: "The games that were around in like, 1982, 1983, most of the music was done by the programmer. The programmer did everything in those days, and some of the music was just absolutely diabolical. I mean,

it was embarrassing, you know. It was like a drunken monkey . . . on the piano, trying to play the Blue Danube or something . . . and I thought, there has to be an opening for somebody that can at least get the notes right . . . in the correct order, for God's sake."<sup>22</sup>

## HOW SOUND WAS USED

### *Coping with Constraints*

The difficulties involved in the available technology were numerous. Not only did composers or sound designers have to be programmers, but the computer and sound hardware had many limitations. In most early games, there was no background music, simply because the processors could not simultaneously process sound, graphics, and interaction. At best, then, games would have short theme songs that played at the beginning, in cut-scenes (short, non-interactive sequences between levels), or in attract mode (see later discussion).

Memory was a significant problem, noted Garry Kitchen, a developer for a variety of systems: "You put sound in and take it out as you design your game. You have to consider that the sound must fit into the memory that's available. It's a delicate balance between making things good and making them fit."<sup>23</sup> Another significant problem was porting (translating) between games systems—an arcade game, a home console, or a home computer, for example, had different sonic requirements, and each system had unique sets of limitations. Ben Daglish, a popular composer of Commodore 64 music, described the process: "For me there was always a Platonic ideal. I'd have a 'perfect' version of a tune in my head that involved 'real' instruments, and then it was a case of arranging it for 3 voices, or even a 1-voice beeper (this was horrible, really horrible) . . . One would start with the SID version [the Commodore 64 audio hardware] then have to 'downgrade' to the others."<sup>24</sup> Similarly, composer Chris Hülsbeck commented, "You always work[ed] with what you had and you always wish[ed] you had more, but it can be very satisfying to make a great piece of music within those limitations. The Commodore 64 computer was the first generation that could do more than just simple bleeps and that's why it attracted such a following among computer music enthusiasts . . . The most important difference was not the format how the music was sequenced, since that stayed fairly similar, but the difference in the sound chip."<sup>25</sup>

Although composing music for the systems was difficult, some programmer-composers enjoyed the challenge and believe it helped creativity. As Hitoshi Sakamoto says, "The process was inefficient. This can be seen

as an advantage, because despite technological limits, composers then had to focus on the essence of music-making. Each individual note and choice of sound effects was carefully examined for its effectiveness. Composers today should still maintain this approach of questioning each note for its usefulness . . . If you were a composer, you had to convince your audience it was not noise.”<sup>26</sup>

### *Sound as Information*

Recent research into video games has often made comparisons between games and films.<sup>27</sup> Certainly there are many points of comparison between the functions of sound in film and recent games.<sup>28</sup> However, today’s console games make use of 3-D sound to help orient the player and to indicate off-screen (acousmatic) events, draw us in emotionally, and create a sense of place in space and time. In the early days, sound had much simpler functions. There was very little attention paid to the rich role that sound can play in helping to create a scene, set a mood, and so on. This is not to say that emotion played no role—the simple four-note marching feet of *Space Invaders* (1978) would have undoubtedly influenced the engaged player as the aliens sped up to kill off the player’s character. Likewise, sound was used to emotionally draw the player into the game, or at least *toward* the game.

A primary focus of sound in arcade consoles was the “attract mode” function. Games in the arcades competed for the attention (and money) of players, and sound was an important way to draw attention, differentiate the machines, and remind players of previous enjoyment. This function perhaps grew in part from the years of experience many of the early video game companies had in the pinball and slot machine industries. Flyers for the games highlighted the importance of the attract function: “Super crowd-attracting race car sound effects” promises the flyer for Atari’s *Gran Trak 10* (1974),<sup>29</sup> and Meadows’s *Lazer Command* (1976) advertises “The ‘never before heard’ sound effects attract attention to the game when not in play.”<sup>30</sup> Kee Games’s *Tank!* (1974) goes so far as to use onomatopoeia in its flyer: “Suddenly, the crunching, clanking sound of another tank tread is heard. A shell bursts near your tank! . . . Your shell “WHIRRS,” and then . . . the ground shakes as it explodes.”<sup>31</sup> Clearly, since the promotional purpose of flyers is to convince store owners to purchase the machines, sound was an important purchase driver for the arcades. Simple sound effects were used to draw players—as in the pinball game *Locomotion* (1982), which whistled like a train, and Gottlieb’s *Reactor* (1982) with a short, repeated guitar riff.<sup>32</sup> More advanced, digitally sampled or synthesized speech was used to taunt players and entice them to play. Sega’s *Space Fury* (1981), for instance, had an alien figure call out “Is there no warrior mightier than I?”

and “Does anyone dare challenge my imperial fleet?”; Stern’s *Berzerk* (1980) would say, “Coins detected in pocket.”

When examining the early days of game sound, it may be more useful to put film theory aside and draw on research into interface design and auditory displays. In these sub-disciplines of computer science and design, sound plays an information-based role (although aesthetics comes into play in the perception of usability of the sounds). It is this information-based interaction with the sound that is at the heart of early game audio. In other words, sound in early games can be more ideally viewed as information and feedback-based.

Most sound in early games was feedback based on the player’s actions: the player was injured or died, was under attack, had taken an action (fired a gun, jumped, bumped into a wall), had earned points, or was experiencing a change in game-state (for instance, a new level begun). As previously discussed, sound in early computing was designed for error beeps and prompts, and the combination of technological constraints and computing history probably contributed to sound’s use as simple feedback device in early games. For example, the *Consumer Reports* November 1980 report on games describes the use of sound as a feedback device in the description of *Vanity Fair’s Computer Matician 3010* tabletop model: “The correct answer elicits a high-pitched, repeating beep and the word ‘right’ flashing at the top of the screen. An incorrect answer is punished by a penetrating low buzz and the word ‘wrong’ flashing at the bottom of the screen . . . most of the children were unnerved and annoyed by the strident beeping and buzzing.”<sup>33</sup>

The other form of audio feedback or prompt was, of course, an alert to the player that they should take an action—that their spaceship was under attack, that an encounter with an enemy was imminent, that time was running out, and so on. In these cases, the game is expecting some form of response from the player. Turning the sound off, therefore, would be detrimental to gameplay, highlighting the importance of sound to games. The July 1983 issue of *Electronic Games* magazine tells the player of the Entex AdventureVision’s *Super Cobra* (1982), “*Super Cobra* makes use of a range of sound effects to enhance the play. Listen to these special tones since they frequently warn you of what type of enemy the helicopter will face next.”<sup>34</sup> For AdventureVision’s *Space Force* (1982), the same guide notes: “Pay close attention to the sound effects. The approach of alien ships are [*sic*] signaled by alien cannon fire. This alerts you to be prepared to shoot. Since the small spacecraft is worth 1000 points, you don’t want to let it slip past you.”<sup>35</sup>

These information-based uses of sound (alerts, prompts, and feedback) were the primary functions of sound in video games in the early days, and

it was not until more advanced sound chips became available that poly-phonic music became commonplace.

#### KEY INFLUENTIAL GAMES FOR SOUND UP TO 1983: A SERIES OF FIRSTS

Although there were many games that were influential to the development of sound for video games, there were a few key influential games that are worth discussing for their innovations in the area of sound:

1971: *Computer Space*, designed by Nolan Bushnell and Ted Dabney at Nutting Associates. *Computer Space* was the first mass-produced arcade game, and had simple beeps and crashes. A flyer advertising the machine highlights its sound-based interactions with the user: “The thrust motors from your rocket ship, the rocket turning signals, the firing of your missiles and explosions fill the air with the sights and sounds of combat as you battle against the saucers for the highest score.”<sup>36</sup>

1972: *PONG*, designed by Nolan Bushnell (adapted from a game by Ralph Baer). Based on the original game developed by Ralph Baer, Nolan Bushnell (who had created *Computer Space*) formed Atari Inc. and released *PONG*. Once again, sound is highlighted in the original flyer: “Realistic Sounds of Ball Bouncing, Striking Paddle.”<sup>37</sup> Of course, the sounds were far from realistic, and have gone down in history for their simple sine-wave bloopers.

1974: *Touch Me* from Atari. Taking advantage of the simple sound capabilities of early handhelds, Atari was one of the first to release an electronic musical-memory game. *Touch Me* was released as a coin-operated arcade machine in 1974 and as a handheld in 1978. *Touch Me*’s original 1974 flyer discussed the use of sound: “‘Beep’ or ‘Bleep’? *Touch Me* challenges the player to remember the sequence of sight and sound, and correctly repeat the pattern . . . When the sound occurs, the corresponding button lights to give a visual clue . . . Did you correctly repeat those sounds when the button lit?” There were four buttons and four tones on the machine whose patterns would get progressively more difficult. Ralph Baer, who would later redesign the game as *Simon*, recalled, “I was in Chicago attending an MOA (Music Operators of America) show of coin-op devices. I went to these shows routinely on Sanders’s and Magnavox’ behalf to check on the presence of games that might infringe our patents, for which Magnavox was our primary licensee. Atari had several coin-op units at the show. One of these was “Touch Me” . . . Howard Morrison also saw “Touch Me” and played it . . . Some time later, we discussed the game. We both came to the

same conclusion: Nice game idea, terrible execution . . . visually lousy, miserable sounds!”<sup>38</sup>

1976: *Missile Attack* was perhaps the first electronic handheld LED game with music (although not the first with sound generally): it played “Taps” when the player lost.

1977: Atari’s earlier *Touch Me* did not catch on until it was redesigned by Baer for Milton Bradley and released as *Simon* in 1977. Similar to *Touch Me*, each button on *Simon* had a corresponding sound and color, and increasingly difficult melodies had to be memorized. This time, Baer improved on the sounds, as he describes his selection: “I took on the job of selecting the four tones, which was a non-trivial matter because the tones actually define much of *Simon*’s character. Looking through my kid’s Compton Encyclopedia for an instrument that can play a variety of tunes with only four notes, I found what I was looking for: The bugle! Henceforth, *Simon* was programmed to beep G, C, E, and G . . . the bugle sounds that can be played in any sequence and still sound pleasant!”<sup>39</sup> Also in 1977, Project Support Engineering’s game *Bazooka* was possibly the first arcade game to offer stereo sound effects, and Exidy’s *Circus* was possibly the first arcade game to have music, although as shown earlier, digital handheld games had music by this time. The music would play when the player got a bonus (stopping the action to play the music). When the player died, a brief funeral march was played.

1978: *Space Invaders*, designed by Tomohiro Mishikado and released by Taito/Midway, was possibly the first game to have on-going background music/sound effects, the four-note marching feet of the aliens.

1979 (Japanese release) / 1980 (North American release): *Pac-Man* (Taito/Midway). The continuing prominence of one particular game sound, Pac-Man’s “waca waca” (in English, the sound the character makes when eating, which was allegedly referred to as “Pakku-Pakku” in Japan, leading to the name of the game<sup>40</sup>), is clear evidence of the significance of this influence. In the 1980s, the sound was incorporated into popular songs such as Buckner and Garcia’s “Pac-Man Fever” (1982) and “Weird Al” Yankovic’s “Pacman” (1983). More recently, it has been used by the bands Aphex Twin, Bloodhound Gang, DMX, Lil’ Flip, and many more. *Pac-Man* was possibly the first game to feature full cut-scene music, although, as noted, *Circus* had a short bonus music clip.

1980: *Berzerk* and *Stratovox* were the first arcade games to employ speech synthesis, although Williams had used speech in their pinball machine *Gorgar* a year earlier. Tony Miller, chief engineer at Stern Electronics described: “The Williams pin *Gorgar* was out when we were working on *Berzerk*, and we thought it would be good to add voice. But *Gorgar* used a

better synthesis system than ours. The robots seemed to go well with the cheap version of synthesis we used.”<sup>41</sup> *Berzerk* had a few simple phrases, such as “Help Me! Help Me!,” “Very Good,” and “Lucky.” *Stratovox*, released by Taito, likewise used voice the same year. The games used a Texas Instruments SN76477, a 1.5MHz chip that drained memory on the computers, causing the sound to be highly distorted.

1981: Nintendo’s *Donkey Kong*. A well-known bass-line created by Nintendo master game designer Shigeru Miyamoto and borrowed from John Lennon’s “Ballad of John and Yoko,” permeates the gameplay. The same year, *Frogger* introduced us to on-going dynamic background music. The game, in which the player guides a frog past cars and over moving logs into a series of four safe-houses, used at least eleven different gameplay songs, in addition to “game over” and level start themes. The player began in the main gameplay theme; when he or she successfully guided a frog into a safe house, the song would switch to another quite abruptly, continuing until a new frog either was successfully guided into another safe house (new song) or died (gameplay song).

1982: *Journey Escape* was released for arcade and a port by Data Age for the Atari 2600. This was the first game to feature a popular music artist, the band Journey, and probably the first arcade game to use cassette bonus tracks. Engineered by the band’s manager, Herbie Herbert, the game contained just the song “Don’t Stop Believin’” (1981) when it was originally released for the Atari VCS home console in 1982. Recently, vocalist Steve Perry admitted he was against the game, “Cause I thought it was silly. I’ve come to find out that there’s a generation of kids who think it’s classic and wish they could find the arcade version. But I personally thought it was dumb . . . Because I thought that we were big already, that we didn’t need a video game.”<sup>42</sup>

The same year, another popular music cross occurred: Data Age gave away free records to customers in September 1982. The 3.5-minute stereo discs were given to retail customers to promote the Data Age product line, which included *Sssnake* (1982), *Warplock* (1982), *Airlock* (1982), *Bugs* (1982), and *Encounter at L-5* (1982). The record, called *Mindscape*, included sounds from the game, produced by Craig Hundley, creator of special electronic music for films such as *The Black Hole* (1979), *Star Trek: The Motion Picture* (1980), *Firefox* (1982), and others.<sup>43</sup>

Also in 1982, *Q\*bert*, although not the first, was perhaps the video game character most well-known for his speech (and perhaps the first video game character to swear). The arcade game also used a knocking sound in the cabinet that would bang when the character fell off the pyramid, as creator Warren Davis described:

One other thing should be credited and that is the knocker which would bang the cabinet after Q\*bert disappeared from the bottom of the screen after a plunge. This was the idea of Rick Tighe, one of our technicians. He put a standard pinball coil in a test cabinet so that I could trigger it at the appropriate time. I didn't actually like the knocking quality of the sound. I wanted more of a thud, so it would sound like a sack of potatoes [*sic*] being dropped. With a little experimentation, we found that a small piece of foam glued to the right spot produced what I thought was the perfect thud. Unfortunately, the gluing of the small piece of foam was deemed too labor intensive for production and wasn't done. But the effect was still fantastic. The knocker was controlled by a DIP switch, so an arcade operator could turn it on and off.<sup>44</sup>

The speech and sound effects were created by David Thiel, according to Davis: "Dave created all the sounds, many on his own, some in response to my suggestions. Dave was the one who came up with the idea of using the random phonemes of a speech chip to make Q\*bert speak gibberish. Contrary to modern myth, he is speaking only gibberish. Nothing was ever programmed to be said specifically, with the exception of "Hello, I'm turned on" when you power the game up and "Bye-bye" at the end of a game."<sup>45</sup> Thiel, who programmed Q\*bert's "voice" using the Votrax speech chip, elaborated:

In the late 1970s, pinball designers were the human interaction researchers of the day. It was their desire to do more with interactive sound that led them to use synthesis rather than prerecorded audio . . . When I began working at Gottlieb, I tried to use subtractive synthesis where I started with a sound and then sculpted it with filters. I knew that many desirable effects could be created with just a noise generator and a versatile filter whose properties could be changed over time. Unfortunately, the minimal system synthesizer did not have enough horsepower. I built some filters that worked, but I could only change their properties as a power of two and the results did not have enough gain or variability to be of any use . . . Because I was developing these sounds in a commercial environment, I was under pressure from management to build a library of sounds that could be reused to speed up development. I resisted this approach because I wanted each game to have the best and most appropriate sounds. However, I needed to find ways to somehow speed up development to keep management happy

while still being able to create cool stuff. This led me to create a synthesis algorithm that I called Multi. By setting eight parameters for the Multi synthesis algorithm, I created many distinctive, evocative, and dynamic sounds. The Multi synthesizer provides pulse width, volume, and pitch control over time in eccentric, but useful, ways.<sup>46</sup>

## CONCLUSION

The early years of video games represented a time of rapid development underscored by technological constraints. Developing from the electromechanical pinball and arcade market, early video game sound served first and foremost to attract the player to the machine and to generate excitement in the arcade environment. This function grew from the fact that most of the video game companies of the time had had several decades of experience in selling other coin-operated games for the arcade market and had learned early on the importance of sound.

Due to technological advances, video games now are aesthetically very different from those of the late 1970s and early 1980s, but the key ideas about the roles of sound that were developed during this time still resonate with sound designers today. Although the functions of sound has broadened in today's games, the early era of video games laid the groundwork for the interactive role that sound would play in the form of alerts, prompts, and feedback to the player. Sound was an integral part of gameplay, turning sound off would affect the ability to play the game. Even though the sounds themselves—relatively simple pulse wave tones programmed by hand—were quite simple sounding and low fidelity, they still often define “video game sound” for many, an indicator of their ubiquity and importance during the early days of video games.

## NOTES

1. See Hofle's website, “Arcade Ambience Project Info,” accessed July 14, 2009, <http://arcade.hofle.com/intro.htm>.

2. See Ken Denmead, “Enjoy the Sounds of Classic Arcade Games,” *Wired*, February 2009, accessed July 14, 2009, <http://www.wired.com/geekdad/2009/02/enjoy-the-sound>.

3. See, for instance, the collection for sale on this website, accessed July 14, 2009, <http://www.coinopvideogames.com/sounds.php> (recorded on an old Sony stereo cassette recorder beginning in 1982).

4. It can be heard in this YouTube video, accessed 13 June 2009, <http://>

[www.youtube.com/watch?v=nyLFkW5IUew](http://www.youtube.com/watch?v=nyLFkW5IUew). Video.

5. Details and sound files can be found on the Arcade Archive, accessed June 14, 2009, <http://arcadearchive.com/em/sound/index.htm>.

6. From the Arcade Archive, accessed June 5, 2009, <http://arcadearchive.com/em/sound/info.htm>.

7. The fourth property, velocity, is typically the same for all sound waveforms and so is not discussed here. Elements of this section are drawn from Karen Collins, *Game Sound: An Introduction to the History, Theory and Practice of Video Game Music and Sound Design* (Cambridge, MA: The MIT Press, 2008), 15–18.

8. It is this distinction, and the tiny fluctuations in signal that a digital sampling of an analog sound may miss, that makes some audiophiles prefer (analog) vinyl over (digital) CDs or MP3s.

9. See Scott Stilphen, “DP Interviews Mark Lessser,” *Digitpress*, accessed June 22, 2009, [http://www.digitpress.com/library/interviews/interview\\_mark\\_lesser.html](http://www.digitpress.com/library/interviews/interview_mark_lesser.html).

10. From a 1978 Mattel Toy Fair catalog, page 83, accessed June 22, 2009, <http://www.handheldmuseum.com/Mattel/Cat1978/1978Cat3.htm>.

11. From a 1979 Mattel Toy Fair catalog, page 95, accessed June 22, 2009, [http://www.handheldmuseum.com/Mattel/Mattel1979/Mattel79\\_5.htm](http://www.handheldmuseum.com/Mattel/Mattel1979/Mattel79_5.htm).

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14. See General Instruments, *AY-3-8910/8912 Programmable Sound Generator Data Manual*, 1979, accessed June 12, 2009, <http://dev-docs.atariforge.org/>.

15. See, for instance, Karen Collins, “Flat Twos and the Musical Aesthetic of the Atari VCS,” *Popular Musicology Online*, Issue 1: Musicological Critiques, 2006, <http://www.popular-musicology-online.com>.

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21. William Gibbons notes that all of the songs for the NES release of *Captain Comic* (Color Dreams, 1989) appear to be taken from Denes Agay's *More Easy Classics to Moderns* (New York: Amsco, 1960). See William Gibbons, "Blip Bloop Bach? Some Uses of Classical Music on the Nintendo Entertainment System," *Music and the Moving Image*, 2, no. 1 (2009).
  22. Hubbard, "Golden Days of Computer Music," 2007. Video.
  23. Martin, "Sound in Video Games: How Do They Make It? How Do We Use It?," *Video Games Player*, 1983.
  24. Quoted in Paul Leach, "Music By Numbers: Music & Audio in Video-games," [undergraduate thesis, York St. John University, 2009], 10–11.
  25. *Ibid.*, 12.
  26. Hitoshi Sakamoto, "Experiences and Rare Insights into the Video Game Music Industry," (paper presented at the Game Developers' Conference, San Francisco, March 26, 2009).
  27. See, for instance, Anahid Kassabian, "The Sound of a New Film Form" in *Popular Music and Film*, ed. Ian Inglis (London: Wallflower Press, 2003), 91–101.
  28. See Karen Collins, *Game Sound: An Introduction to the History, Theory and Practice of Video Game Music and Sound Design* (Cambridge, MA: The MIT Press, 2008), 123–38.
  29. See The Arcade Flyer Archive, accessed July 15, 2009, <http://arcadeflyers.com/?page=flyer&db=videodb&id=463&image=2>.
  30. See The Arcade Flyer Archive, accessed July 15, 2009, <http://arcadeflyers.com/?page=flyer&db=videodb&id=1752&image=2>.
  31. See The Arcade Flyer Archive, accessed July 15, 2009, <http://arcadeflyers.com/?page=flyer&db=videodb&id=1167&image=2>.
  32. See The International Arcade Museum: The Killer List of Videogames, accessed July 16, 2009, [http://www.klov.com/game\\_detail.php?game\\_id=9274](http://www.klov.com/game_detail.php?game_id=9274).
  33. According to *Consumer Reports*, November 1980, 654.
  34. See Joyce Worley, "Adventure Vision: Inside the Hardware," *Electronic Games*, July 1983, 116, accessed June 4, 2009, [http://www.handheldmuseum.com/BooksMagazines/Mag-EG\\_0783/EG0783\\_16.htm](http://www.handheldmuseum.com/BooksMagazines/Mag-EG_0783/EG0783_16.htm).
  35. *Ibid.*, 118.
  36. See The Arcade Flyer Archive, accessed 15 July 2009, <http://arcadeflyers.com/?page=thumbs&db=videodb&id=1530>.
  37. See The Arcade Flyer Archive, accessed 15 July 2009, <http://arcadeflyers.com/?page=thumbs&db=videodb&id=795>.
  38. See Ralph H. Baer, "The Simon Story," accessed June 28, 2009, [http://www.dieterkoenig.at/ccc/english/se\\_story\\_simon.htm](http://www.dieterkoenig.at/ccc/english/se_story_simon.htm).
  39. *Ibid.*
  40. See "A Brief History of Pac-Man: A Timeless Classic," accessed July 11, 2009,

<http://www.brighthub.com/video-games/console/articles/12187.aspx>.

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43. *Arcade Express*, September 26, 1982, [http://www.digitpress.com/library/newsletters/arcadeexpress/arcade\\_express\\_v1n4.pdf](http://www.digitpress.com/library/newsletters/arcadeexpress/arcade_express_v1n4.pdf). The game can be heard at Atariage.com, accessed January 23, 2008, <http://www.atariage.com/audio/mindscape.mp3>. MP3.

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## The Rise and Fall of Cinematronics

### A QUICK BUCK

For several decades prior to the eruption of *PONG* (1972) and its clones and mutations, pinball games were the kings of coin-operated amusement. That changed drastically when cathode-ray tube (CRT) displays enabled amusements like *Computer Space* (1971), Nolan Bushnell's coin-operated version of *Spacewar!* (1962), and of course, Ralph Baer's TV tennis game that inspired *PONG*. The new, virtual entertainments brought with them new economic models. Compared to the video games that would eventually eclipse them, pinball machines were expensive to produce and transport. Not so video games like *PONG*. Games that used CRT displays did not take up the large areas required by pinball games, allowing space for extra seating or more games. Even so, one has to ask why so many bar and arcade patrons chose to play early coin-operated video games when pinball obviously offered far more stimulation. In the early years of video games, people were thrilled to manipulate objects in the virtual world, a place few had visited at that time. Pinball games, though arousing and flashy, felt somewhat repetitive and a bit restrictive after so many years of the same type of gameplay. Leaving that and aesthetics aside, the economics of video games were clearly attractive to established amusement operators and anyone who had a small amount of capital. Simply put, they were cheap to manufacture and transport. If video games were a short-lived fad, not much would be lost. If they were more than that, they could be a gold mine. This formula had a strong appeal for Jim Pierce (Fig. 9.1), Dennis Parte,

and Garry Garrison, the new owners of Cinematronics. It was 1975 when Cinematronics first opened its doors, and without consulting an almanac, I think I can say that it was hot that day, because it was almost always hot in the desert of the El Cajon Valley, a location far inland from the nearest, somewhat cooler, city of San Diego, California. Like virtually all pioneers who came to find gold in California, Pierce and his cohorts trod in the footprints of those who went before them, which is to say, they bought the schematics, software, and hardware necessary to make and sell their own copy of *PONG*. Shortly after their initial production run of that game, Parte and Garrison sold their shares to “Papa” Tom Stroud, a veteran of the coin-operated amusement business. Stroud, a frugal soul, saved every silver dollar he came across when working his route’s collections. By the time I met him, he had accumulated enough to fill the frozen freezer chest in his basement. (Yes, he literally saved cold, hard cash.)

After surviving their initiation into the fraternity of men who sold *PONG*, Cinematronics purchased another game, *Flipper Ball* (1976). Little is known of the game, though an online source for video game information, The Killer List of Video Games ([www.klov.com](http://www.klov.com)), has this to say of it: “A colorful video pinball game from Cinematronics. The game has an on-screen, horizontally-controlled flipper which the player uses to knock out bumpers and hit a moving target to score points.”<sup>1</sup> “Colorful” is a reference to the game’s multicolored overlay, as the company began with simple black-and-white raster graphics and would not introduce color until *Solar Quest*



Fig. 9.1. Jim Pierce, co-founder and chief executive of Cinematronics. Photo courtesy of *RePlay* magazine.

(1981). Even color overlays were not used again until *Star Castle* (1980).

Next up was *Embargo* (1976), the first original game designed and programmed at Cinematronics. In the words of engineer and game designer Robert Shaver, “I was a green kid just out of school and I only had chief engineer Bob Long for any kind of help. I did everything on that project except design the cabinet.” I can sympathize. I wasn’t an engineer, but after *Starhawk* I designed all of the game cabinets and hired the artists to execute the cabinet art. For an early black-and-white raster game, *Embargo* was clever and simple. Each of up to four players controlled white-on-black images of a boat that could “drop mines” (turn on white pixels) which would sink any boat that contacted them. This included the player’s own vessel. The rules for the game couldn’t have been simpler: maneuver your boat, press a button to place white pixels in the path of your opponent, and avoid letting your boat touch any of the white pixels, anywhere. When the inevitable collision of white on white occurred, the screen added insult to injury with phrases like “Got his bikini wet,” “Lost his rubber duck,” and, my favorite, “Out runs women and children.” *Embargo* managed to keep Cinematronics alive, but something more was needed to ensure the success of the company.

In 1976, when Garrison and Parte sold their shares of Cinematronics to “Papa” Tom Stroud, Tommy and Dave Stroud, his sons, joined the company as sales reps. Pierce and the Strouds had no idea that soon they would be building and selling one game in record numbers, *Space Wars* (1978). It was a game with origins in the first vector game ever, *Spacewar!* (1962), which was originally designed by Steve Russell, J. Martin Graetz, and Wayne Witanen, who finished the original game at the Massachusetts Institute of Technology in April 1962. There have been multiple, similar versions of it over time. For instance, in June 1971, Bill Pitts and Hugh Tuck put a low end PDP computer and a Hewlet Packard display into a cabinet, and for ten cents students could play *Galaxy Game* (1971), their version of *Spacewar!*, making it the first coin-operated video game.

### SPACE WARS, OR IS IT WAR?

Larry Rosenthal trod his path much in the spirit of his predecessor, Nolan Bushnell. Both were inspired by Steve Russell’s *Spacewar!* though Rosenthal was much closer to the source, having graduated from MIT where the game was created. Rather than build a raster scan version of *Spacewar!*, as Bushnell had before him, Rosenthal created his own low-cost vector display, one similar to the original he first saw at MIT. To do this, he built a custom processor made from inexpensive transistor-transistor logic (TTL)

chips combined with a great deal of ingenuity. One important component was a “watchdog” circuit that insured that the electron beam would never be pointed away from the safe area of the game’s cathode-ray tube. If the active stream of electrons moved off the tube face, the game could burn up and possibly explode. Similar measures were taken to ensure that the electron beam would always be in motion and not permanently burn an image into the cathode-ray tube. Why choose a vector display over a raster display? Excepting Pitts and Tuck’s *Galaxy Game* and the original *Spacewar!*, raster technology was preferred, likely because of cost and reliability. With raster displays, an electron beam sweeps evenly back and forth and up and down across the screen. Circuits respond to programmed memory and turn the electron beam on and off to create images. The downside to this system is that, whether turned on or off, the entire screen must be scanned by the electron beam. The beam can only be moved so fast, so early raster games made up the difference by using pixels, chunked groupings of glowing phosphors that appear as illuminated blocks. For *PONG*, this was perfectly acceptable. For most other games, the result was a blocky approximation of an image. If you were playing video games during the early years, it helped to have a good imagination. This was especially true of home game versions of arcade titles. The cost of electronic memory has always been a limiting factor regarding the quality of video games, and early home game players suffered for it the most. Memory was expensive for arcade games as well, but they made up for it over time. Home games did not have that advantage; because of the cost of memory, the look and feel of home games was impoverished.

Larry Rosenthal was about to bring to Cinematronics something that raster displays could not duplicate well: clean rotations and a frame rate greater than the flicker fusion rate, the speed at which we perceive moving images to be to continuous. For years, the benchmark in cinema was 24 frames per second. Television images advanced this to 30 frames per second, but television interlaces frames and depends on phosphor decay to create a smoother, more “real” moving image than film. In today’s parlance, Rosenthal’s *Space Wars* was “buttery smooth” full frames presented at 30 frames a second, full frames containing glowing sticks of light that you felt you could touch. But it wouldn’t be seen by the general public until 1977. In 1976, with a license from the Massachusetts Institute of Technology to produce a commercial version of *Spacewar!*, Rosenthal began looking for a manufacturer to build units. He was turned down by nearly every video game manufacturer he approached, mostly because he was asking for a remuneration of 50 percent of revenues on every game sold, an unheard of deal in the coin-op business at that time. One company was desperate

enough to take that deal, however: Cinematronics. The collaboration was a huge success, but even though Pierce and Stroud were very happy with their share of the revenues from *Space Wars*, they were not so happy with their arrangement with Rosenthal. Few companies, if any, were willing to split company earnings fifty-fifty with a single game developer. In addition, Rosenthal retained the application patents to his hardware, which he licensed to Cinematronics. This brought him about another \$50 per Cinematronics game shipped, *Space Wars* or otherwise, that used his technology. Sales for *Space Wars* were around 30,000 units. This was not unreasonable for that time, given that the game was one of the top 10 industry earners for almost three years, starting as number one best seller in 1978 and ending at seventh in July 1980, according to estimates from *RePlay* magazine.

Based on manufacturing and sales figures at that time, a reliable number for net profit per unit on sales of upright coin-op games was \$1,000 per game. Manufacturing costs were approximately \$1,000 per unit, and the games were sold to distributors for around \$2,000 each. Through the 1970s and late 1980s, this \$1000-per-unit figure was generally applied. Of course, this varied with the desirability of the game, but given the success of *Space Wars*, it could be assumed that it earned at least the minimum in profits. Doing the math, it appears that, even without Rosenthal's licensing bonus, he should have made almost \$15 million from *Space Wars*, an unheard of amount at that time for someone who was not a manufacturer himself. It made sense then for Larry Rosenthal to become his own manufacturer. He named his new company, not surprisingly, Vectorbeam. Larry's exit from Cinematronics was not without consequence. In a single night, Rosenthal and sales rep Bill Cravens, had removed all of the development hardware and documentation required to create new, original games for the vector-based hardware system.

## VECTORBEAM AND ME

I interviewed for a job at Cinematronics in the late fall of 1976. After talking to co-owner Jim Pierce, I was sent to the tech area to talk to Larry Rosenthal. There he showed me the hardware development system he used to program *Space Wars*. It was a piece of plywood covered with wires, light-emitting diodes (LEDs), TTL circuits, and push buttons that allowed him to manually enter hexadecimal op-codes (HEX codes) into the system. This was the nature of Larry Rosenthal's machine, and it scared the hell out of me. At least I knew how hexadecimal and machine coding worked. But scarier still was my limited computer graphics experience. In that field,

my experience had been entirely with bitmapped graphics like those in the game *Embargo*. I knew next to nothing about vector displays and, as it turned out, almost no one else in the company did either.

During my job interview with Larry Rosenthal, he had little to say to me and answered few of my questions. When I mentioned the possibility of our working together, he was evasive, so I believed that I had failed the interview. That night, I flew home to Kansas City, Missouri, and waited to hear back from some other game companies I had contacted. I was amazed when Jim Pierce called and told me to drive on out. I had the job! After a four-day drive from Kansas City to El Cajon, California, I found myself back at Cinematronics. I was shown to my office, which was the same tech area where I had been interviewed; now empty except for some office furniture, a yellow legal pad, and a pencil. Gone were the circuit boards, push buttons, and logic chips. I met Jim Pierce and the rest of the Cinematronics employees, who informed me that during the four days I was on the road, Larry Rosenthal and salesman Bill Cravens had departed to start their own company in the California Bay Area. They had taken with them everything that might have been necessary or useful for developing games on Rosenthal's vector-based system. However, as long as Rosenthal got his licensing fee, Cinematronics still had the legal right to build games based on his hardware. There was little chance that Cinematronics would retaliate. Rosenthal, as of this writing, is still the owner of a copyright to *Space War*. This adds to the confusion regarding the name of the game. The Cinematronics builds were all shipped as "*Space Wars*," plural. Rosenthal's copyright reads "*Space War*," singular. Quite likely, Rosenthal used the singular title during the time when he had established his own company, Vectorbeam. Regardless, whether "*Space War*" or "*Space Wars*," the game was soon to be at the end of its run. The company's only hope was to build original games based on Rosenthal's hardware, and this created an immediate problem. Prior to the move to Vectorbeam, Rosenthal (or, more likely, Cravens) talked Pierce into firing technician Bob Long, the only person besides Rosenthal to have knowledge of the workings of Rosenthal's hardware and software. I can only imagine what went on between Cravens and Rosenthal, but I choose to believe that Rosenthal was led, not leading. I don't know if I ever heard him say more than a few words even when I was being interviewed by him for my job with the company. To me, Cravens seems the most likely architect of the sudden move to Northern California and the firing of Long, which almost crippled Cinematronics. This wasn't done for spite or anger. Cravens knew that *Space War* was under patent to Rosenthal and that Rosenthal had great potential. Before their move, Rosenthal and Cravens removed all system documentation and development hardware. This could have killed

any chance Cinematronics had of staying in business. Fortunately, and to the relief of all, Long had made a reference copy of the system documentation. Long struck a healthy financial bargain with the company chiefs, but knowing Pierce and Stroud, I'm sure they walked away with a bargain.

With that timely bit of good fortune, Cinematronics was once more able to create new games based on Rosenthal's hardware and codes. However, to create and program those new games, they only had me, a novice programmer with a degree in radio, television, and film. The good news was that I had spent several months programming original games on a hobby computer, the Polymorphic Systems 88. A videotaped play session got me the job at Cinematronics, probably because *Embargo* featured graphics similar to the games I had been programming on the Polly 88 computer (see Fig. 9.2). I don't think Pierce or Papa Stroud realized the enormous difference between bitmapped and vector graphics.

I was very shaky about programming Rosenthal's machine. My prior game programming experience had been with BASIC, an early computer language: Beginner's All-purpose Symbolic Instruction Code. At one point, to try to relieve my stress, I called Tom Defanti, a friend of mine and a professor of computer graphics at the University of Illinois. I had visited

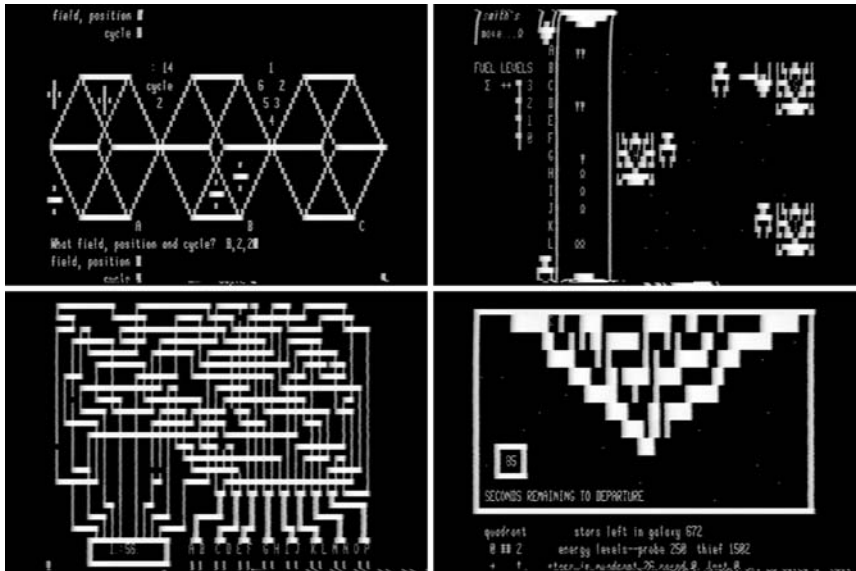


Fig. 9.2. Images from games I designed and programmed on the Polly 88 computer: *4D Tic-Tac-Toe* (upper left), *Back Space* (upper right), *Maze Bomb* (lower left), and *Star Thief* (lower right). Photos courtesy of the author.

Defanti's lab more than once while living in Chicago, and on one of those visits I had seen his vector animation of a spaceship moving down a trench. You saw it too, later on, in the movie *Star Wars* (1977). He offered to send one of his students to help, but there wasn't enough time for that. The techs were busy re-creating Rosenthal's Vectorbeam system, so I busied myself with drawing screenshots on legal pads. My first effort was an idea for a hang-gliding game. The sport was big at the time in California, and I liked the idea of a flying game. However, as I sketched out how the screen would look, I realized that I would have had far too many vectors to render within the system's short cycle time. So, remembering Defanti's lab, I did what so many others would do over the years to come, I made a game that looked a lot like the trench sequence in *Star Wars*. I called mine *Starhawk* and hoped to make up for the obvious "lift" from the movie. To do that, I added one unusual gameplay feature. The primary background image of the game is, of course, a trench running down the center of a rotating sphere. But, in a feature not found on any other game, before or since (to my knowledge), certain attacking ships, if not stopped, directly attacked the digits of the player's score, which was decreased by eight hundred points.

At first, my development tools were limited to yellow legal pads and a pencil. However, engineers Rob Patton, Dennis Halverson, Bill DeWolfe and others put together a new development system that gave me the ability to write and test my programs. Even so, for a while I had to enter them by means of a Telex machine located in a closet. It was damn hot in there, I can tell you.

The Cinematronics technical team was outstanding, creating custom sound boards, software tools, game controls and upgrades to Rosenthal's original hardware. Because of the support of those mentioned and others, I managed to crank out my first game for Cinematronics, *Starhawk*, just in time for an amusement game exposition held in the Alexandria Palace in London, England. *Starhawk* and *Space Wars* used only 4KB of memory, but all future games would support twice that amount. Pierce designed the *Starhawk* cabinet, which had a tendency to tip forward when players were being especially energetic. This was rectified with the addition of a cinder block mounted at the back of every game, a move rather typical of Pierce's design and engineering talents. The company that silkscreened the cabinet graphics also provided the game's cabinet artwork. Hard to believe, but at that time video games were so new that manufacturers had to either build all of a game's components from scratch or find substitutes. For instance, since there were no vendors making trackballs at the time, Atari bought bocce balls, small hard balls used for lawn bowling. The game company then created its own hardware to integrate the bocce balls into the

game cabinets. Because of the popularity of *Atari Football* (1978), bocce balls were for a time unavailable to people who just wanted to play bocce! Joysticks had been in use in many video games prior to their use by Cinematronics, but those earlier devices tended to be expensive and fragile. So, not unlike Atari, Cinematronics devised a way to solve the joystick problem. For *Starhawk*, one of the technicians came up with an unusual substitute for the otherwise expensive user interface. The joysticks for the game were made of flat octagons of one inch iron welded to a length of pipe. The idea was that no springs would be needed to right the joysticks because gravity would handle that. As a bonus, these joysticks would not break! The sticks were held in place with bolts that were meant to be loosely screwed down to allow eight-direction tilt. Most of the games shipped with the joysticks set like that, but many went out with the joysticks (or “joy cudgels” as we called them) tightened down all the way. Fortunately, this was an easy fix for the arcade operators. As you can imagine, there was no chance that these devices would break. We drove filled shipping container trucks over our prototypes as a test, and there was not a scratch on any of the joysticks. And, since we often worked late into the desert night, we kept a few around the office as security measures.

*Starhawk* was enough of a success to keep the doors open, so I began my second game, *Sundance* (1979). This game was an oddity in many ways. It had a vertical screen and a switch that could be set to display Japanese rather than English, the only game that Cinematronics ever made with a feature of that kind. The controls were two matrixes of push buttons, each three by three, one set per player. Think of two tic-tac-toe boards facing each other, one above, the other below (see Fig. 9.3). The game would randomly launch sparkling “suns” toward one of the nine squares on the grid. The player could capture the sun by pressing the corresponding button. Every time a player missed and let a sun bounce rather than capturing it, the tic-tac-toe boards would move closer together. When the boards were close enough, the game would be over. If things got too hectic, the player could press a button that would remove the suns in play. There were two hardware problems with *Sundance* that shortened its longevity. One was an additional hardware “daughter board” that was added to create multiple layers of intensity. This was somewhat fragile. Worse, the display tubes used for this game tended to be defective, causing many of the games to fail in transit and sometimes worse; some screens actually burned and exploded. Fortunately, these misfortunes tended to occur while the tubes were in transit and not during play! I executed the cabinet art for the game myself, for better or for worse.

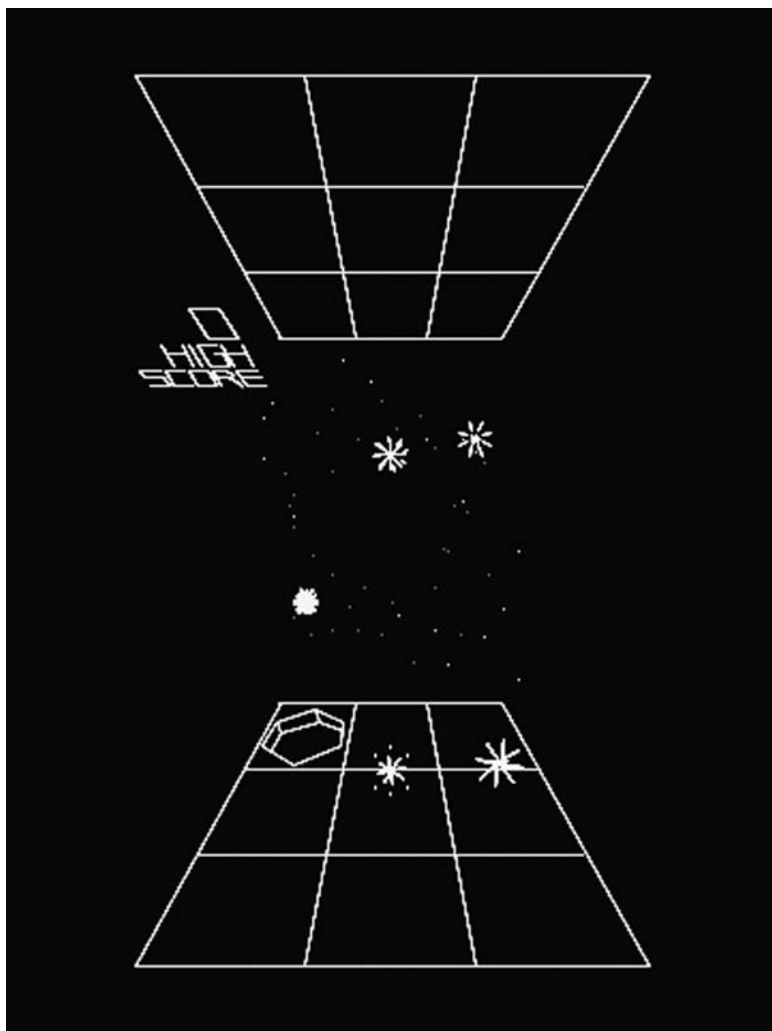


Fig. 9.3. An image from *Sundance* (1979).

Rob Patton had been hired as a technician and was a valuable asset when the hardware system needed to be reconstructed in the wake of Rosenthal's midnight move to Vectorbeam. Around the time I was finishing *Sundance*, Patton asked to try his hand at programming a game. Earlier, company president Pierce had walked into the lab with a Mattel handheld football game. This was one of the first handheld games, the first being Mattel's *Auto Race* (1976). The football game was extremely popular and incredibly

simple, with a display of just a few LEDs. Pierce thought we should turn it into a video game. I told him that although popular as a handheld game, it was unlikely to attract arcade players given its extremely simple gameplay, to say nothing of risking a lawsuit with Mattel. Pierce forgot about it for a while but when it became clear that Patton had run out of projects, Pierce talked me into letting Patton program a vector version of the handheld game strictly as a learning exercise. That game was at first called *Blitz* (1976). To make Pierce happy, we put it out on test. We did not have high expectations for the game, but the coin intake was so low that even Pierce agreed that we should put it on the shelf. On the upside, Patton was now able to program games on the Cinematronics system. We stuffed *Blitz* into the closet and hoped it would never resurface.

### CROSSED SWORDS

According to Wikipedia, the first ever two-player video fighting game is Sega's *Heavyweight Champ* (1976), which "had no real influence on subsequent fighting games."<sup>2</sup> I would be delighted to dismiss the game as Wikipedia does, since my game *Warrior* (1979) has long been considered to be the wearer of the crown. But in all fairness, *Heavyweight Champ* was the first fighting game on the scene. By examining what little is known about it, we might gain some insight into the state of video games circa 1976, the year Cinematronics purchased *Flipper Ball*. At first sight, *Heavyweight Champ* is easy to dismiss in terms of gameplay because there isn't much gameplay involved. The closest comparison would be a heated game of rock-paper-scissors; but I exaggerate. Players of the game had only a single mechanical grip with a limited amount of movement: fist up, down, toward or away from their opponent. With only one "glove" per player, there were only a few positions they could assume: position high, position low, punch in, and pull back. Permutations included: punch high in, pull back down, move glove in and down, etc. The game was straitjacketed. Nevertheless, I would bet you that when *Heavyweight Champ* turned up in Japan and other countries, plenty of kids and adults were ready to stick their hands into cyberspace to see how it felt. That was certainly the reaction to *Warrior*.

One thing about computer programs that never seems to change is the time spent waiting for them to compile. Compile time is a period of time always much longer than the programmer likes if they are in hurry and a period far too short if they are procrastinating. To fill the odd bits of time while waiting for my programs to compile, I would often read the works of Michael Moorcock, including his stories of Elric of Melniboné, a sword and sorcery antihero. The theme of *Warrior* (see Fig. 9.4), my next game

after *Sundance*, was clearly inspired by Moorcock's character Elric. My challenge for this game was to see if I could find a simple, elegant manner in which I could improve on earlier fighting games. Previous fighters like *Heavyweight Champ* were, for lack of a better word, clunky. A dozen years into the future of fighting games, Capcom's game *Street Fighter II* (1991) would become so popular that rumors circulated claiming that the game was causing coin shortages. But in 1979, game creators were still grappling with low-resolution bitmapped graphics, or, in my case, creating medieval warriors out of short sticks of light.

As a programmer of vector graphics, I found that the Cinematronics/Vectorbeam hardware offered two things: making pictures from short sticks of light and rotating them. Pretty much just one thing, if you don't split hairs. Long vectors could be drawn as they had been in *Starhawk*, but their length depleted the number of lines that could be displayed within a refresh cycle. On the upside, because of the delay that accrued while waiting for a vector to be scanned onto the face of the CRT, there was plenty of computation time available. Sine and cosine functions were my best friends. The Vectorbeam system was fantastic for rotating objects on the screen. This might explain why I chose a top-down point of view for *Warrior*; it immediately gave me an advantage over previous fighting games like *Heavyweight Champ*. That game had to account for hits to an uneven side-view profile. In *Warrior*, the hit zone was a circular area close to the center of the player figure. A second zone was attached to the tip of each player's



Fig. 9.4. The playfield for *Warrior* (1979): Note the pits, staircases, and player initial-ization areas.

sword. Move your sword tip into your opponent's hit zone and ouch! the stabbed player turns into a ball of swirling pixy dust, scores are updated, the dusted player is reconstituted, and play continues. One aspect of *Warrior* that I felt quite good about was the system I devised to animate and control the player characters. It struck me early on that in a sword fight (my version at any rate) the primary area to attend to was the tip of the sword. Each player had a joystick with a single button. One of the two available button states allowed the player to translate their figure. In that state, the "move" state, the player could change their position in one of eight directions, but they could not rotate. In the "fight" state, the player was stuck to a single point on the playfield, but the tip of that player's sword could swing and rotate freely in all directions. I implemented a rough version of inverse kinematics to animate the characters, and it worked rather well. I would have liked to have enabled players to translate and rotate at the same time, but during tests, I found that task was like patting your head and rubbing your stomach at the same time. Some could do it, but most found it too difficult to deal with and still have fun.

For reasons I have mentioned, the player characters in *Warrior* were small. For gameplay, this was good. Players had plenty of room to maneuver for a favorable position against their opponent, whether attacking or running away. When seen only as vectors with no additional embellishment, *Warrior* was terribly sparse. In particular, the illusion of characters changing elevation when walking up and down stairs was barely noticeable, since the only visual cue was a slight difference in the size of the player figures. Besides this problem, something was definitely needed to flesh out the fantasy that the players were mystical knights. During the time I was working on *Warrior*, I spent a few days at the annual San Diego Comic-Con. It was there that I met fantasy artist Frank Brunner, whose comic book work I had admired for some time. I asked him if he would be interested in creating the cabinet artwork for *Warrior*. He accepted with enthusiasm. Frank lived and worked in Northern California, not far from Vectorbeam, where, as luck would have it, *Warrior* would be built.

Even though our rivals, I had to admire the craftsmanship shown at Vectorbeam. When Rosenthal started selling his own line of *Space War* games, it was clear that his cabinets were literally made of better stuff than the cabinets built by Cinematronics, whose games were more likely to be damaged in transit due to the use of less sturdy materials. To their credit, Pierce and the Strouds were businessmen who knew where the bottom line was. Rosenthal, even with the advice of Cravens, was clearly not in their league of tough, make-a-dollar men who cared only about cash. Rosenthal was all about the programming, the games and not much else. So, who was

responsible for the fantastic craftsmanship behind the *Warrior* cabinet? That was Tommy Stroud, son of Papa Stroud.

#### VECTORBEAM

After moving their operations to Union City, California, Rosenthal and Cravens continued to sell *Space Wars* machines, though they now called the game *Space War* (singular), in attempt to differentiate their product which was more durable than those manufactured at Cinematronics. Initially, this was the only way they could attract new customers. In the meantime, Rosenthal and programmer Dan Sunday created an original vector-based game that was somewhat like a video pinball machine. It was called *Scramble* (1978) and only a few units were sold. Still, enough were purchased to keep the company's doors open. It was fortunate for the Vectorbeam crew that they were able to hold on long enough to build and ship their next game, *Speed Freak* (1978).

While working on *Warrior* at Cinematronics and waiting for code to compile, I'd go down to the production floor and set a new high score on the *Speed Freak* machine we kept in the loading dock. No question, *Speed Freak* was several steps above the other driving games of that time. It displayed fluid curves that twisted and turned smoothly, putting the player in the driver's seat. It was a landmark: great fun to play and quite special when compared with earlier, blockier raster-based driving games. All of us who programmed games on Rosenthal's system knew how to draw lines on the screen and manipulate them in two dimensions. For instance, in *Sundance*, the grids and balls appear to be three-dimensional, but in truth, they were only artistic imitations. Larry Rosenthal was the first and only one of us to program game images based on three-dimensional geometric data. Because of Rosenthal's skill and expertise, *Speed Freak* simulated the driving experience quite well, even with its vector limitations. Obstacles included a hitchhiker, a road sign, trees, and a cactus, all made of vectors and restricted to one of the three planes in the 3-D world. On occasion, a flat airplane would pass over the top of the player's car. When the player inevitably crashed into an obstacle, the screen displayed a cracked windshield. If the player ran head-on into an oncoming vehicle, they were treated to a full, mathematically true three-dimensional wireframe animation of a car exploding. For some players, including myself, that alone was reason enough to swing into the oncoming lane. Larry's exploding car was most likely the first full three-dimensional animated rendering in a commercial video game.

While *Speed Freak* was a great game, there still weren't enough orders for it to keep the Vectorbeam production lines going. The company needed a game they could sell and sell fast. Pierce and Stroud offered *Blitz* to Rosenthal's company; the game that was only a training exercise for a novice programmer, a game never intended for production. Vectorbeam took the deal and renamed the game *Barrier* (1978). As was expected, *Barrier* failed to generate much income, but it did keep the doors open at Vectorbeam. Reflecting on this move, some of us at Cinematronics wondered why we were helping our rival. Then the quarter dropped. Pierce and the Stroud intended to purchase Vectorbeam and its assets. Rosenthal received a royalty and other incentives based on the use of his hardware and patents, whether he worked for Cinematronics or for himself. After the purchase, Pierce and Stroud would have the same agreement, but now the revenues would flow directly into their pockets, not into the pockets of Rosenthal or Cinematronics. Not a bad deal for Pierce and Stroud.

Just before the Cinematronics takeover of Vectorbeam, Rosenthal had an idea for an original game he called *Oops!*, a game somewhat similar to his major success, *Space War*. The unlikely theme was birth control. This could have been because Rosenthal was programming flocking simulations or he thought the ships in *Space War* looked like syringes, or perhaps he was just a horny guy. Instead of spaceship versus spaceship, the battle in *Oops!* was waged between a syringe filled with contraceptive foam and a cloud of sperm cells. Modifications to the program had the syringe fixed in the middle of the screen, allowing the player to rotate and shoot outward at the sperm. This has been interpreted as the origin of my game *Star Castle*, but that clearly was not the case. Aside from rings rotating around a central core, the two games could not have been more different.

On my first trip to Vectorbeam, I finally had the opportunity to play *Scramble*, Rosenthal's first original game after *Space Wars*. It was an unsuccessful attempt to create a video pinball game, mostly because it was rather difficult to play. *Scramble* was displayed at trade shows, but purchases were few. Also in view was an early demo of the most recent version of the game that had been *Oops!* By the time of my second trip to Vectorbeam, it would be quite different from the original. The later version featured thick, rotating walls that encircled a gun in the middle of the screen. The player's gun and defensive rings were able to move about, but only slightly. The game, such as it was at the time, was set up with the player in the middle of the screen shooting outward with the gun in the center. Attacking objects that resembled snowflakes or spaceships drifted toward the player, attempting

to knock out the player's defensive walls. The goal of the game was to stay alive as long as possible by shooting at the attackers. After watching the demo, it struck me that the game was inside-out. In the version I saw at Vectorbeam, all the player could do was rotate, move a bit, shoot, and hope to hold out for as long as possible. This was not my idea of a fun game. Death by attrition is not fun.

On that first trip to Vectorbeam, several techs and I were tasked with evaluating the Vectorbeam software and hardware assets, specifically those connected with game creation. It was on this first trip that I met Dan Sunday, Rosenthal's co-programmer. On our arrival, we got a demo of Sunday's work, in particular, a nearly finished first-person space shooter. That game became *Tailgunner* (1979). In a moment of insight, Tommy Stroud realized that the space shooter needed a stronger sense of purpose. It also needed something to set it apart from all the other shooters, in particular, something different from the usual attack point of view that had been around since Atari's *Starship 1* (1976). Sunday and Rosenthal designed the game so that the player lost a "life" whenever an enemy ship managed to escape the player's shots. However, Tommy asked to have the movement of the stars reversed. This put the player into a tighter corner than before. Imagine you are being pursued and whatever attackers you miss are the ones who are going to shoot past you and destroy your comrades. You are the first line of defense. It sounded right to me, and I had no reason to doubt Tommy Stroud, a veteran of the war in Vietnam. Having played the game many, many times, I can doubly confirm his logic.

I made a second trip to Vectorbeam to check on progress with the *Warrior* cabinet. When I got there, Rosenthal was working with Sunday on *Tailgunner*. They were adding the old, static *Space War* star field and Sunday's initials to the bottom of the screen. Regardless of their motive, these were bad things to do for one simple reason: Rosenthal's board had a watchdog circuit that reset the program counter to zero if it wasn't hit every fraction of a second. This was used to prevent a runaway program from letting the cathode ray shoot the side of the display tube. This scheme also initialized the program counter, which would usually start at zero but was not guaranteed to by anything in the hardware. If it came up at some random value, in a very short time the watchdog would reset to zero. Sometimes the counter would start inside a bogus loop that hit the watchdog continually, but that was very rare and could be fixed by turning the machine off and back on again. Every moment of frame time was precious. How much we could draw on the screen was based on worst-case scenarios. We had to hit the watchdog, and we couldn't do it while a line was being drawn. If something

on the screen wasn't 100 percent necessary to gameplay, it had to go. So, away went the additional stars and Sunday's initials. In the early years, we game designers had to forgo putting our names on the product for the sake of the game. Every bit of code and graphics space was precious. However, denial of visible credits continued long after the technical limitations were removed. *Reactor* (1982), my first game for D. Gottlieb and Company, was the first coin-op game to have the designer's name on the screen. I only received that because I was working freelance at the time, and my screen credit was negotiated into my contract. Most other programmers were not as fortunate.

*Tailgunner* did well initially, but not as well as we had hoped. The problem was not the game. Sunday had created a great one. The problem was with the joysticks we had purchased for the game. The new joysticks used a conductive plastic material instead of conventional wires and brushes. This made them extremely durable, a very important feature for an arcade game. Obviously, we wanted to make sure that the joysticks we used would hold up to abuse. But, more importantly, the underlying electronics had to be extremely rugged as well. On the plane flight back from Oakland, the Cinematronics crew stomped on the sample we were given to see if it would hold up to brutal, punishing, arcade game abuse. We pounded and abused the little joystick and we couldn't even put a scuff on it. It was a very cool, very rugged little joystick. However, what the manufacturer hadn't thought to tell us was that after a certain number of movements or "sweeps" of the joystick, the conductive plastic at the heart of the device lost its electrical qualities. For the products the sticks were originally designed for, this was not a problem. Their normal usage was relatively light. But, used in a popular video game? The number of sweeps of the joystick in a day would be huge. After putting *Tailgunner* into arcades, we found that we had a very popular game but one that almost always had an "Out of Order" sign hanging from it. As a result, many fewer units were sold than might have been. In 1980, another game manufacturer, Exidy Inc., would build a licensed sit-down version that featured a more conventional joystick.

Because Vectorbeam had few games ready to ship, *Warrior* was manufactured at Vectorbeam rather than at Cinematronics, and I was quite grateful that things worked out that way. Tommy Stroud was not the pinch-penny that his father was, nor was he a spendthrift. Tommy simply knew that there was more to a video game than just what was seen on the screen. Many video games had "attract modes" that played sample images from the game. But, in my opinion, the game cabinet's art really sold the game to the player. If not, why display the stunning cabinet art and illuminated

marquees? With no sideshow barker to help, video games had to be their own advertisements. More than that, they fleshed out the bare bones of early, primitive video game graphics. When I told Tommy that Frank Brunner was willing to execute the artwork for *Warrior*, he was immediately on board. This was a good, because without Brunner's renderings of the playfield and his stunning cabinet art, my game would just look like two piles of angry, glowing sticks. I knew from the beginning that *Warrior* would use a half-silvered mirror to superimpose Frank Brunner's artwork onto the same plane as the CRT display. Frank's renderings of the stairs, ramps, pits, and player characters' base positions, when bathed in ultraviolet light, would glow as brightly as the vectors on the display tube. The illusion wasn't perfect. To show a player falling into a pit, I would scale down the size of the character, but the vector image would remain at its usual level. A minor point, all things considered. The smooth and subtle indication of heights on the stairs also appeared to work well, the same with the scattering and reforming of the players when hit.

After returning to Cinematronics from my first visit to Vectorbeam, I resumed work on my next game, *Rip Off* (1980), and a former tech and new programmer, Scott Boden, needed a project. It struck me that we might be able to make Rosenthal and Sunday's rings into a playable game. Often, you can turn a bad idea into a good one if you invert it. When Boden and I designed *Star Castle* we put the primary enemy inside the rings and anchored it to the center. The player had a free-moving ship, much like the one in *Space Wars* with wraparound enabled. The player's goal was to shoot out the rings that guarded the *Star Castle* cannon and destroy it. Making this task challenging was the accuracy of the central cannon. However, while very accurate, the shots of the enemy could not pass existing ring segments. This meant that by shooting out the shields, the player was shooting at the one thing protecting them from the gun in the center. Boden and I cut the shield segments down to lines instead of the blocks favored by Sunday and Rosenthal. This gave us far fewer lines to render, which in turn allowed us to add more rings. The player now scored points by hitting and destroying ring segments and space mines. As the rings were taken out, the central cannon became exposed. Once players destroyed the cannon, they were rewarded with an extra life. However, this also renewed all of the protective rings and space mines. The circle began again. There is no real end to *Star Castle*. It is a game of attrition and renewal. However, unlike many games that promise nothing but inevitable failure, *Star Castle* nourished players' hope that they could continue indefinitely.

Boden and I put in many late hours while working at Cinematronics. Aside from the cleaning crew, no one was in the building while we worked. One night, out of boredom alone, we took a peek at the company's books. Remember the agreements that Rosenthal had with Cinematronics? The ones that paid him an extra fee for each vector-based game that shipped? That night we discovered that Pierce and Papa Stroud, after dissolving Vectorbeam, had transferred those agreements to themselves. From then on, for every vector game built and shipped by Cinematronics, the two execs got an additional piece of it. This late-night curiosity was not always to our advantage. When you work all night, you sleep a good part of the day, which means you aren't always around to watch your own back. At the time of *Star Castle*, Cinematronics hired a new production manager, and Pierce and Stroud left most low-level operations to him. One such operation was the distribution of cash bonuses. Cash because, as I have mentioned, Cinematronics was that kind of operation. When Scott and I got ours, we were pleasantly surprised, though the amounts were relatively small. Still, it was unexpected and welcomed. Not as welcome was finding out later that the new manager had given us only one tenth of our bonuses and had pocketed the rest. To add insult to injury, he also claimed to a magazine journalist that he had been one of the creators of *Star Castle*, which he was not, omitting my role all together. I still have the letter of apology from *Science 81*, the magazine of the American Association for the Advancement of Science. The final score: shady dealers one; science nothing.

As mentioned, most nights Boden and I worked until daylight broke and the fleet of garbage trucks across the street began to move out. During the pre-dawn hours, even the fast food franchises were closed. On those occasions, we would make do with ma-and-paconvenience stores. One night, while working on *Star Castle*, Boden and I made a food run and came back with a pile of porn magazines. This had never been our habit. That evening it just hit us that we were tired of the usual constellations in our background starfields. We were tired of Orion the Hunter, Libra the Scales, the Big Dipper, the Little Dipper, Ursa Major, and Ursa Minor. We decided to create our own constellations that night; thus, the porn magazines. We went through our purchases and found one picture that might possibly look like a naked woman if you turned it into a constellation. Of course, no one noticed until we told them, long after the game was into production and Marjorie, the *OUI* Magazine centerfold, had ascended to the stars. Less controversial was our latest addition to *Star Castle*: a multicolored overlay that distinguished the areas where the rings appeared.

Besides the welcome splash of colors, the overlay served to show the player, even if faintly, where they were in relationship to areas where ring segments had been and would be again.

After the success of *Warrior*, I asked Frank Brunner if he would create a science fiction-themed cabinet design for my game *Rip Off* (see Fig. 9.5). (I hoped that choosing that name ensured that I would make the best game I could. Oh, the horrible irony if the game was a dud!) By now, I was pretty sick of spaceships flying around, but I didn't mind going the science fiction route one more time. This time, around I wanted to create a two-player cooperative game. At the time, my girlfriend was working as a disc jockey in Kansas City, Missouri. During one of our long-distance phone calls, she mentioned to me that the research people at her radio station had determined that their audiences "wanted to cooperate." Perfect! A cooperative game was just what I was thinking about. I began work on *Rip Off*, a two-player game that could also be played by a single player. There had been one other two-player cooperative game prior to *Rip Off*, Howie Delman's raster game *Fire Truck*. His raster game was clean and straightforward. From a top-down view, the player or players had to maneuver a long hook and ladder fire truck through narrow streets for as long as they could. The gameplay was certainly cooperative, as either player could crash the truck. Two-player mode was the intended play, but Howie managed to allow a single player to play either the front or rear steering wheel while the computer did the rest, no small feat. There were several differences between *Fire Truck* and *Rip Off*, the primary one being the constraint placed on the players who were tethered together. One could argue that forced



Fig. 9.5. Cinematronics distributors, executives, and friends with *Rip Off*. Left to right: Sandy and Ira Bettelman of C.A. Robinson & Co.; Ed Adlum, publisher of *RePlay* magazine, and his daughter, Ingrid; Tommy Stroud; Dave Stroud and Ms. Tom Stroud. Photo courtesy of *RePlay* magazine.

cooperation could be a character-building exercise, but let's not go there. Really, the differences between the games could be found in the two years between their manufacture. These were fast-moving times and much happens quickly in a fast-growing industry.

In *Rip Off*, my version of cooperative play was free and fast moving, largely due to having an open playfield that allowed players to create their own strategies, not unlike *Space Wars*. *Rip Off*'s cast included player figures personified as "space tanks." Enemies had six different types of vehicles, three to a wave, and each faster than the one before it. If all six waves were completed, the enemies reset to their initial speeds. However, this did not affect the number or positions of the canisters on screen. The canisters were the objects of desire: eight almost entirely passive triangular canisters. I say "almost" because the canisters were made to visibly vibrate. When a player's tank moved over a canister, this "vibration" randomly created slight changes in the direction of the player's tank, making it difficult for the player to shoot straight. I added this feature because during tests I found that it was too easy for a player to sit on top of a canister to defend it. The ultimate goal of the enemies was to remove all eight canisters from the playfield, at which time the game would end. There were no "lives" as in most other games. *Rip Off* was simply the player versus entropy. As long as a canister was on screen, players could continue to play. Due to the limitations of the system, game scores were only displayed between waves of attackers. The gameplay was this: one or two players, working together or alone, protected the eight triangular canisters initially placed in the center of the screen. Three enemy tanks entered from the periphery of the screen and attempted to attach a canister to themselves and drag it off the playfield. If a player's tank shot and destroyed an escaping enemy, the canister was left where it was until picked up by another enemy. There were three types of attackers, each differentiated by shape and speed. Clever players sometimes allowed canisters to be picked up by enemies in order to reposition them nearer to the center of the screen, but this was a risky move. The game ended when all eight objects had been removed from the screen. No instructions were given to the enemy tanks to avoid player tanks. And, while the enemy tanks shot "rays" from the front of their vehicles, those were usually ineffectual. The most useful trick players would exploit was the tendency of the enemy tanks to orbit. Occasionally, due to slight computational errors, an enemy tank would rotate continuously around a fixed point, which would allow a player to catch their breath. It was functionally a pause button. Prior to *Rip Off*, I had admired Vectorbeam programmer Sunday's clever idea for moving spaceships around. He introduced a tiny amount of "game AI" to save on memory. Unlike earlier games, which stored the paths of enemy ships in

detail, he chose to store key points along random paths. Once activated, his spaceships oriented themselves toward their target points as they traveled forward along their own main axis. This resulted in graceful, curved paths that could not be easily anticipated by the player. The paths were spline curves, and armed with this “orient and move” behavior, I was able to give my enemy tanks enough intelligence to complete their tasks.

These were their instructions:

**THIS IS WHAT YOU WANT:** When initialized, the attacking tanks were each given a particular canister to retrieve. If there were more tanks than canisters, the extra tanks were put into “attack mode,” which will be described describe later.

**GO GET IT:** Each tank moved toward their assigned canister in the fashion of the ships in *Tailgunner*. They moved forward while turning toward their target position, decelerating when near their targeted canister to prevent “orbiting.”

**HOOK IT TO YOUR TRAILER HITCH:** When close enough to do so, an enemy tank would stop, rotate, and attach the target canister to its tail end.

**RUN FOR IT:** Once attached to a canister, the tank was assigned a random exit point to accelerate toward. On reaching the exit, the tank and canister were removed from play.

So far, there is no significant departure from the seeking behavior used by Sunday in *Tailgunner*; but my enemies had more rules.

**DON'T BUMP YOUR BUDDIES:** When within a certain radius of another tank, each tank was to steer away from the other until out of range. This was also used to initialize the tanks on entry. I placed each tank on the same spot and then let their avoidance routines and seeking behavior push them apart.

**GET AWAY FROM ME OR DIE:** Besides avoidance, there was one behavior that had priority over canister seeking and removal. Enemies were programmed to make the player's tank their primary goal. Avoidance came first, canister seeking second, and removal was last. When within a certain radius of a player, if they were not attached to a canister, enemies were programmed to make the player's tank their goal. They were to fire a short-range “beam,” and if that beam hit the player's tank, the player character was removed from the screen for a few seconds and then placed back at its starting position.

Unlike the enemy's behavior when approaching a canister, in attack mode enemy ships did not decelerate when they were nearing their target. This meant that clever players could, and often did, allow enemy tanks to orbit them, thus effectively putting the game on pause.

IS THIS YOURS? TAKE MINE: As someone once said, the trick to making computers appear intelligent is simply to make them not do stupid things. An enemy tank that would drive right over an available canister on its way to the one assigned to it would look stupid. When within a certain radius of ANY canister not attached or in the process of being attached, enemy tanks were programmed to make the nearby canister their target and to go immediately into “pick up” mode. Before doing so, the tank would check to see if the canister it was now attaching had been assigned to another tank. If so, it would swap canister assignments with that tank.

Over the years, I have continued to receive messages from people who played *Rip Off*. Clearly, players did want to cooperate.

Around the time of *Rip Off*'s release, Jim Pierce began an unstated but enforced policy of removing one color from the cabinet art and overlays of each new game. It was a sign that, very slowly, Cinematronics was losing money. An overlay was critical for *Armor Attack* (1980). Because of the usual line-drawing restrictions, *Armor Attack* vectors were limited to the active elements: the tanks, helicopters, and the player's jeeps. This mandated the use of an overlay as in *Star Castle*, except with only one color on the overlay, khaki green. Also like *Star Castle*, the overlay was not just decorative. In the case of *Armor Attack*, it was imperative. Without the overlay, players would have been unable to see the outlines of the road and town square, the game's playfield. *Armor Attack* featured a top-down view and could be played solo or with a partner. In the latter mode, players could not hurt their partners. Players were represented by jeeps that the players controlled. Players could shoot at and destroy enemies including tanks and helicopters. Shots fired by the helicopter did not have to worry about obstructions, so as an enemy, it was particularly dangerous. Even so, helicopters could be shot down. I programmed the chopper to display its characteristic motion when turning, a swinging drift loaded with inertia. This gave the players time enough to respond to the overhead menace. Not that the tanks were pushovers; hit once, they would be unable to move from their location. But, that meant that they would block the road, continuing to fire on the player. It took a second hit by the player to remove the tank completely.

Coincidentally, in 1980, the United States required that all males born on or after January 1, 1960, had to register with the Selective Service system. To not do so meant the possibility of five years of imprisonment or a \$250,000 fine. To date, no one has been prosecuted under this law. However, in 1980 when the law debuted, it caused more than a little anxiety among the men who fell under it. I was exempt due to my age, but my friends and working partners, Scott Boden and Rob Patton were not. Having been eli-

gible during the Vietnam-era draft, I was taken aback. Ironically, here I was working on a war game. Despite it being a futile gesture, I programmed *Armor Attack* to sound out the words “Don’t Register” in Morse code, when the game was in attract mode. To my chagrin, not too long after I had left the company, Cinematronics was contracted by Perceptronics to work on a 3-D tank battle system that would be used for genuine military training.

There were two “orphan” games at Cinematronics while I was working there, games that had failed to earn enough quarters to justify a full run of units. *Blitz* was one of them, the game Cinematronics had earlier sold to Vectorbeam. The other orphan was Rob Patton’s *War of the Worlds* (1982), programmed in 1978 but not tested or released until 1982. In 1978, we had plenty of games to sell and we could afford to put one or two aside, based on their collection results. I helped Patton by creating the animations for the game. It was fun to play, but it was a bit repetitive. We put it out on location tests in 1978, and the results were disappointing. At the time, we had enough titles to carry us through, so *War of the Worlds* went on indefinite hold.

By 1981, it was clear that Cinematronics was losing ground. At a minimum, they needed to introduce color vector displays, though color vectors were not going to save the company. Short of creating or buying an entirely new system, color vectors were the only way Cinematronics could upgrade its games. An effort to overhaul the Cinematronics hardware was needed, but that would not happen until Boden’s game, *Solar Quest* (1981), a space shooter with the altruistic goal of saving the space-wrecked survivors of enemy attacks. Cinematronics considered using color monitors for the game, but the company was unable to procure enough color display tubes. So, for its initial run, *Solar Quest* went out with white vectors colored by overlays, as was done for *Star Castle*. *War of the Worlds* was eventually displayed at an industry game show in 1982, sporting full-color vectors and cabinet art by Rick Bryant, the artist for *Star Castle*, *Tailgunner*, and *Armor Attack*. I was no longer working for Cinematronics in 1981, but I was there long enough to provide Boden with artwork for his last game at Cinematronics. In Boden’s own words, “The last thing I was working on was *Outpost* (1981), which had a cannon and gun in the center with attackers on the periphery. I left and Jack Ritter took over. He renamed it *Boxing Bugs* (1981) and tried to make it cute.” In my opinion and Boden’s, *Boxing Bugs* was a travesty. Cute things have curves and vector games do not. To make matters worse, it displayed long messages about how the game worked. I knew from experience that if the player could not get into the game immediately, they would usually walk away. Poor coin reports confirmed my opinion of the game.

It is possible that during the 1982 Amusement and Music Operators Association (AMOA) trade show where *Boxing Bugs* was being shown, Pierce and the Strouds made a deal to purchase *Brix*, a prototype raster game that was soon renamed *Zzyzzyxx* (1982). Or, they might have been looking at *Jack the Giant Killer* (1982) or *Naughty Boy* (1982) or *Freeze* (1982). At one time or another they purchased all of them. These were tough times for Cinematronics, and there were hoping that at least one of those games would keep them alive. The company filed for Chapter 11 bankruptcy protection, and tried to organize themselves, hoping that a standardized hardware solution, the Cinemat system, would help.

In 1981, I moved on to Gremlin Industries, a growing video game company near El Cajon, soon to be renamed Gremlin/Sega. Sega had recently purchased the company and were operating as both developers of games and as importers of video games from Japan. I worked for a short time on their color vector system and was glad to be there to see the development of the first color vector game, *Space Fury* (1981), but I was more than a little tired of vector displays. After a few experiments with the color hardware, I took up raster graphics with a first-person flying shooter. However, that was quickly squashed when Cinematronics brought a lawsuit against me and Gremlin/Sega. To my former employers, it was just a way to slow down a competitor. Tommy Stroud told me that, of course, “it was just business.” In court, the suit was dismissed for what it was: harassment of a competitor. But Gremlin/Sega did not want to be involved, and I was out of work. Fortunately, I was soon hired by Mylstar Electronics, the former D. Gottlieb and Company, in Bensenville, Illinois, which had recently been purchased by Coca-Cola.

It was there that I created *Reactor* (1982), a game that featured an octagon-shaped block in the middle of the playfield that changed size, a feature that would make an appearance in Cinematronics’s game, *Cosmic Chasm* (1983). I don’t wish to make much of this, as it could easily have been coincidence, but I found it humorous that a feature from my first Mylstar game would turn up later in a Cinematronics release.

In 1983, Cinematronics was lucky enough to find a white knight, the laserdisc game *Dragon’s Lair* (1983). The game was created by Rick Dyer, an inventor and businessman who dreamed of video games that had all the colors and animation of Disney cartoons. His solution was to hire former Disney animator Don Bluth and his staff of artists and animators to provide source material for his game. Dyer’s idea was to use the new technology of consumer laserdiscs, which could play high-quality audio and video

from optical discs the size of LP records. The primary advantage to Dyer was the laserdisc player's ability to play back selected sections of audio and video, thus enabling branching narratives. After years of blocky graphics and tinny video game music, game players were delighted to wait in line to play *Dragon's Lair*. There were even rumors of *Dragon's Lair* units filling with quarters to the point where coins could not be inserted. But, as ever, there was a problem: *Dragon's Lair* and its sequel, *Space Ace* (1984), followed a branching strategy to give players a sense of control. Optical-disc games were not very interactive; certainly these two were not. After viewing a short segment of high-quality cartoon animation, players would have to quickly move their joysticks to select a branch to another segment. Pick correctly, and the game continued. Pick the wrong branch, and the player character is shown dying a terrible death. Game over. After years of subpar video game graphics, *Dragon's Lair* and *Space Ace* were intoxicating. Gameplay be damned, players were finally able to play a movie, even if it was just a tiny step toward the home gaming units of today. But, at the time, the end result was this: players would choose paths based on trial and error. After spending enough quarters, players could play the movie to completion, also game over. After a while, even the show-offs stopped playing. To his credit, inventor Dyer did ultimately come up with a much more interactive version of his idea, a laserdisc game called *Thayer's Quest* (1984) for his home system, but it was produced by DRI Video Systems, not Cinematronics.

#### ANOTHER GRAB BAG OF GAMES AND LEGAL ENTANGLEMENTS

I once heard a rumor that Jim Pierce and Cinematronics had set a record for length of bankruptcy in California, and I was around him long enough to believe it. What I knew for sure was that he was always looking for an advantage, anything to keep his company alive. The last game to be designed and programmed by Cinematronics was *Boxing Bugs*. Boden and I had both left the company by March of 1982, Boden staying on longer than I did. My reason for leaving was simple. Gremlin Industries, just prior to their merge with Sega, recruited me to join their team. I had just settled in to work on my bitmapped shooter when I found myself at the wrong end of a lawsuit. I had done nothing wrong, as was proven in court, but almost immediately Gremlin cut me loose, not wanting to have any more problems from my former employer. The lawsuit was dismissed, and I had no love left for Gremlin and even less, if that was possible, for Cinematronics.

After the soaring highs and sudden lows of *Dragon's Lair* and *Space Ace*, Cinematronics went back to purchasing any game that looked like a bar-

gain or, at least, looked like it would sell; games like *Express Delivery* (1984), *Cerberus* (1985), *Mayhem 2002* (1985), *Redline Racer* (1986), *Danger Zone* (1986), *Double Play: Super Baseball Home Run Derby* (1987), *Baseball: The Season II* (1987), and *Alley Master* (1988), which was quite likely the last of Cinematronics's games. Some were standouts, most notably the baseball titles, in particular, *World Series—The Season* (1985). Like most games, *World Series—The Season* had one or two player modes and it featured high-quality sound and graphics. Its outstanding feature was the spring-loaded joysticks for pitching and batting. Plus, it had buttons for other features like “extra base” or “go back.” Unfortunately for Pierce, the game would eventually be involved in one of many legal proceedings he would have to deal with over the years. As I said, at one point there was even a rumor that he held the record for the longest Chapter 11 bankruptcy in the State of California. I have no legal background or materials to support this, but if any one man could have done it, it would have been Jim Pierce. Cinematronics always seemed to be on the edge of losing everything, but I never saw it happen.

#### WMS WINS THE GAMES, I SIGN THE PAPERS

From this point on, it's mostly about name changes and buyouts. If you need, or even enjoy, the details of corporate turnovers, please check the Internet for details. As for me, the really important things are the games and the people who created them. Ultimately, the games of Cinematronics were collected together by Williams Entertainment Inc. (WMS). In 1997, I was invited to WMS offices in California near San Diego and was greeted warmly. I enjoyed talking with the executives and staff, though I knew why I was there. I would be putting my name on documents that clearly stated that WMS was the sole owner of my games. Do I regret this? Hell, yes! But I knew that legally it was what had to be done. During that visit, I saw a prototype of the re-imagined console version of *Robotron: 2084* (1982), a game originally created by Eugene Jarvis and Larry DeMar (aka. the Vid Kidz). The new games looked great, and I hoped that now that they were part of WMS, something similar would be done with the games of Cinematronics. But, unfortunately, that did not happen.

#### PGD, TRIVIA MASTER, AND THE REAL END OF CINEMATRONICS

The Great Video Game Industry Crash of the early 1980s threw the game industry to the winds, and I'll take the risk of explaining why. When video games first appeared, they were as novel as novel could be, and I have al-

ready touched on why they became so popular in such a short time. For several years, we saw tremendous leaps in novelty and gameplay, but by definition all novelty eventually ceases to be novel. Entertainments either disappear as fads or they become part of the landscape, more like templates or platforms for future creations. Put simply, the delight of novelty wanes over time. For a platform to stay alive, it must either renew itself or succumb to this last hope I once saw expressed outside a second-run movie theater: "It's always first run until you see it!" This is as close as I can get to explaining why, in 1984, it seemed that the only successful coin-operated games were trivia games. They were arcade and bar-room friendly, and their questions and answers could be renewed frequently. That aside, what was important was that they were novel. While Cinematronics limped toward eventual bankruptcy and a roster of unmemorable games, Scott Boden left the company and went to work for Taito America in Chicago. However, by then, the market was dead or dying. Boden founded Enerdyne Technologies, his own company, in 1984 and handled virtually everything himself, including game design and programming. Nearby, Dave Stroud had a company of his own that was focused on sales and distribution under the name P.G.D. Incorporated. Technically, his company name was Progressive Game Distributors, but the joke was that it meant "Pretty good, Dave."

In that same year, I was living in Los Angeles working as a consultant on interactive Capacitance Electronic Disc (CED) projects. CEDs were, for all purposes, identical to laserdiscs. Rather than optically scanning the disc with lasers, like optical discs, CEDs were read physically. They were quite similar to conventional long-playing audio discs, but with enough bandwidth to playback both video and audio information.

I was on my way back to my home in Chicago and thought I would stop by and see Boden, who was living in El Cajon at the time. His first project was doing game conversions for Sega using *Zaxxon* board sets. He followed that with some Atari 2600 work and was stiffed on his payment, something most freelancers and short-time developers have had to deal with.

When I arrived, I found that Boden was up to his ears with programming *Trivia Master* (1984) for his company, Enerdyne Technologies (see Fig. 9.6). Trivia games were practically the only video games making money at the time, a pretty good indication that the era of stand-alone coin-op video games was about to fade away, if not drop dead. Boden was close to finishing the trivia game's basic functions and had work for me programming code to make sure that as many games as possible could be played without repeating questions. Boden had not yet begun work on the graphics or interface design for the game, so I took care of that and designed the game's marquee and cabinet art. It was great fun to work with Boden again,



Fig. 9.6. Enerdyne Technologies; Tim Skelly, designer; Scott Boden, president.  
Photo courtesy of *RePlay* magazine.

even though we were working in a warehouse with no air conditioning in temperatures that were well over 100 degrees in the daytime. *Trivia Master* was a hit, and we spent a good deal of time looking for sex trivia to include in the game. No surprise there. As you might guess, the most commonly selected trivia category was sex. The demand for that category was so great that toward the end we were reduced to getting our sex questions from animal husbandry books; no one seemed to mind. After *Trivia Master*, Boden became involved with electronics projects and eventually grew Enerdyne Technologies into a highly successful company having nothing to do with games. As for myself, in 1985 I became one of the founders of Incredible Technologies, a game company with its own story to tell and one that found later success in the gaming industry.

In 1998, after years of innovative and successful titles, WMS Industries abandoned video games completely and turned its attentions full time to video gambling devices, an extremely profitable area and one that shared much with video games, both in terms of history and style. In hindsight, it is easy to see why Cinematronics was not able to move forward. It was a very small company without a plan for the future; the moment they chose to buy games, rather than build their own, they were lost. Why would a company buy games of unknown quality when they could design and build their own? Desperate people do desperate things. Still, in the long run, Cinematronics brought to the world a unique style of video game presentation and play, one that was appreciated during its time and is still fondly remembered today.

## NOTES

1. International Arcade Museum, "Flipper Ball," accessed Oct. 18, 2011, [http://www.arcade-museum.com/game\\_detail.php?game\\_id=12768](http://www.arcade-museum.com/game_detail.php?game_id=12768).
2. "*Heavyweight Champ* (1976 arcade game)," accessed Oct. 18, 2011, [http://en.wikipedia.org/wiki/Heavyweight\\_Champ\\_%281976\\_arcade\\_game%29](http://en.wikipedia.org/wiki/Heavyweight_Champ_%281976_arcade_game%29).

BRETT CAMPER

## Color-Cycled Space Fumes in the Pixel Particle Shockwave

*The Technical Aesthetics of Defender and the Williams  
Arcade Platform, 1980–82*

In today's gaming press, it's common enough to hear about pixel shaders, polygons per second, the Cell chip, and the network speed and latency of our current game hardware—the Xbox 360, the Playstation 3, the iPhone, or the latest PC graphics boards. This technical fetishization is not always helpful in assessing games as meaningful play experiences, but it does tell us something about the underlying materials that those games are made from. Computing platforms are about constraints, the techniques they do or don't allow a game designer or artist to use, qualitative and quantitative differences in visual style: the raster-based pixels that dominated the 8-bit and 16-bit PC and console eras, the sparse, brightly lit early arcade vector graphics of *Asteroids* (1979) or *Major Havoc* (1983), the 3-D filled-polygon graphics and lighting effects that have ruled the cutting edge since the 1990s. But in gaming history, we rarely hear this level of technical depth applied to earlier eras. Here I hope to redirect some of our current technical obsessions, going back to the pioneering arcade games released by Williams Electronics between 1980 and 1982, beginning with one of the best-selling and most challenging arcade games of all time: *Defender* (1980).

We often don't think of an arcade game as running on a *platform* in the way that we naturally do for home computers—the Commodore 64 or Apple II then, Windows 7 or OS X now—or dedicated gaming consoles (the Atari VCS or the PlayStation 3). But that's exactly how many arcade makers came to think of them: as stable, repeatable hardware designs that could be repurposed or incrementally tweaked across different games, providing a common set of capabilities that both simplified the game develop-

ment process and drove down the costs of manufacturing, distribution, and other logistics. Usually, we assume that the platform comes first, and the games programmed for it are second. Yet, especially in video games' formative years, this progression was often flipped, with particular game designs shaping platform hardware directly. In *Racing the Beam*, their study of the Atari VCS, Montfort and Bogost describe the ways in which Atari's home console was built, from the circuit board level up, with the previous arcade successes *PONG* (1972) and *Tank!* (1974) in mind, and the latter was expanded into the VCS pack-in *Combat* (1977) (both games were released in the arcade by Kee Games, a wholly owned subsidiary of Atari intended to foster the illusion of industry competition). They also note that Steve Wozniak included key features, such as color graphics, in the Apple II home computer hardware based on his prior experience developing the *Breakout* (1976) arcade board.<sup>1</sup>

When Williams Electronics designed their 1980 arcade hit *Defender*, they established a foundational hardware platform that they would go on to use for six more titles, beginning with the sequel *StarGate* in 1981. They continued with further commercial and critical successes in 1982 with *Robotron: 2084*, *Joust*, and *Sinistar*. But that year the company also released two offbeat and less-known experiments: *Bubbles* (see Fig. 10.1), in which a player-controlled soap bubble scrubs a sink clean while defending from approaching vermin, growing ever-larger in a mechanic that anticipates Namco's *Katamari Damacy* (2004) by 25 years; and *Splat!*, a one-on-one food fight with conveyor belts of food and a bizarre mechanic that triggers the detachment of the player character's head. While the core hardware remained constant across all seven machines, Williams expanded the platform incrementally to serve individual game designs: *Robotron* necessitated dedicated graphics-blitting chips to draw its overwhelming hoard of enemies on a single screen, while *Sinistar* was noted for the speech synthesis of its menacingly omniscient antagonist. This essay introduces this influential video game platform through a close analysis of *Defender's* visual aesthetics, its technical underpinnings, and its relationship to other games of its day. In doing so, I aim to bring Montfort and Bogost's concept of *platform studies* to the realm of the early arcade.

From *Defender* onward, the computing hardware for all seven early Williams games is organized across five circuit boards: the main CPU and video board, responsible for running the game code, juggling the unfolding game state in 48KB of RAM (random-access memory), and assembling the screen graphics in real-time; the ROM (read-only memory) board, which holds all static data in the game (such as code and graphics that "make up" the game and persist when the machine is turned off), also totaling 48KB



Fig. 10.1. From 1980 to 1982, Williams released seven arcade games that shared the same basic hardware platform. Among classics such as *Defender* and *Joust* are lesser known titles with unusual premises: in *Bubbles*, the player cleans a sink.

of memory; the sound board, with its own CPU and ROM for generating sound effects; the interface controller, handling player input from the cabinet in the form of joystick and button presses; and the power supply, providing electricity not only to the other boards, but also to the cabinet itself, powering elements like the lights above the monitor and behind the “marquee” advertising the game up top. For our graphical analysis of *Defender*, it is the CPU, video, and RAM elements that are most influential.

All early Williams arcade games use the 1MHz Motorola 6809E chip as their main CPU, driving the core game logic and coordinating with other elements of the platform, such as the dedicated sound and graphics hardware. The 6809 is an 8-bit processor first released in 1977, a follow-up of sorts to two other influential chips of the era: the Motorola 6800 (1974), and the MOS Technology 6502 (1975); the latter, the 6502, was the basis for many of the most well-known and successful computing platforms of the 8-bit era, including the Commodore 64, Atari VCS, and Nintendo Fami-

com (known as the Nintendo Entertainment System, NES, in the United States). The 6809 itself was also used in home-based computer and game consoles, including the short-lived, vector-based Vectrex game system, Radio Shack's TRS-80 Color Computer, and in Japan, Fujitsu's FM-7 personal computer.

As arcade emulation pioneer Aaron Giles notes, "the 6809 was hugely popular for arcade games, being used by Williams, Namco, Konami, Exidy, Atari, and a whole host of other game manufacturers."<sup>2</sup> According to the list of game ROMs supported by the popular (and de facto authority) Multiple Arcade Machine Emulator (MAME), an impressive 660 of the 8544 currently compatible ROM images are from games using a 6809 processor in some capacity (though not all of these games use a 6809 as the main CPU; in many cases, the chip could serve an auxiliary purpose, such as for specific sound or graphics tasks, or as a companion CPU).<sup>3</sup> In other words, 7.7 percent of all MAME ROMs, representing games from the 1970s through today, rely on 6809 emulation. Influential 6809-based arcade games beyond those from Williams include *Qix* (1981), *Mappy* (1983), *I, Robot* (1983), *Gyruss* (1983), and *Tower of Druaga* (1984), among others. However, according to MAME, Williams's *Defender* is the earliest 6809 game, and the series of successful Williams games from 1980–83 may certainly have contributed to the establishment of the chip as a standard arcade building block.<sup>4</sup>

Indeed, in a January 1979 *BYTE* magazine article chronicling the history of the 6809 processor, chip designers Joel Boney and Terry Ritter cite games and other consumer-oriented products as a core business driver not only of the 6809 but of the entire industry, the necessary motivator to move microprocessor development beyond the earlier, unwieldy mainframes that had dominated academic and early business computing: "Only when microprocessors entered high volume markets (hobby, games, etc.) did the manufacturers begin to make money and thus provide a credible reason (and funds) for designing future microprocessors."<sup>5</sup> Enter Williams Electronics, Namco Ltd., Taito Corporation, and the other companies that established the arcade format—a new hybrid between consumer electronics manufacturers and media entertainment publishers.

Like many companies seeking to understand and enter the very young arcade market of the 1970s, the first computer-driven arcade game that Williams created was a straight copy of Atari's *PONG* (1972): it was called *Paddle Ball* and was released in 1973. *Paddle Ball* was computationally simplistic, with one collector noting that the game "pre-dates the practical application of a processor chip. The computer board is 'one big processor,'" with a matrix of individual logic chips strung together in place of a single CPU.<sup>6</sup> Although *Paddle Ball* likely made Williams more comfortable in this

new market, the true start of their creative and commercial success—and historical importance for gaming—was *Defender*, the first of the games to use the arcade platform described in this chapter, released in 1980.

*Defender* is known for its notorious difficulty and frantic pace, with *Edge Magazine* giving it the nod for #6 on its list of “The Best 50 Games of the 1980s”: “With its daunting array of controllers (five buttons and a joystick), a range of bad guys sporting complex behaviours, plus a weird control system drenched in inertia . . . Eugene Jarvis’s uniquely challenging creation for Williams remains one of the most difficult-to-master video games ever conceived.”<sup>7</sup> *Defender* pioneered new gameplay concepts and technologies, such as the use of a “mini-map” or radar for tracking gamespace beyond the visible screen area, an inaugural distinction it shares with Atari’s *Battle-Zone* (1980). Both games debuted at the Amusement and Music Operators Association (AMOA) trade show in 1980, and the idea appears to have been simultaneously developed independently. Although *Defender* was not the first game to provide continuous screen scrolling (a breakthrough first found in Kee Games/Atari’s top-down racing game *Super Bug* in 1977), it is likely the first side-scrolling shooter, making it an influence on the entire genre of spaceship-centric, 2-D shoot-em-ups popularized by titles such as Konami’s *Gradius* (1985) (though not a true genre ancestor, as there are significant conceptual differences in gameplay style, spatial modeling, and goal structure between *Defender* and such titles). Another notable element is the mountainous terrain that comprises the planetary surface above which the player flies, providing a more naturalistic variation in the environment than the typical hard-edge, straight-line game graphics.

From a technological historical perspective, however, the most immediately striking aspect of *Defender* is its raw sense of speed, an ability to present the player with fluid, split-second-decision scenarios as immersive as those of any present-day gaming technology—despite its lowly 1MHz processor, which was responsible not only for all gameplay logic, but also for “pixel-pushing” its 60-frames-per-second graphics in tandem. How is *Defender* able to accomplish this with such relatively under-powered hardware? Its aesthetic style is closely matched to its particular technical architecture, and perhaps surprisingly, the game’s most distinctive effects are arguably the result of a *lack* of the type of dedicated tile-and-sprite graphics hardware that became common on competing arcade platform designs.

What do I mean by a lack of hardware? When *Defender* was released in 1980, two key conceptual models for storing screen graphics were maturing in parallel. The first and most straightforward model is that used by *Defender*: the *framebuffer*, an area of (usually contiguous) memory that stores a value for each pixel on screen. One obvious advantage of the framebuffer

is that it is easily graspable, with a logic that directly mirrors the way the video monitor is physically constructed: one pixel location on screen, one pixel location in memory. As the monitor's electron gun scans across the screen, the video hardware reads the corresponding pixel location in memory. For game aesthetics, the most important advantage of the framebuffer is flexibility—each pixel can be manipulated individually. But as Aaron Giles explains, this flexibility is also the model's downside: "Keep in mind that a typical arcade game is approximately 256 pixels by 256 pixels, so even just clearing the screen requires  $256 \times 256 = 65,536$  operations. If each operation takes 4 clock cycles, then that is about 1/4 of a second on a 1 MHz CPU!"<sup>8</sup> There are simply too many pixels for the processor to keep up.

To solve this problem, hardware designers developed a second screen graphics model: the *tile-map*. In a tile-map, the screen is divided into a grid of smaller areas ("tiles"), typically 8x8 pixels each for this era of hardware. A limited number of 8x8-pixel tiles are stored for the common, repeatable elements in the game world. For example, arbitrarily shaped "walls" can be easily created by stringing together tiles for horizontal and vertical wall segments, with 90- or 45-degree corner pieces used to join them. At heart, the basic logic behind a tile-map is no different from that of LEGOs or other common toys that construct larger structures from a small set of individual pieces. Instead of needing to store one location in memory for each pixel, the programmer need only store one location in memory for *each tile*: the tiles are numbered, with each tile value mapping (hence, the name) to a unique type of 8x8-pixel tile. To draw the screen, the hardware first reads the tile number, and then looks up the pixel pattern for that tile. From a hardware performance standpoint, the primary advantage of the tile-map over the framebuffer is an exponential reduction in the amount of memory needed to store one screen's worth of information—and by extension, an equal reduction in the amount of processing power and time needed to make changes to that screen. Giles does the math: "a game with 256 by 256 pixels would need a 32 by 32 tilemap to cover that area with 8x8 graphics tiles . . . At 4 cycles per operation, clearing the screen happens in a brisk 1/250th of a second for a 1 MHz CPU."<sup>9</sup> In short, the tile-map requires *64 times less* memory and processing time.

The framebuffer and tile-map hardware models coexisted in the industry, and Giles points out that outwardly similar games of the same genre took different routes in their graphics implementations: Taito's *Space Invaders* (1978) used a classic framebuffer, while Namco's *Galaxian* (1979) introduced the tile-map model—most likely as a competitive response, enabling the more sophisticated enemy-swooping patterns for which the latter is known, not to mention freeing up memory to allow for color

graphics (*Space Invaders* was a strictly 1-bit, monochrome experience). The framebuffer used by *Defender* and subsequent Williams games has a visible area of 292x240 pixels. This screen resolution is distinct from, yet similar in scale, to the other arcade games of its era: *Space Invaders* (1978) was 224x240 pixels, *Galaxian* (1979) was 224x256, and *Pac-Man* (1980) and *Mappy* (1983) were both 224x288. But whatever the reason, the exact 292x240 resolution was not a common one, and according to MAME's game list was used almost exclusively by Williams games.<sup>10</sup>

Each of these 70,080 pixels is one of 16 colors, chosen by the programmer from a total selection of 256 possible colors. A palette of 16 simultaneous colors is a widely shared feature of early 1980s graphics hardware: the Commodore 64, MSX, and PC EGA home computers all use 16-color palettes, as do fellow arcade games such as *Pac-Man* and *Mappy*.

However, in all of those preceding examples, the 16 colors are fixed; the specific set of colors is literally baked into the hardware, either in the graphics chip itself, such as in the Commodore 64's VIC-II, or on a dedicated chip called a "color PROM" in the case of an arcade board.<sup>11</sup> The Williams platform, by contrast, gives the designer considerably more control, allowing the particular 16 colors displayed at any one time to be manipulated by the programmer. In hardware, each color is defined as a single byte, or 8 bits, allocated as 3 bits of red, 3 bits of green, and 2 bits of blue. Forced to partition 8 bits across 3 colors, it is no accident that the blue is short-changed. When a human perceives brightness on an RGB video screen, the eye is 10 times more sensitive to green than to blue: the green contributes about 71 percent of the sensation of brightness, the red 21 percent, and the blue a mere 7 percent.<sup>12</sup> This blue perception imbalance has a long history of influence in the design of display hardware, right up to today—Google's Nexus One mobile phone, for instance, uses an AMOLED display with subpixels that intentionally provide more physical resolution for the green components, de-emphasizing the red and blue.<sup>13</sup> For the early 1980s Williams games, the practical consequence of the 3-3-2 RGB bit pattern is that for each color definition, the programmer can mix colors by choosing from eight levels of intensity for red and green each, but only four such levels for blue.

While the visible screen area is 292x240, the underlying video memory area is larger, with a full capacity of 304x256 pixels (see Fig. 10.2). Why the discrepancy? As with almost all 1980s video hardware that output to a CRT-based, NTSC television, portions of the screen were often deliberately omitted. At the heart of the CRT television is an "electron gun" that is constantly scanning the screen from left to right, top to bottom, literally shooting onto the glass. TVs of the time (especially those from the 1970s or

earlier) were often poorly calibrated, and there was no guarantee that the screen's edges would align from set to set. To alleviate the problem, hardware designers stuck to a "safe zone," with the discarded video areas known as "overscan." Even though Williams was designing arcade games with their own dedicated monitors, rather than games for home televisions, they still had to contend with individually calibrated monitors in arcades across the country. The need to avoid manual maintenance wherever possible influenced arcade hardware platform design.

There is also a hardware convenience to the particular 256 pixel height. Unlike most video framebuffers (especially on contemporary platforms), which are organized in a linear, horizontal fashion with bytes incrementing pixel locations from left to right, the Williams framebuffer is laid out vertically, two columns of pixels at a time: a zigzag pattern that traces two pixels right, then skips down one row and back two pixels before continuing (see Fig. 10.3). The two-column layout is due to the platform's palette depth of 16 colors. Each pixel is stored in 4 bits (since 4 bits contain a number between 0 and 15), meaning that two pixels are stored in every byte (which consists of 8 bits). Thus each byte in the framebuffer corresponds to two pixels side by side. But a 256-pixel height is relevant because it allows fr-

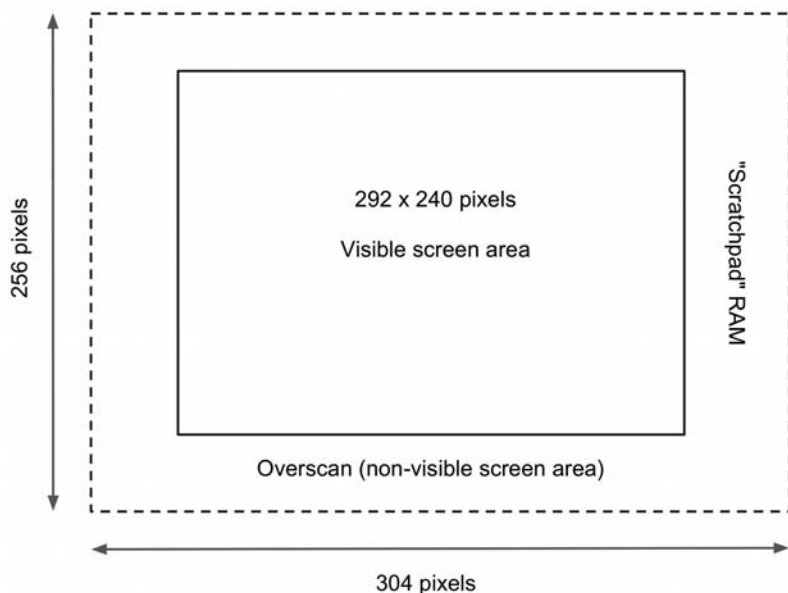


Fig. 10.2. The Williams arcade platform had a total video framebuffer size of 304x256 pixels, but only 292x240 pixels were visible; the nonvisible areas were used to adjust for monitor differences and could be co-opted by the programmer as extra "scratchpad" RAM.

amebuffer locations to be easily encoded in a single 16-bit number. Thanks to the properties of binary math, if the “lower” 8 bits represent the Y coordinate, and the “upper” 8 bits the X coordinate, then the Y coordinate will automatically “wrap” from 255 to 0 as it fills up, causing the X coordinate to increment as well.

So with a total framebuffer resolution of 304x256 (77,824 pixels), the current screen state is stored across 38,912 bytes, or exactly 38KB of RAM. Given that the Williams platform contains a total of 48KB of RAM, we can see that the screen graphics are by far the most dominant memory component, eating up almost 80 percent of all available memory. The remaining 10KB of RAM is used to keep track of all other “live” aspects of gameplay: player and enemy positions, orientations, speeds, the current level and scores, time limits, and anything else that the system would have to remember to keep the game running. Keep in mind that RAM is only used for transient, “per-play” information; persistent data that remains when the machine is turned off—such as the character graphics, level layouts, and actual game code—is stored in the nonvolatile ROM chips.

10KB may not sound like a lot compared to today’s generous RAM allowances, when 2GB (or more) of RAM is common on typical desktop or laptop computers—over 43,000 times that of the Williams game board. But the constrained spatial areas of the games (a single-screen layout in *Joust*,

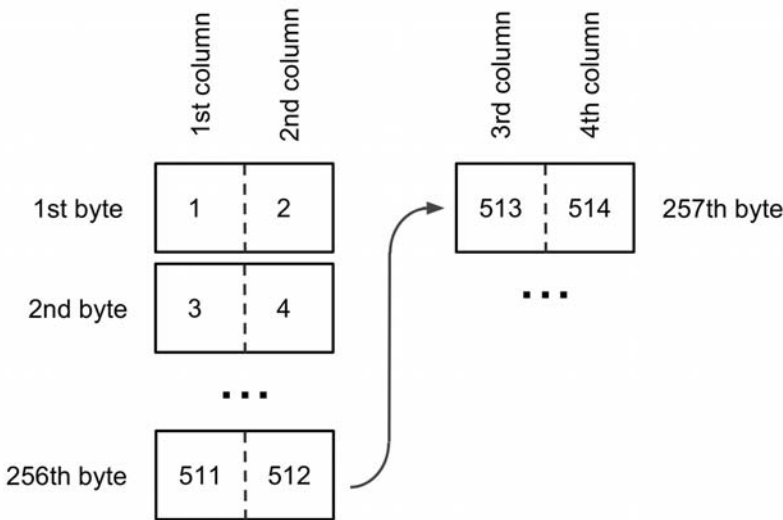


Fig. 10.3. The framebuffer is organized in a zigzag pattern, with pairs of side-by-side pixels stacked vertically on top of each other: 256 bytes and 512 pixels per column. The numbers in each box indicate the pixels’ sequential positions in memory.

*Robotron*, *Bubbles*, and *Splat!*, for instance, while *Defender*, *Stargate*, and *Sinistar* allow screen scrolling but within a limited area) keep this allocation reasonable and, indeed, comfortable. For example, the source code for the Atari 7800 port of *Robotron* (gameplay was certainly not identical to the arcade version, but presumably similar in scope) reveals that the game tracks up to 80 simultaneous enemies, with 16 bytes allocated for each enemy: 1 byte to indicate the type of creature; 2 bytes to hold X and Y screen locations; 7 bytes for values related to the direction, speed, and animation frame of the character's movement; and 6 bytes for other miscellaneous information.<sup>14</sup> The game state for these 80 enemies, easily the largest single group of game objects, consumes 1280 bytes of memory, or only 12.5 percent of the available 10KB RAM.

On the other hand, memory was not so plentiful that it was taken for granted or wasted by Williams programmers. Especially for arcade collectors, one graphical hallmark of these Williams games is a jittery, multicolored pattern of dots and lines sometimes visible on the right side of the screen: this video confetti is the slim, 12-pixel gutter between the 292-pixel edge of the screen that is intended to be visible, and the full 304-pixel area of memory that lies underneath. Given that some of this memory was nominally marked as "video RAM," yet was not intended to be actually *seen*, the programmers used it as an extra "scratchpad" area, storing other non-graphical data there instead. But when the monitor's horizontal positioning is not configured to precisely line up with its physical seating in the arcade cabinet, these hijacked scratchpad pixels find their way onto the screen: "Basically, some of the scratchpad RAM being used by the program is being scanned by and displayed by the video circuitry."<sup>15</sup> Quirks like these lay bare the relationship between hardware and game phenomenology; for a more contemporary equivalent, we can look to how the effect of "polygon seams" in some 3-D games—particularly the ability to see between them—alters the player's experience of game objects as supposedly "solid" geometry, and changes the nature of gameplay by revealing elements that were originally intended to be hidden.

So due to memory and speed limitations, the central graphics tenet of a 1980s-era, framebuffer-based game such as *Defender* is to change as *few pixels as possible* from frame to frame. *Defender* runs at a very smooth clip of 60 frames per second (fps). For comparison, film runs at 24fps and U.S. television stores one full frame per 30fps but interlaces alternating frames to simulate a higher rate of change. If we continue to use Giles's assumption of 4 CPU cycles per pixel operation, we can estimate that the 1MHz processor can alter the framebuffer values of 524,288 pixels per second (262,144 byte operations, with two 4-bit pixels drawn per byte): about 8,700 pix-

els per frame. In some respects, this does not seem to be much of a hindrance. There are 70,080 visible pixels on *Defender's* 292x240-resolution screen, so the game is able to alter a theoretical maximum of 12.4 percent of the screen area per frame (1/60th of a second). On the other hand, this precludes certain graphic world models, most notably the smoothly scrolling background graphics that would become dominant on tile-map-based hardware like the Nintendo Entertainment System (NES), with *Super Mario Bros.* (1985) the quintessential example. Such games change more than 100 percent of their pixels per frame (a background layer covering the entire screen, plus the sprite characters and objects drawn atop it: some pixels will appear across multiple layers and will need to be drawn more than once, hence a per-frame pixel throughput that exceeds 100 percent). Tile-map-based platforms often included hardware-enabled scrolling features like X and Y offset registers that allowed them to accomplish this with relative ease: when drawing the screen, the video hardware would simply shift the entire tile-map over by a small pixel increment, obviating the need for the programmer to redraw the entire screen in software.

Yet even with its 12.4 percent pixel change ceiling—in actuality a highly optimistic limit that does not account for game or display logic necessary to decide which pixels to draw where—*Defender* does offer continuous side-scrolling and did so very early in the life of arcade platforms, before the effect was common. Two core graphical tactics are harnessed to enable the scrolling effect, and both depend on the game's sparse, sci-fi aesthetic of strong colors against a solid black background. The first is a multicolored field of stars drawn on that background. These “stars” are each a single pixel, and they quickly twinkle in and out, frequently changing color. The star field is a simple mechanism for creating a point of reference, an illusion of motion that the world is “scrolling” by, and it offers several advantages. Most obviously, because the field is sparse, there are very few pixels to redraw when the entire field must be “moved.” And because the stars are constantly twinkling, there are even fewer of them visible at any one time than the eye perceives. Several screen captures (via MAME emulation) revealed no more than 14 stars simultaneously visible, dispersed across an area roughly half the size of the entire screen: that's a mere 0.04 percent of the total pixels in that screen area, an extremely efficient ratio of active to passive pixels.

Another more subtle advantage of the starfield is that because it changes so rapidly itself, it is not important to preserve the field's “integrity” when player or enemy characters travel across it. That is, unlike a “pictorial” background that must be carefully replaced pixel by pixel as a graphic moves “on top” of it, a star in *Defender's* background will as likely as not

have already conveniently disappeared by the time the player's spaceship uncovers it. The nature of the starfield makes any potentially "lost" pixels essentially undetectable by the player. In fact, all of the game's character graphics—the player's spaceship, the enemies, and so on—are drawn with a black background that covers up any graphical layer behind it: if you look closely as the player flies near the bottom of the screen, the terrain in the background will be blocked out. This is because the hardware lacks support for sprites, a feature that in later platforms would provide for transparency in character graphics. The starfield background helps to make this shortcut less noticeable. The game's liberal use of black spaces is well suited to its limitations.

The second tactic that provides *Defender's* smoothly scrolling world is the mountainous terrain drawn across the bottom third of the screen. The surface is rendered in a fine-line style, a trail of brown pixels that wanders up and down, forming a vaguely planetary silhouette. As with the starfield, the terrain is arranged with economy, a single pixel drawn per X coordinate: a total of 292 pixels across the visible width of the screen. At first glance, the mountain terrain is purely decorative. It is, like the starfield, a non-interactive graphical element that has no direct impact on game state. The player does not crash into it, nor can it be used for cover from enemy fire or to avoid detection. Yet it is far from "useless." Like the starfield, its true role is as a perceptual indicator, a physical frame against which the player can correlate the position of his own ship and those of his enemies while the entire screen space is shifting. In fact, because it is a continuous line, is drawn in a stable, easier to see color, and is fixed in the world across time (unlike the twinkling stars), the terrain is the backbone that establishes the game's spatial model. A game with tile-based hardware would have taken this scrolling background for granted; *Defender*, predating the widespread use of such a model, relies on compact alternatives.

*Defender's* approach to motion and spatial navigation is notable for its divergence from both its contemporaries and its genre successors. The game creates a sense of depth and layer separation through parallax scrolling: the starfield, ground terrain, and player's ship all move at different speeds that adjust as the player accelerates (see Fig. 10.4). It is unusual, by later-established genre conventions, that there is no stationary, visual "grounding" element in *Defender*. In most scrolling games, at least one of the player's avatar, foreground, and background graphics layers is moving at a constant speed (or not moving at all in the case that the player's avatar is stationary). Shoot'em-ups such as *Gradius* have a constantly scrolling, "forced" background progression, with the player able to perform constrained movements within that moving screen frame. In side-scrolling

platformers like *Super Mario Bros.* (1985), either the world foreground scrolls in lock-step with the player (causing the player sprite itself to be fixed as the level moves forward), or the player navigates the level while the background stays in place (both modes are often seen in the same game, depending on level design, player backtracking vs. moving forward, etc.). But in *Defender*, these graphic layers are often all accelerating relative to one another. The player graphic does eventually become stationary once it has reached top speed—though in any case there is little practicality to playing the game at this velocity; the gamespace and enemy AI encourage strategic maneuvers rather than cowboy running-and-gunning. This relative layer parallax would likely not have been possible on a hardware platform with built-in scrolling. Although later “16-bit” platforms did often provide multiple scrolling layers that could move at different speeds, the cutting edge of *Defender*’s era was the much simpler single layer with smooth, per-pixel scrolling control.



Fig. 10.4. *Defender*’s graphics are sparse and derive much of their impact from color and motion. Key elements are visible here, including the mini-map radar at the top of the screen, the player’s laser beam streaking across the screen, and the single-pixel line that forms the mountain range along the lower third of the screen.

In the realm of world simulation, *Defender* (along with *BattleZone*, as previously mentioned) initiated the use of *off-screen action* as a significant focal point of player attention. As noted, it is not the first title in which off-screen space *exists*, but it does appear to be the initial introduction of player multitasking to core gameplay psychology, requiring the player to track both enemies and their human prey spread across the level, each of which can be both visible and invisible. It further complicates this mental tracking with the use of multistage gameplay. Although the primary player goal is to simply shoot all enemies before they are able to reach the human characters at the bottom of the screen, the game also enables more sophisticated “recovery” operations. If an enemy does reach a human, that human is captured and carried upward by the enemy toward the top of the screen, rather than being killed on contact. The player can recover from this situation and avoid losing points by shooting the enemy, and then catching the suddenly falling human before it impacts the ground. The use of multiple-screen spaces, dependent-move sequences, and fallback goals reflects the game’s desire to split the player’s attention as widely as possible—the ungrounded, relative graphical velocities of player/foreground/background are part of this effort—but also to temper its own difficulty by adhering to a fair and logical system that reward mental orchestration.

Also peculiar is *Defender*’s presentation of a side-scrolling gamespace that wraps. This has the effect of equalizing the direction of play: flying from right-to-left is just as effective as the left-to-right movement standard to the vast majority of other horizontal flying/shooting games (Namco’s *Sky Kid*, 1985, is an unusual example of a right-to-left scrolling shooter). Several forms of wrapping space are common to games of *Defender*’s era, yet they usually fall into other categories: single screens with objects that wrap at the edges (as in *Asteroids* and *Pac-Man*), or top-down four-directional scrolling (as in *Super Bug*). *Defender*’s single-axis, wraparound space forms a conceptual cylinder and runs counter to the the genre of horizontal 2-D shooters that followed it starting with Konami’s *Scramble* in 1981, in which there was a presumed progression along one direction and through a non-repeatable space. And from a technical perspective, the smaller wrapping space requires less data than would a longer linear level. From our historical vantage point of established side-scrolling genres, *Defender* is a fascinating case for its techniques that did *not* become genre precedents, more so than for those that *did*—though the impact of the mini-map/radar user interface pattern should not be forgotten and remains highly influential to this day.

The essence of *Defender*’s phenomenology is its feeling of speed and (what is best described as) “power,” an unforgiving, lightning-fast, and

always colorful response to in-game action. We have seen how *Defender* constructs a spatial environment by minimizing its pixel deltas. The same approach is behind two techniques that animate the action within that world. The first is a family of graphics algorithms broadly known as *particle systems*. Simply put, particle systems orchestrate the animation of a group of individual graphical entities (the “particles”), to form a perception of a larger, coherent object. Particle system effects can be used in a relatively humble, lo-fi manner as they are in *Defender*, as groups of individual pixels that form explosions, laser beams, and teleportation. But the style has also been used extensively in graphics and scientific research to model complex substances and motion such as fluid dynamics and gas clouds. Likewise, particle effects have played a prominent role in special effects for commercial films.

One does not have to wait long to observe *Defender*’s particle system effects: on the game’s title screen, the *Defender* logo materializes from an array of pixel clumps (about 4 to 8 pixels each), yellow and red rectangles that converge from all directions, from screen edge to center, joining together to spell out the game’s name. Particles are also the visual vehicle any time the player’s ship materializes (at game start or when the “hyperspace” teleportation is activated) or is destroyed; likewise for enemy spawn and death animations. Particle effects are efficient because they can spread a relatively small number of pixels across a large area, moving and coloring those pixels in a way that presents a much larger object—and one more sophisticated and flexible than a typical game sprite, constrained by its invisible rectangular fence. They are also able to construct a feeling of action-at-a-distance. The most effective use of particles in *Defender* is the player’s laser beam: when fired, the beam streams across the screen as a single, pixel-high line, solid at its leading edge, stuttering and re-forming in the trailing half. The player can strafe up and down the field, stacking these beams. It is a far more striking enabler of player power than the typical individual bullet of the shoot-’em-up genre. As with the star field, the laser beam requires minimal pixel redraw. It is drawn by adding pixels forward, with the back portion of the beam following a fixed toggle pattern—4 pixels on, 2 pixels skipped; 3 pixels on, 1 pixel skipped; and so forth—that acts as a mask as the pixels stream by. Only a few pixels need be removed while in transit, until the entire beam exhausts itself and disappears all at once.

A similarly powerful particle effect is used when the player’s ship is destroyed, replaced by a cluster of 2x2-pixel rectangles that scatter in all directions, “erasing” the game’s surroundings as they go: as the ship remnants pass over the star field, enemies, and even the world’s ground terrain, they leave a black trail in their wake. This is technologically convenient, as the

game simply back-fills the trail of the moving particles with solid black, rather than actually storing and redrawing the original pixel colors that were underneath. But this software shortcut also creates an emotionally effective feeling of decay and immediate obliteration: the simulation of the game world collapsing before the player's eyes, as if it no longer meaningfully existed without them.

Whereas the starfield and mountain terrain are examples of ways in which *Defender* has to work extra hard to create graphical layers of space that would have been easily accessible in arcade games with tile and sprite hardware, its particle effects are the opposite. Because particle effects operate by manipulating individual pixels across the framebuffer, the style simply would not have been possible on a system dependent on tiles and sprites, in which the lowest common denominator is a rectangular group of pixels more commonly sized at 8x8 or larger, and often constrained to particular patterns of location. Many hardware-native sprite implementations support a maximum number of sprites per scanline: 4 per line on the MSX, and 8 per line on the Commodore 64, for example. From a platform studies perspective, it is key that the particle effects of *Defender*, so central to its visual style and animation, would have been unavailable on later arcade hardware that from other points of view would be considered more “advanced.”

Another technical feature that is key to the game's aesthetic is color-cycling, used extensively and cleverly by *Defender* (and later Williams games, especially *Robotron*) to create an impression of greater color variety and motion. Earlier, I described how the Williams platform allows the programmer to choose 16 colors for simultaneous display. Each of these colors is referenced by a number; for example, if color number 2 is defined as red, then all pixels in the framebuffer that are set to the value 2 display as red. Color-cycling is the ability, enabled by some graphics hardware, to change those color definitions “on the fly.” For example, by changing color number 2 from red to green, we can instantaneously change *all* red pixels on screen to green, without changing any of the actual pixel values themselves in the framebuffer. This is because each time the video hardware redraws the screen (60 times per second), it is first reading the 16 color values set by the programmer, then correlating those to each pixel value in the frame, as it draws them one by one. The memory and computational benefits of color-cycling are obvious: anywhere from hundreds to tens of thousands of pixels can be changed in bulk, all by manipulating a single byte in the color lookup table.

Of course, the technique has limitations. Most animations require more than a simple mass-color change, instead requiring that individual pixels

be manipulated to “move” across the screen, as when an entire character graphic must be repositioned. But color-cycling can be harnessed to construct motion effects such as wave or ripple patterns, by smoothly animating a band of colors with brightness levels along a single hue—commonly used for water, fire, or other “fluids.” Alternatively, a block of palette values can all be set to the same actual color, with one contrasting color cycled through the band, a “shockwave” effect as the contrast color makes it way through the palette. For example, with 15 blacks and 1 red, the particular color number coded as red can be rapidly changed from 0 to 15, causing the appearance of a red line animating through space (to set this up, the framebuffer is stacked with pixel lines of increasing color numbers: a row of color 0 pixels, a row of color 1 pixels, etc.).

Color-cycling is a constant feature of *Defender*. There appears to be literally no point in the game’s operation, from the title screen to the attract mode to the gameplay, during which color-cycling is not actively in use. Almost all of the core visual features of the game are enhanced by the technique: the twinkling star field, the laser beam, the explosion of the player’s ship. But color-cycling is also used in more subtle and more ostentatious ways. The cockpit of the player’s ship, a mere 3-pixel row, cycles to bring the ship to mechanical life, a noticeable contrast to typically static game sprites (and requiring no additional ROM to store animation frames). (The cockpit animation is even replicated in the mini-ships shown at the top of the screen, representing the number of lives the player has remaining.) A triangle behind the ship’s tail end cycles through random colors, mixing to form a fiery exhaust that appears to propel the player forward. More generally, color-cycling pervades the non-diegetic game elements such as in-game scores, the high score board, the Williams logo on the title screen, and almost all text appearing anywhere. In short, like *Defender*’s stars, mountains, and particle effects, color-cycling is used to enable gameplay through minimal computational change. Yet it also sets the game’s frenetic, loud, brightly lit ambiance, as identifiable a historical feature as its difficulty or game mechanics.

The next evolutionary step for the Williams arcade platform came in 1982, with *Robotron: 2084*, the quintessential single-screen “survival” game, the player surrounded by a claustrophobia-inducing mob of robots. *Robotron* is best known for its introduction of a dual-joystick control scheme: one eight-way joystick controls the player’s movement, while another determines the direction of the player’s shot. This allowed for the player to move and shoot in two directions at the same time, enabling more nuanced maneuvers such as strafing and backing away. The most significant technical difference between *Robotron* and *Defender*, however, is the addition of

two “blitter” chips, dedicated graphics hardware that could quickly move rectangular blocks of pixels back and forth between video RAM and other general memory. The blitter chips were literally game-changing because they allowed the programmer to orchestrate the mass movement of pixels without having to expend more than a few cycles of primary CPU. Blitters were a hardware feature necessitated by designer Eugene Jarvis’s vision for *Robotron* with up to 80 characters on screen simultaneously, it simply would have been impossible to “push” the required number of pixels in software (see Fig. 10.5).

How fast were the Williams blitters? Aaron Giles notes that the theoretical maximum is about 1 megabyte per second (1MB/s), based on the chips’ 4MHz clock and the underlying hardware’s 8-bit data bus.<sup>16</sup> However, by instrumenting his original Williams hardware and capturing the output on a PC, collector Sean Riddle explicitly tested the blitters and pegged their real-world performance at about 910 KB/s (about 10 percent below

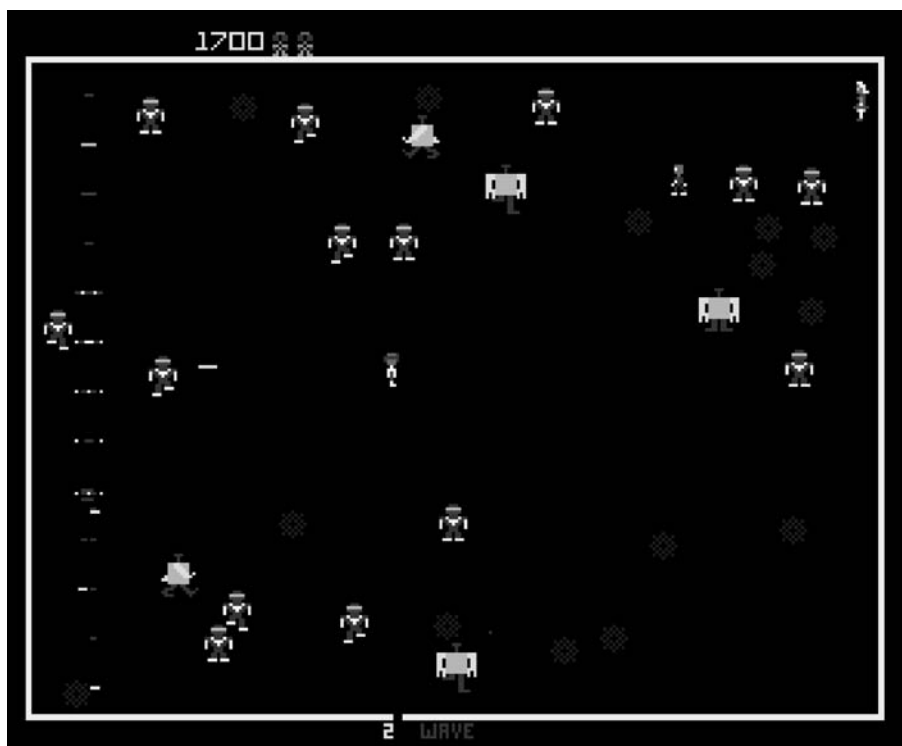


Fig. 10.5. The overwhelming number of simultaneous on-screen characters in *Robotron: 2084* led to the addition of «blitters» to the Williams arcade platform: specialized chips that are dedicated to moving rectangular blocks of pixels at high speed.

the theoretical limit).<sup>17</sup> At 60 fps, this equates to roughly 31,000 pixels per frame—impressive considering that the entire screen’s framebuffer is only around 70,000 pixels. In actuality, the pixel throughput is lower: programmers must carefully time their character blits to stay in sync with the video beam drawing the screen, or to keep characters from erasing or overlapping one another, for example. The flexible nature of Williams’s blitters parallels the hardware philosophy of their pixel framebuffer. Although many game hardware platforms provided hardware support for sprites, as noted previously these often carried limitations on sprite size, shape, and position (especially maximum number of sprites per scanline). The Williams games, by contrast, were limited only by the total throughput of the blitter chips themselves, with real impacts on gameplay. In their 1982 ostrich-battle game *Joust*, for example, the enemy flight and chase patterns are unencumbered by hardware limitations; characters can fluidly move between areas of the screen, allowing the programmers to focus more on the game’s surprisingly sophisticated flight physics, with spatially freed enemies that appear more intelligent than typical lumbering arcade sentinels.

Williams’s blitters also offer a nice example of hardware “limitations” proactively harnessed for game design. When the screen becomes filled with too many characters for the blitter to fill, it buckles under the weight, and the game literally slows down, allowing the player to pull off complex moves and daring escapes “in slow-motion.” Game designers and players are familiar with this slowdown effect of the 8-bit era, providing a built-in trigger for managing difficulty that became an intentional design tactic of the 2-D shoot-’em-up genre. In fact, slowdown is not only artificially introduced into such games today, but has also found its metaphorical way into the periodic slow-motion scenes known as “bullet time” in many contemporary titles. The meaningful integration of hardware blitter speed into gameplay has also meant that programmers who seek to emulate arcade platforms must be keenly aware of low-level computing; again, Aaron Giles: “I’m currently working on an update to the early Williams games that will factor this [maximum blitting speed] in, in the hopes that Robotron might slow down enough to match the arcade (a number of folks have noticed that Robotron runs too fast in MAME at the higher levels).”<sup>18</sup>

With the foundation created by *Defender* and its sequel *StarGate*, and the addition of the blitter chips for *Robotron*, the Williams platform held steady through 1982, seeing the further release of *Joust*, *Sinistar*, *Bubbles*, and *Splat!* These seven arcade titles leave a remarkable legacy, running the gamut from familiar to strangely alien. While *Defender* and its siblings helped establish key user-interface (UI) components such as the mini-map and design approaches to off-screen space and multi-tasking, they also of-

ten applied control schemes and logic that can feel unorthodox by today's gameplay conventions: the "reverse" button in *Defender*, the frantic head-on collisions between player and asteroid in *Sinistar*, the soap bubble avatar of *Bubbles*. These games come from a period of rapid innovation, when the models of both hardware and game mechanics that we take for granted as "classic" today were still being established. Technical design plays a crucial role in the development of the gaming medium, but not in a technologically determinative fashion—instead often flowing in equal directions between hardware and game design. And this tension is especially relevant and illustrative in the early arcade era, when the designers creating the game rules and the physical machines were not from separate companies, with different professional, artistic, or economic goals, but instead were often the same or closely linked as a team.

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CARLY A. KOCUREK

## Coin-Drop Capitalism

*Economic Lessons from the Video Game Arcade*

The video game industry as a whole recovered after the Crash of 1983, but many arcades did not, and within a few years, towns that had previously boasted numerous arcades were left with just a few grimy machines in the corner of the bowling alley. Today, the video game arcade persists as a nostalgic space, an entertainment gimmick, or a nerd mecca for the truly dedicated. The history of gaming as practice critically illuminates the evolution of a set of cultural beliefs that have become central in the digital age. As the wired generation transitions to the wireless generation, and as digital natives become dominant cultural elites, we are seeing the refinement of values and ideals readily observed in the arcade culture of the 1970s and 1980s. Ideas about gaming formed prior to the Crash have, like the industry, survived and propagated, and continue to influence popular conceptions of youth, masculinity, and technology; to understand these is to go a long way toward understanding the underpinnings of contemporary digital culture. The video game arcade provided early exposure to computer technologies for thousands of youth years before computers became commonplace in offices, classrooms, and homes across the United States. The arcade may persist in some permutations as a physical space, but more significantly, it persists as a mode not only of play, but of economic decision making and a set of cultural values. The values of the arcade have become the values of our daily lives, including our labor practices and financial habits. In some ways, we are still in the arcade.

This essay presents a phenomenological tour of an imagined golden era arcade. I draw on documentation of actual arcades and surviving arcade cabinets, popular press coverage of games and gamers, and interviews with

arcade owners and gamers. The tour is presented as a way of entering into a discussion about the meaning of the arcade as a place where computers became culture, boys became men, and simulation became a way of living. We travel through this imagined space not by placing one foot in front of another, shedding quarters along the way, fueled by candy and Funyuns, but instead, by moving from concept to concept, exploring the arcade's key components: sight, sound, and play. The arcade as imagined here is itself a memorial to the modern era and a map to the postmodern age we have come to know as the present, a place we have been and still are. To walk through the arcade is to confront the digitization of culture, including significant changes to the role of money in daily life. This treatment of the arcade provides unique insights into the values system of the arcade itself. Rather than analyzing individual games, this essay offers a phenomenological reading of the machines as objects, specifically as toys with didactic implications, and of the cultural and economic environment that they existed in—both the immediate geographic environment of the arcade and the historically and nationally defined environment of the United States from the early 1970s through the early 1980s.

The tour is followed with a consideration of the underlying business structure of the arcade, offering historical perspective on the development of video gaming as a public commercial practice that involved not only the individual gamer consumers, but those who worked in and around the industry. Early video gaming was a set of consumer practices, but it also involved the production, marketing, and distribution of the machines, which influenced the format of the games and shaped the consumer behaviors essential to the games' early success. Although the coin-operated amusement industry was nothing new, the craze triggered by video games was somewhat unique. The vitriolic response many moral guardians had to the games tied not only to the young age of many gamers and the novelty of the medium, but also to the longer history of coin-operated amusements and the parallels between the economic and cultural values of these new games and greater socioeconomic upheaval. Video gaming then, was a site where old worries about youths' access to commercial entertainments coupled with anxieties about emergent technologies and broader cultural and economic shifts. However, this discussion of the arcade as a historical site requires an understanding of the arcade as a physical site.

#### SIGHT

The arcade beckons visually, its name blasted in neon or cartoonish script, the machines inside visible through the windows or open doors. The most

popular games are surrounded by clusters of onlookers, some of whom have added a quarter to the top of the cabinet to hold their place in line. The fluorescent lighting is low to maximize the visibility of the machines' cathode displays, allowing the glow of the screens to light players' faces. The game cabinets offer the flash of concert posters, screaming their names in lurid orange and yellow, attempting to entice with images of intergalactic robots, implausibly leggy cartoon characters, and bizarre creatures. The unoccupied games play in attract mode, displaying top scores, titles, and short bursts of simulated play. The screens tease. The giant ape takes the girl hostage and rushes to the top of the screen; aliens invade, making steady progress toward the earth. If this is a particularly modern arcade, the video games may dominate the space completely; in an older one, pinball machines may line one wall or occupy a corner, or perhaps there are pool tables. If this is the case, older patrons may be absorbed in rounds of pool or pinball wizardry, leaving the newer machines to younger customers.

## SOUND

Inside the arcade, as the machines blink and blast, players punch and pound at them, and the hard plastic buttons clack against their casings. Change machines spill quarters in a noisy avalanche, or a teenaged employee doles tokens into plastic cups. You can hear the frantic pace of play almost before you see the action. There can be no quiet here; even if the place were abandoned during a mid-afternoon dead spell, the machines would continue untended, playing an infinite loop siren song of computerized audio, a chorus of boops and bleeps. The pinball machines in the back corner clank mechanically, remnants of the machine age. Other machines bleed even stranger sounds, like the *Q\*bert* (1982) voices, randomized and generated by Votrax (a speech synthesizer). Perhaps the arcade staff make announcements over the PA, or a cluster of children sings "Happy Birthday" at a long table near the heart of the arcade. The voices mix with the machines. Conversations here are clipped, efficient, divided neatly into the space between levels. And, the whole mess mingles with the mall's piped in Muzak, a reminder of the cool serenity of the department stores further down, of the perfume counters, shoe departments, and handbag sales. Of suits, of ties, of order.

## PLAY

Pick a quarter out from the change in your pocket and choose a machine, any machine. Perhaps it is *Pac-Man* (1980) or *Centipede* (1981) or *Galaga*

(1981). It doesn't matter. Put your quarter in the slot where the machine swallows it with a faint metallic clank before the game announces itself; the machine awakes from attract mode and switches into assault. Defend the planet from aliens, avoid ghosts, gobble cherries, dodge barrels. Make it maybe 60 seconds, or survive the first level on a game you haven't played before, and you have proven yourself exceptional. Go again. Find yourself dead, confronted with the listing of top players—of players better than you, of players who don't blow through 12 bucks in quarters in 45 minutes, players who know what comes next. After level one, level two, level three. Go again. More quarters. You're sweating in the refrigerated air. Go again. The last quarter burnt, you hit the machine hard enough to sting your hand. You feel foolish, but no one notices. They're too busy watching some kid down the row who's been playing steady for an hour on one quarter. Perhaps at this point you say enough and leave. Perhaps you don't. Perhaps you feed the change machine a five and stuff your pocket with more quarters. Perhaps you challenge someone to two-player. Maybe you win. Maybe you don't. Maybe it's getting late and you realize you've neglected your algebra homework again.

#### REFLECT

Maybe, back here in the present, you've never been to an arcade and the experience just described is foreign to you. Or, perhaps you spent much of your childhood in a place like the composite I have described. The arcade nearest my own hometown was an Aladdin's Castle, where my brother and I played until the respectability of the mall took a sharp turn south, and the nightly news began reporting on routine busts of a crack dealer operating out of the arcade's back corner. Although that arcade did not close until the mid-1990s, the industry Crash of 1983 sounded the death knell for what became a kind of protracted agony for video game arcades in the United States. Arcades fell victim to numerous factors, including a general decline in the industry, and also of inflation—the quarters the machines took in were increasingly devalued, which compounded the fact that there were fewer of them in the first place, as more and more gamers switched from the public space of the arcade to the private space of the home, where they plugged in Atari 2600s, Intellivisions, and other early home gaming systems or plugged in to online games which provided a gaming community of their own.

Prior to the industry Crash, the cost of gaming was not insignificant, particularly for those who were new to the practice or otherwise lacking in particular skill at it. When, in 2008, I popped a quarter into a *Galaga* (1981) machine for the first time at a movie theater in north Austin, my money bought me just 65 seconds of play. I had not previously played *Galaga*—by the time I was old enough to be dropped off for a few unsupervised hours at the shopping mall that housed the only arcade in my home county, *Galaga* was obsolete. I was a novice player. That first game, costing me 25 cents and lasting 65 seconds, was followed by a second lasting only 55 seconds. In total, I played 10 games of *Galaga*, which varied in length from 50 seconds to 136 seconds, with an average of just under a minute and a half. Within 15 minutes, I had blown through \$2.50.

I mention my experience playing *Galaga* not to engage with the specifics of that particular game, but to introduce the kind of consumer spending demanded by coin-operated arcade games generally. Admittedly, I am not good at *Galaga*, but many players who encountered the game early in its release would not have been either—at least initially. Even assuming that I am exceptionally bad at *Galaga* and that my average game time is half what it should have been, the price of gameplay is high, with an hour of play likely running between \$8 and \$12. Presumably, arcade players increase their skill and maximize game time—even in the brief time I spent playing *Galaga* at the theater, my skill at the game improved—but doing so requires a substantial financial investment in play.

Building on my earlier description of a composite arcade, I am offering here a reading of the cultural values embedded in early coin-operated video games and in early video game arcades. Early coin-operated video games prepared players to serve both as laborers in the emergent white-collar service economy and as investor players in an increasingly deregulated marketplace. They introduced thousands of people to computers as approachable, everyday technologies just as the workplace was entering a period of massive computerization. Video games' didactic function made them suspect as they carried an emergent set of values and practices at odds with existing cultural norms and ideals. The economic practices of gaming coupled with the focus on individual competition put the games at odds with modernist economic and labor practices. Although the gameplay experience of different games varied, the cost of play and type of spending, the speed of the games, and the focus on individual achievement remained fairly consistent. Because gameplay has ideological and didactic value and serves a key role in shaping a labor force, both individual games and the

places they were played served as lightning rods for moral reformers whose social standards reflected waning norms rather than the emergent values of a society in transition.

Arguments about the moral and economic implications of individual video games have been the bread and butter not only of public moral guardians seeking to police gaming, but of numerous scholars. For example, Steven Poole says that the problematic political underpinnings of *The Sims* (2000)—namely, the glorification of consumerism—may be to some degree unavoidable: “Perhaps it is inevitable that, as products of decadent late capitalism, most videogames will, consciously or not, reflect the same values.”<sup>1</sup> Although Poole’s argument is specific to a game, many games work through the cultural values of late capitalism not only at the levels of gameplay and narrative, but also in the kinds of practices they encourage. In particular, the coin-operated video games of the 1970s and 1980s seemed uniquely poised to introduce the young to emergent consumer patterns and economic practices through the “pay for play” arcade environment described here. Unlike earlier coin-operated amusements, they were rapidly clustered in businesses designed specifically to appeal to the young. The focus on making video game arcades “family-friendly” (read “kid-friendly”) meant that rather than seeming nonthreatening as the owners likely intended, arcades appeared extra threatening and were perceived as selling directly to vulnerable children. Arcades became a crash course in spending for youths who had not yet passed into the economic order by joining the labor force.

This introduction to a specific set of consumer experiences and values warrants critical inquiry, especially as it offers insight into the nervous response many moral reformers had (and continue to have) toward video games. Further, the new, computerized nature of the games made them technologically foreign to those who had not yet been exposed to computerization through school or workplace use. Although the temptation to dismiss negative responses to gaming as the hand-wringing of overly worried moralists may be strong, doing so is unfair—both to those who wanted to keep video games far away from children and to the games themselves. To dismiss would-be moral reformers is to undermine the notion that community standards are in flux and may change. Not everyone who participates in these kinds of discussions proves right in the long run, but they provide insight into the concerns of the kinds of community figures (PTA presidents, parents, ministers) who often have profound influence even when they do not garner name recognition. To argue that video games are not a legitimate source for serious social concern would be to argue against their cultural significance. As Jesper Juul has pointed out, “Games

are learning experiences, where the player improves his or her skills at learning the game.”<sup>2</sup> This is true both at the level of the individual game and at the level of the arcade and the surrounding cultural environment, which is to say that the player improves his or her skill at learning games at a content level, but also improves his or her skill at working within the values system in which these games operate. This being the case, that video games should raise significant moral concerns should come as no surprise.

Neither coin-operated games nor arcades are unique to the computer age; coin-operated mechanical games in the United States date to 1931, and other forms of coin-operated amusements date even earlier.<sup>3</sup> Thomas Edison released a coin-operated moving picture machine, the Kinetoscope, in 1894,<sup>4</sup> and coin-operated amusements became staples at midways and boardwalks and were persistent targets for moral guardians.<sup>5</sup> Arcade machines of all kinds serve the economic purpose of accruing wealth, coin by coin, for their owners and operators. Video game machines are no different, and, even cursory analysis reveals that the earliest coin-operated video games cost substantially more to play than did the earliest coin-operated mechanical games when inflation is taken into account.

The manufacturers of video games were a mix of newly founded companies, like Atari and Exidy, which produced video games primarily or exclusively, and older manufacturers, like Bally and Rock-Ola, which had a history of producing other kinds of coin-operated machines, including bar games and jukeboxes. Video games are now their own separate industry, but at the outset they were largely a spin-off of other industries, including the coin-op industry and the television industry. And, much as they were often produced by some of the same companies that manufactured earlier coin-operated amusements, video game machines circulated through some of the existing networks that supported distribution of earlier coin-operated machines, particularly cigarette machines and jukeboxes.<sup>6</sup>

Distributors purchased machines from manufacturers and then sold them to operators, who placed them at locations like bars, restaurants, bowling alleys, Laundromats, or arcades. The location owner and the machine operator divided the income from the machine or machines, usually on a 50/50 or 60/40 split. Factors influencing the split included the initial cost of a particular machine, its popularity, and the desirability of a particular location. The machine operator took responsibility for machine repair and maintenance, and the location operator absorbed the cost of powering the machines on a day-to-day basis. Arcade operators sometimes bought machines outright, garnering a higher percentage of machine revenue as profit when they did not have to divide the income with a machine operator.<sup>7</sup>

Although earlier coin-operated amusements had persisted, at the time that video games first emerged, none of these alternatives were functioning as a cultural craze. Video gaming was very lucrative for a number of long-term operators and lured others into the business as the intense media coverage made the games seem like an avenue to fast riches. The opportunity to attract younger customers meant existing operators could expand their market by selling to youth, which helps explain why video-game-specific arcades emerged. Existing outlets like bars had unsavory connotations and were considered inappropriate environments for the very young. Video game arcades were typically all-ages outlets, which enabled operators to reach a broader audience than they could have in adult-only venues. In the arcade, video games were the primary attraction, not a secondary revenue generator as they were in most other locations.

The change in venues may have further fueled audience shifts; both adults and children would have had incidental encounters with early video games in public spaces outside of arcades, trying a game out of boredom at the Laundromat, for example. Arcade machines were less likely to encourage this kind of casual interaction as the arcade itself would have been the destination and video games or video game–related socializing the primary purpose of entering the venue. Video game arcades, then, may have served primarily to attract players who already knew they liked video games. Although contemporary representations of classic arcades frequently portray them as male-dominated spaces, Atari founder Nolan Bushnell maintains that 40 percent of the coin drop on Atari's *PONG* (1972) came from women, and several of the individual gamers and arcade owners I interviewed stated that girls and women were a minority among arcade gamers but still formed a significant percentage of the players.<sup>8</sup> This discrepancy may stem in part from shifts in player demographics over time. The movement of games into arcades perceived as male spaces may have reduced the number of women players. Assuming Bushnell's assessment of the number of girls and women spending money on *PONG* is correct, *PONG* may have had an unusually high percent of women players because of its initial placement in bars, not arcades. Content may have also contributed to the games' appeal to female players. Cindy Toopes, who played first pinball and then video games in the 1970s and 1980s and lived in Ottumwa, Iowa, when the town declared itself "the video game capital of the world," guessed that girls and women made up roughly 25 percent of the players in the arcade she went to most frequently.<sup>9</sup>

The cost of gameplay doubtless also affected who played the games, just as it affected who owned the games and where they were placed. The relatively high cost of individual instances of gameplay likely contributed to the

rapid diffusion of video games, as savvy operators would have seen substantial profits. A 1977 advertorial from Amalgamated Industries's North Texas division boasted that "many machines have been known to yield in excess of \$100 a week," which would be the 2010 equivalent of nearly \$400.<sup>10</sup> The advertorial implies that video game machines could rapidly build wealth for the people who put games in the right locations; the suggestions for appropriate locations—including cocktail lounges, finer restaurants, yacht clubs, college student centers, and golf clubhouses, among others—speak to an assumption of adult, or near-adult players with disposable incomes. A 1982 article placed the average yield for an arcade machine at a more conservative \$90 weekly, with the investment for a new machine running roughly \$2,500. Working from these numbers and the assumption that the location operator and the machine operator would split profits evenly, a machine with an average level of income would take in enough money for the operator to pay off the initial investment and begin making a profit in just over one year.

#### ARCADE AS DEVIANT SITE

As video games became clustered in arcades and developed a substantial audience among teenagers, the high cost of gameplay began to catch the attention of people who were neither players nor owners. Numerous articles from the early 1980s document attempts by cities and counties to curb gaming; these frequently point to the money teens were spending on play. Most of the gamers I interviewed insisted that the money they spent playing video games was not given to them by their parents, but earned through household chores, collecting bottles and cans for return deposits, newspaper routes, or other odd jobs. Although this does not necessarily suggest great affluence, it does suggest a degree of economic stability: players were able to support their gaming largely because the income they earned did not need to be contributed to the family's income and could be reserved for discretionary spending. The cost of gaming imposed real limits on who could game and how much time and money they could spend playing. For example, Mark Hoffman, who worked at the Twin Galaxies Arcade in Ottumwa, Iowa, as a teenager in the early 1980s, said he became interested in gaming only after his interest in computers snagged him a job at the arcade, where he enjoyed unlimited play as a perk. For Hoffman, the cost of gaming seemed wasteful, even when he was a teenager, due in part to his family's working-class socioeconomic status.<sup>11</sup>

Although teenaged players were doubtless aware of the money they were spending, they seem to have often viewed the income as truly dis-

posable and did not worry about the overall cost. Adults observing these spending habits, however, saw them as a serious community problem. Communities made efforts to curtail game access in a number of ways, often setting up specific restrictions to limit the number of games in a business or restricting patronage to adults. In a February 1982 article covering the U.S. Supreme Court's decision to postpone judgment in *City of Mesquite v. Aladdin's Castle, Inc.*, a *Los Angeles Times* reporter summarizes the conflict, saying that "city residents and officials complained that teen-agers were wasting time and money on the games."<sup>12</sup> The court ultimately ruled that the ordinance in Mesquite, which restricted those under 17 years of age from playing coin-operated video games without a parent or guardian present, was unconstitutional because games should be protected as free speech.<sup>13</sup> Although some of the Mesquite residents who complained about the games may have thought the games constituted some kind of incitement to violence, the court did not show any willingness to consider them as such. Further, the language frequently deployed in discussions of the Mesquite statute and similar measures taken by communities around the United States points to the violence as only one factor in a more general concern about the "wasting" of valuable resources (time and money) encouraged by games. With this in mind, the intention of the original ordinance becomes clear. The restrictions on youth access to coin-operated video games were intended to force youth to use their time and money more wisely—in ways more in keeping with the values of older community members.

In this specific case, the court's ruling protected video games as free speech, but also protected the right of entertainment companies to sell their amusements to children, and the rights of children to purchase media access without the intervention of parents or guardians. Given the generally marginal legal status of youths in the United States, this granting of rights, indirect as it may be, is still significant in its recognition of the rights of minors. Further, the ruling nods not so subtly toward the late capitalist assertion that the freedom to consume is a fundamental civil liberty.<sup>14</sup> This represents a significant change from modernist conceptions of free speech, which allowed not only for shouted four-letter words, but for paperbacks of *Naked Lunch* (1959) and screenings of *Deep Throat* (1972). Discussions of free speech like that in *City of Mesquite v. Aladdin's Castle, Inc.* do not focus on the issues of obscenity that are at the root of these earlier, modernist arguments about the meaning of free speech. Instead, they focus on the right to sell and consume. The earliest attempts to curtail youth access to video games through the legal system ultimately failed, owing largely to the effectiveness of arguments tied directly to neoliberal arguments about the

free market; this departure from older justifications of free speech becomes less surprising when placed in historical context.

### ARCADES IN ECONOMIC CONTEXT

The early period of arcade gaming, placed here as that period between the successful launch of *PONG* in 1972 and the video game industry Crash in 1983, coincides with substantial upheavals in the U.S. economy. Larger economic trends and crises, including the oil crisis, the end of the international gold standard, and the decline of traditional communism, substantially influenced the micro-level decisions made by consumers. In particular, the elimination of the gold standard in 1971 severed the tie between money and real, tangible goods, definitively abstracting capital. Since then, consumers have proved more willing and able to part with abstracted capital, a truth nearly universally acknowledged by anyone who has ever had a credit card. Geographer David Harvey points to two major changes in consumer culture: a “mobilization of fashion in mass (as opposed to elite) markets [which] provided a means to accelerate the pace of consumption not only in clothing, ornament, and decoration but also across a wide swathe of life-styles and recreational activities (leisure and sporting habits, pop music styles, video and children’s games, and the like),” and “a shift away from the consumption of goods and into the consumption of services—not only personal, business, educational, and health services, but also into entertainments, spectacles, happenings, and distractions.”<sup>15</sup> Both trends serve to shorten the lifetime of expenditures and accelerate spending, enabling a move from an industrial, production-based economy to a service-based, consumer economy.

These shifts in the economy were not seamless and triggered a great deal of instability at levels that affected the day-to-day lives of workers. This instability often took the shape of significant economic decline as workers and communities who had depended on the profitability, stability, and growth of the industrial sector confronted layoffs and plant closures. Profitability for U.S. companies peaked in the 1960s before entering a steady state of decline and stagnation that lasted 15 years. National economic growth dropped significantly: after maintaining an average of more than 4 percent annually for three decades, growth reached just 2.6 percent in 1969 and then plummeted to negative .3 percent the following year. Growth stood at an average of just 2.87 percent through the 1970s. Simultaneously, the national inflation rate more than doubled, climbing to 5.3 percent in 1971 after averaging 2.5 percent annually through the 1950s and 1960s.<sup>16</sup>

The recession hit manufacturing particularly hard, with massive layoffs

in industrial plants that had previously served as the economic backbone for many communities. The postwar boom was decisively over. Labor historian Nelson Lichtenstein notes, "By the early 1980s, they [profits] were approximately one-third less than a generation before; in the manufacturing sector only about one-half."<sup>17</sup> Although economic growth continued, the annual rate remained low, and real wages remained stagnant into the early 1990s. Young male workers faced drops in real wages of 25 percent during this time.<sup>18</sup> The young men who were playing early coin-operated video games, then, would have been a population at a seemingly unprecedented level of economic risk, faced both with decreases in their earning power and increases in unemployment caused by palpable economic instability.

The rise of the coin-operated video game industry, then, coincides not only with a rapid increase in spending on entertainment services, but also with a substantial spike in the demand for novel entertainments, which are intimately bound to the transition from modernity to postmodernity. Fredric Jameson pinpoints 1973—one year after the release of the first successful commercial video game and the same year as the oil crisis, the end of the international gold standard, and the decline of traditional communism—as the moment in which postmodernity and late capitalism emerged as dominant cultural and economic forms.<sup>19</sup> Expanding on the observations of Harvey and Jameson, the cost of gameplay figured as a commodity in a post-modern economy makes sense, as gameplay is an entertainment service uniquely desirable in the time period during which video game technology is diffused. The desirability of gameplay as a commodified entertainment service was stimulated by the same shifts that made the financial expenditure required seem particularly risky to older community members. The shifts in the labor market heightened anxiety about the economic practices of the young, particularly young men who were facing limited job prospects and decreased earning power. Discussion of youths' gaming practices point so frequently to the financial and time cost likely because the economic pressures faced by many Americans would have led to increased worry about the industriousness and employability of these same youth. Video gaming may be just one among the "entertainments, spectacles, happenings, and distractions" that Harvey points to, but it would have been among the most novel as it was the most radically new media technology introduced to the public during the time. Novelty contributed to the high visibility of video gaming and to its role as a lightning rod issue for those concerned about what values system the nation's youth were absorbing.

Decades earlier, at the height of the modernist age, the pinball machine had fulfilled a similar cultural role by introducing players to modernist values while scandalizing older community members. Pinball games first appeared in the early 1930s, but the golden age of pinball came in the postwar period—a period of robust economic growth in the United States. Real wages doubled from 1947 to 1967, allowing many Americans unprecedented levels of economic stability and wealth.<sup>20</sup> The rise of pinball coincides with the expansion of Fordist principles in the mid-century United States. Although Henry Ford had largely developed these ideas much earlier—perhaps as early as his implementation of the eight-hour, five-dollar workday in 1914—Fordism as a broader set of practices did not gain traction until the postwar period. After World War II, shifts in class relations and in regulatory practices combined with the decentralization of the population through suburban growth to enable a sharp turn toward Fordism.<sup>21</sup> The postwar period also saw the rise of the teenager as a clearly defined social category. Due to the lack of available work during the Great Depression, for the first time in history most youths attended high school, and adolescence or teenager-hood became normalized as part of the coming-of-age process.<sup>22</sup> Teenagers in the postwar period were significant consumers, and pinball was, like video gaming later, a way for teens to spend their time and money.

This golden age of pinball was marked by public disputes over the value of the games, and banning of the machines in cities including New York and Los Angeles.<sup>23</sup> Warren Susman has said that pinball was an amusement uniquely suited to the period's culture: "The pinball machine was the ideal toy of the machine age, with its spinning balls passing through a series of obstacle pins that meant points for the player if they met, although at the same time the injunction 'Do Not Tilt' severely limited the player's opportunity to interfere with the chance movements of the balls."<sup>24</sup> Susman's assessment of the pinball machine is that the notion of play it embodies is derivative of the age that produced it, and that these games serve a didactic purpose, instilling cultural values through physical and mental engagement with a toy. The cultural values of the pinball machine would have been the cultural values of the era that produced them most effectively for the broadest audience—which is to say, the postwar period.

#### PLAY AS TRAINING

Playthings doubtless serve didactic purposes—classic toys like tea sets, model cars, and toy vacuum cleaners allow children to engage with the

adult world, inviting them to mimic the tasks of older family members and become familiar with the sorts of actions that occupy adults. However, most of these toys allow open-ended play. Although most adults assume that a 5-year-old girl given a tea set would use the objects to stage a pretend tea service for her dolls or friends, the child could as easily stack the pieces into a tower, smash them against a wall, or otherwise play against the toy's intended purpose. Pinball machines, as Susman so distinctly describes them, do not readily allow for such play; the games limit the amount that a player can intervene in the game's outcome. The education pinball games can provide is narrower and more tightly controlled than the learning experience that may be had with a set of crayons or a rubber ball.

Decades later, coin-operated video game machines demonstrate a similarly limited play principle at two levels—at the level of gameplay permitted by the game's programmed rules, and at the level of hardware tampering possible. First, at the level of the basic rules governing play, many early arcade video games are, as suggested by Jesper Juul, games of progression rather than emergence, which means that there are real limitations on how the game may be played. Games of progression are those in which “challenges [are] presented serially by way of special-case rules.”<sup>25</sup> These tend to have a single model of mastery, which is to say, there is a best, right way to play the game. A progressive game can usually be exhausted or beat more readily than emergent games. This is why competitive arcade gamer Billy Mitchell could play a “perfect” game of *Pac-Man* (1980). Games of emergence are those in which “rules [combine] to provide variation.”

Although some classic arcade games, notably *PONG* (1972) are essentially games of emergence, they usually still have significant structural limitations to play variance. For example, if someone in a two-player game of *PONG* simply refused to move his paddle, the game would end almost immediately—an outcome unlikely to be mutually desirable for the players at 25 cents a game. So, even in the case of more emergent coin-operated video games, the game limits the potential for playing against the game's set objectives, as many early video games will terminate if not played according to their objectives. Discussing the game *Zork* (1979), Terry Harpold summarizes this principle as “to behave badly is to play badly,” further pointing out that the game will not allow types of play that run counter to the game.<sup>26</sup> Like pinball machines, most video games would have been played in public amusement spaces and would have been owned by businesses, not by individuals who would have kept them in their homes. Physical alterations or technological tampering with machines would have been limited by this factor, and, further, arcade machines kept in homes would have likely been prestige commodities for serious players who would be invested

in preserving the integrity of the game, and, by extension, the credibility of their game scores. The world record culture cultivated through the efforts of individual players and media outlets that granted significant attention to the “best” players particularly raises this issue of an individual instance of gameplay’s credibility. Walter Day, the first video game referee, has said that part of the historical role of Twin Galaxies in serving as the arbitrating body of video game top scores has been to develop rules of play based on notions of fairness and the perceived purpose of individual games. In short, both form and ownership effectively limit the types of play allowable, and these limitations are further enforced by cultural factors specific to the practices of competitive gaming.

These limitations serve several practical purposes. Most relevantly, they create a player perception of fairness in competition. They also ensure that games end at regular, usually brief intervals, thus guaranteeing that the amount of play time purchased is relatively small, and that those desiring to play for extended periods will continue to spend money. Most novice players would have confronted a situation not unlike the one I faced in taking on *Galaga* for the first time: spending a good deal of money, not necessarily to master the game but just to gain a firm enough understanding of the rules of engagement and the game’s rhythms to play for longer than a minute or two. In the economy of the arcade, the most proficient players spend the least money, and their games can stretch to hours. Record-breaking bouts of gameplay, referred to as marathons, can last in excess of 24 hours. The ability to extract hours of gameplay from minimal financial expenditures is exceptional, and is complicated by the fact that while it enables the player to “beat the house” in a sense by keeping his money, he can do this only by following the rules of the game exceptionally well. So, the player’s goals were at odds with those of most arcade managers and venue operators. Tim McVey, who became the first person to score a billion points on a video game in 1984, had several marathon sessions on *Nibbler* (1983) cut off by arcade employees to force marathoning players away from the machines they were monopolizing.<sup>27</sup>

However, the disruption of gameplay by a factor outside the player or the game is something that game designers could not have accounted for and is outside the rules system embedded in the game. Again as posited by Harpold, “to behave badly is to play badly”: exceptional players are exceptionally well versed in the rules. They are the best adherents to the cultural, economic, and social standards of the arcade and of the games they play. The impulse to beat the house may have put players at odds with machine operators’ perception of the games’ economic purpose, but they can beat the house in this way only by becoming exceptional gamers—usually

through hours of play, many of which would have occurred before they became skilled at gaming. One of the principle lessons of the arcade is that there is only one way to play, even in the case of games that can be played using various strategies, a player can sustain the length of the game only by playing to the game's objectives. This is to say that the better an individual plays by the rules, the more value he receives for his financial expenditure. Further, the longer a player can play, the more points he can earn, and the more clout he has in the competitive social environment of the arcade. Superiority in gameplay is, like superiority demonstrated in other arenas, an opportunity to assert dominance and gain social clout. In the case of both video games and pinball games, this superiority is accrued by an individual, not a team or other organized group. The money fed into an arcade game's coin slot is an investment. Players assume that they will receive for their money not only a chance to play, but a chance to improve, to become noteworthy, to have the skill required to play individual games that last for hours. When these players become workers, the same values hold—they do not care about the accolades they may earn for their employer, instead focusing on their individual wealth and prominence, with labor as a tool to meet these ends.

#### COMPUTERIZATION AND ECONOMIC UPEHAVAL

At a surface level, the public debates about the social and cultural value of arcade games frequently focused on anxieties about “wasting” money. These arguments about the frivolous nature of entertainment spending were, as mentioned earlier, nothing new. Commercial amusements have always attracted controversy, as have media forms ranging from the theater to the novel to the Sony Walkman. However, the debates about arcade video gaming came at a critical transitional moment as the United States shifted from a modernist to a postmodernist economy. The teenagers who patronized arcades in the 1970s and 1980s were among the first natives of this new culture. They came of age in a culture filled not only with digital entertainments, but shaped by a white-collar service economy. The discomfort many adults felt at the prospect of teenagers spending hours and endless quarters in arcades doubtless seemed silly to the teenagers who patronized these amusement spaces. And, in retrospect, these concerns can often seem farcical, just another set of grumblings set off by generational differences that have caused conflict over everything from dress hems to novels to MP3 players and cell phones.

However, in the case of video gaming, the conflict developed at a point of massive cultural change and economic upheaval. At the back of the

seemingly reactionary treatment of a new entertainment technology was a profound discomfort with radical shifts in the ordering of culture. If access to the arcade provided access to emergent values and practices, then the issue of access to the arcade becomes not just a question of who had access to a relatively expensive leisure activity, but a question of who had access to the first wave of computerization, and which children would be best prepared for the labor market in which they would eventually come of age. As researchers including Henry Jenkins and Justine Cassell have argued, the gendering of video games remains a critical issue in addressing the persistent underrepresentation of women in the tech and related industries as the games provide youth with a point of access to computer technologies. Access to these earliest video games, rudimentary as they may seem now, was no less important.<sup>28</sup> In considering access to these games, it is also critical to consider popular representations of the games and gamers, particularly in the early years. As video gaming became a major cultural trend, it received significant media coverage in the popular press, which helped solidify notions of who was gaming and why. Dismissals of gaming as a frivolous leisure activity undermined the real lessons being learned by gamers and effectively short-circuited early discussion about why various demographic groups were not gaming and what effect limited or no access to gaming might have on young people facing computerization as a major factor in the labor market.

## CONCLUSION

Coin-operated video gaming served as an introduction to the spending practices essential to the emergent consumer economy. The golden age of the arcade corresponded with a shift in consumer spending away from durable goods and toward novel entertainments. This shift, articulated by Harvey and Jameson, also included economic shifts away from Fordist manufacturing and consumption toward postmodernist manufacturing and consumption. Changes in manufacturing and consumption occurred alongside significant upheavals in the U.S. economy as a whole, which in particular altered the volume and type of work available across the country, forcing workers away from industrial labor and toward more service-oriented occupations, which were at that point becoming computerized for the first time.

Teenagers feeding quarter into *Galaga* or *PONG* or any number of games were not only playing but learning the cultural and economic values that would allow them to survive and thrive in a de-industrializing work environment that would have seemed as foreign to their parents as the Fordist

production lines and clanking pinball machines of the mid-century must have seemed to their grandparents. At an individual level, the coin-operated video games served as a didactic introduction to these new practices, allowing the young to learn by doing and preparing them for participation in a new economy, first as consumers, but ultimately as citizens and laborers. The discomfort with which many parents and moral guardians greeted the rise of the arcade stems not from knee-jerk terror of technology, but instead from deep anxieties about economic and cultural changes that have had profound and long-lasting effects not only on American youth, but on American culture as a whole.

The video game arcade as it existed in its glory days has mutated into several surviving forms, including the entertainment complex as represented by venues like Dave & Buster's, the "classic arcade" in which vintage machines are used to lure nostalgic Gen Xers, and hangouts for those who were or wish they'd been there (like Brooklyn's Barcade). In some ways, this afterlife represents games going back to where they came from—the first machines had, after all, been sold to bars and advertised as novel amusements for adult consumers. Whereas the novelty of the games in 1972 would have been sheer newness, the novelty now is that of other antiquated bits of popular culture. The games that once represented the encroachment of the new now represent the seeming simplicity of our recent past.

Arcade machines remain one of the earliest broadly diffused forms of popular computing, and the boards that enabled *Space Invaders* (1978) and its ilk would have been the first computers many people had access to. The machines that now look quaint would have once looked flashy and new, and although the cost of play may seem sharp when adjusted for inflation, the machines' capacity to seduce clearly often overrode the impulse toward frugality. The seduction proved particularly effective on the young; as dedicated video game arcades became common, they overwhelmingly became youth spaces where adolescents engaged in social and economic practices that parents and other moral guardians found at best suspect.

The arcade represents a variety of values and factors: the novelty of the computer age being one significant thread, and the compulsion to spend money on novel amusements being another. To play in the arcade would have been to participate in a set of emergent cultural practices, and the discomfort many adults felt watching children feed coin after coin into the flashing machines would have been not simple knee-jerk moralizing, but instead an unease with tangible evidence that children were being inducted into an era that would operate on different value principles than their own. The arcade was a training ground for different models of consumption, labor, and culture. The children were not growing up with nega-

tive moral values so much as they were being brought up as natives of the new economy; adults who had grown up in an era of company men, Fordist production, and savings accounts were watching the young grow up in an age of rapid-fire career changes, flexible accumulation, and easy credit. The intense competition of the arcade, filled with 8-bit violence and the enticement to spend this week's allowance and next week's all in one go seemed decidedly unwholesome. The individual games of the arcade may have been simulations of sci-fi and cartoon scenarios, but the arcade itself was a simulation of generalized economic values, which we are still confronting now, not as teenagers, but as consumers, laborers, and citizens.

## NOTES

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5. See John Kasson, *Amusing the Million* (New York: Hill and Wang, 1978), 98–100; and Roy Rosenzweig, *Eight Hours for What We Will* (Cambridge: Cambridge University Press, 1983), 192 and 203.

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10. “A lucrative business: Electronic video games in the best places,” *Dallas Morning News*, November 2, 1975, accessed February 8, 2009, <http://infoweb.newsbank.com.ezproxy.lib.utexas.edu>.

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STACI TUCKER

## Early Online Gaming

*BBSs and MUDs*

It's an unmistakable sound, the piercing shriek of a 300-baud dial-up modem making a connection. It's followed by then the flash of a welcome screen and pathways to buzzing chat rooms, fantasy role-playing in virtual dungeons, libraries of pirated software, text-based flirtation, and impish trolling. The year is 1983, a decade before the World Wide Web became a truly worldwide phenomenon.

In the 21st century, exploring online virtual worlds as a pastime is now an acceptable mainstream activity.<sup>1</sup> Online games are a cultural phenomenon of increasing relevance, with millions of players in North America alone. They are no longer only toys for teenage boys; those of us who grew up with computer games matured to adulthood, and games evolved in complexity and sophistication. The game development industry continues to grow in economic importance, and ever-increasing numbers adopt online games as an essential recreational and social outlet. The global video game market is expected to be three times the size of the recorded music market by 2014, based on current growth trends..<sup>2</sup> They are played in the privacy of homes on computers and game consoles, in public on cell phones and handhelds, on planes, at the office, in schools, and, based on adoption rates among children, over the next generation, millions more will play.<sup>3</sup>

For much of the general public, the online world did not exist prior to the introduction of HTML (hypertext markup language) and its contribution to the rise of the Internet in the mid-1990s. It's difficult to imagine a vibrant online world other than the Internet or online games that preceded

*Neverwinter Nights* and *Doom*. In an age preoccupied with intellectual property rights, digital media, online pornography, celebrity tweets, Net neutrality, the Xbox 360, and Playstation 3, it's easy to forget the people and experiments that spawned the first online communities and online games decades ago.

The term *digital natives* refers to children, teens, and young adults who grow up surrounded by digital technology and can't imagine a world without the Internet, cell phones, and MP3 players. People born before the late 20th century have been called "digital immigrants," since they can remember a pre-digital world.<sup>4</sup> Industry statistics indicate that older players log more hours than their younger counterparts, and that the average age of video gamers has risen by about one year each year, averaging in the thirties in 2008.<sup>5</sup> It seems that once people start playing, most don't stop, particularly as the games mature with them.

Virtual worlds today are constructed by computers, often a network of computers, which simulate a contained environment. Users, represented by avatars, can interact with each other and objects in the synthetic space. Although virtual worlds have many applications beyond entertainment, they began as computer games. For this reason, much of the language describing virtual worlds is game based. Today, massively multiplayer online (MMO) games are persistent and always accessible, and the player's avatars develop and change as they advance in the game and participate in long-term social relationships with other players, making MMOs vibrant sites of community. Most MMO virtual worlds are immersive, 3-D, graphically and sonically rich, testing the boundaries of game consoles and home computers.

However, the first virtual worlds were text-based and did not begin with the Internet, that colossal maze of packet-switching networks through which online games are played today. These virtual worlds originated as ASCII text-based environments, transmitted via analog modulated signals on telephone lines, by a niche community of digital immigrants who populated the bulletin board systems (BBSs) and multi-user dungeons (MUDs) that sprung up in the 1970s and 1980s. Today online games offer stories, sounds, visual stimulation, and movement. They also offer community, interactivity, challenge, and experiences of fear, achievement, and success. In that regard, they still closely resemble the text-based worlds where it all started. This essay explores the origins of these text-based virtual worlds and investigate the issues persisting today with the explosion of their popularity brought on by the advent of modern computer technology and 3-D graphics.

## SPACEWAR!

The creation of *Spacewar!*, coded by Steve Russell, a student at the Massachusetts Institute of Technology (MIT), in 1962, served as a significant milestone in the history of online games. Steve Russell, J. Martin Graetz, and Wayne Witanen, regulars of a dingy tenement near campus fictitiously named the “Hingham Institute,” imagined the game in 1961 for the mainframe DEC PHP-1 computer at MIT.<sup>6</sup> Russell completed the game by February 1962, taking approximately 200 hours of development time to complete the first version and earning the nickname “Slug” for the slow pace at which he tackled the project.<sup>7</sup>

*Spacewar!* involved two spaceships, “the needle” and “the wedge,” that attempted to shoot each other while maneuvering in the gravity well of a star. The ships had limited ammunition and limited fuel. A hyperspace feature could be used to evade enemy fire, but the reentry location was random and carried the possibility of exploding with continued use. The player controlled their ship with test switches, which included actions for clockwise and counterclockwise rotation, thrust, fire, and hyperspace. The switches were prone to wear out after significant gameplay.

Like many experiments prior to the 1980s, *Spacewar!* was tinkered with by a number of hobbyists over the years, who added to the games design, including Rick Blomme in 1969. Blomme changed *Spacewar!* from a single-player game to a two-player game that could be accessed over a remote network named PLATO (Programmed Logic for Automatic Teaching Functions). Networked multiplayer gaming was born.<sup>8</sup>

PLATO was a pre-Internet, mainframe computer-based system originally designed for computer-based education. For many, PLATO’s most enduring legacy is the creation of an online community that resulted from its communication features. The system originated in the early 1960s at the Urbana campus of the University of Illinois (UI). Driven by an interest in using computers for education, Professor Don Bitzer, co-inventor of the plasma display panel, recruited UI colleagues and founded the Computer-based Education Research Laboratory (CERL). In collaboration with engineers and creative programmers, many of whom had no computer background, Bitzer designed the PLATO system. Through the 1960s, it remained small, supporting only a single classroom of terminals; in the early 1970s, it transitioned with advancing computer technology to a collection of mainframes that could support up to 1000 users simultaneously.<sup>9</sup>

PLATO was one of the first time-sharing systems to be operated in public and at least a decade ahead of its time. Though originally designed for computer-based education, PLATO contributed significantly to advance-

ments that spawned culturally transformative online tools of the future. These included PLATO Notes for online messages boards, Personal Notes for e-mail, Talkomatic for chat rooms, Term-Talk for instant messaging, remote screen sharing, and even emoticons.

After *Spacewar!*, several more games appeared on the PLATO system, including *DECTAR* (1974, based on “Star Trek”), *Empire* (1974), a *Dungeons & Dragons*–inspired game named *dnd* released in 1979, *Moria* (1975), the original *Freecell* (1978), and a flight simulator named *Airfight* (1974). Like *Spacewar!*, these games were open source and ever-improving with new iterations, which helped to inspire continued play. In the early 1970s and early 1980s, PLATO had superior graphics to other systems, 512x512 random access monochrome displays. Also, much like console systems today, everyone accessing the mainframe system had the same hardware capabilities, so the response time was impressive for the age. A series of games influenced by *Spacewar!* followed in its wake, including *Galaxy Game* (1971) and *Computer Space* (1971), *Space Wars* by Cinematronics (1977), the Atari 2600 game *Space War* (1978), *Asteroids* (1979), and *Star Control* (1991). The introduction of networked gaming led to a significantly larger list of games.

In the early 1980s, the PLATO service was heavily advertised, but it was expensive. An attempt was made to mass-market a Micro-PLATO, which could be run on various home computers, such as those by Texas Instruments, Atari, and IBM. Micro-PLATO could connect to a central data center for Multi-User programs, but cost \$5 an hour. The legacy and value of PLATO was in its online applications, which were overly expensive before and after conversion to microcomputers. Due to the lack of success in their transition to personal computers, the plug was pulled on PLATO in the mid-1980s.

Due to increasing availability, technical improvements, and affordability, beginning in the mid-1970s, microcomputers, the first personal computers, began significantly growing in popularity, and hobbyists were quick to tinker and explore their capabilities. Using the microcomputer and modems to convert data from analog to digital to communicate with computers remotely via phone lines, bulletin board systems (BBSs) were born, and online communities throughout the country sprang to life.<sup>10</sup>

## BULLETIN BOARD SYSTEMS

In Berkeley in the early 1970s, a music store named Leopold’s Records housed an odd typewriter beneath a bulletin board in the hallway. Sheltered by a cardboard box with a transparent top, the teletype machine churned

out personal ads, classifieds, and messages, which customers gathered to read. A mainframe was connected to the teletype machine through a 110-baud modem, which produced a mere 10 characters per second. The teletype was noisy, the cardboard box kept the SDS 940 timesharing system dry, the transparent top contained holes for typing, and a set of instructions were mounted above on how to send messages, look for content, and tag messages with searchable keywords.

The mainframe running that teletype machine at Leopold's Records comprised the first version of a computerized BBS, the brainchild of a project known as Community Memory. Community Memory formed from a group of Berkeley innovators who gathered to reimagine how information systems and social communities could fit together. Ken Colstad, Mark Szpakowski, Lee Felsentein, and Efrem Lipkin were friends and computer enthusiasts who sought to build a system that could centralize and source community information. With the help of the Resource One computer center at Project One in San Francisco, which had access to a mainframe computer, the first BBS was born in August 1973.

The term *bulletin board system* is a reference to the conventional cork-and-pin bulletin board, such as the one mounted above the teletype machine at Leopold's Records, where people post advertisements and community news. People took to the Community Memory project as they would a neighborhood kiosk, immediately engaging in disjointed conversations, seeking out used furniture and rides to Los Angeles. Participants exchanged messages about music, the Vietnam War, art, literature, economics, current events, and local cuisine.<sup>11</sup>

"We wanted to use the computer to create a sort of information flea market," said Lipkin, still residing in Berkeley in 2001. "We were thinking in terms of cork bulletin boards, community-generated newspapers, things like that. We took this mainframe the size of six refrigerators and put it to use."<sup>12</sup>

Driven by financial considerations and evolving technology, Community Memory changed over the years, ultimately aiming to create a global information network. In 1974, Community Memory moved from the XDS-940, which was large and underpowered, to a network of microcomputers. In the 1980s, coin-operated hardwired terminals for posting and reading messages could be found throughout Berkeley neighborhoods.<sup>13</sup>

With the advent of microcomputers, hobbyists and early adopters were soon tapping into BBSs from the privacy of their homes and offices. With ever-advancing computers being brought home, it was only a matter of time before someone connected one to a telephone. In Chicago, during the Great Blizzard of 1978, Randy Suess and Ward Christensen (who later de-

veloped the Xmodem file transfer protocol) took shelter indoors and began preliminary work on their own computerized BBS, which was made public the following year. These cyberspace pioneers used microcomputers and some creative programming to build CBBS (computer bulletin board system), turning home computers into communication devices. It didn't take long for the idea to spread through the personal-computing community. Within a few years, a flood of Apples, IBMs, and Commodores were going online.<sup>14</sup>

Using a terminal program, users could connect and log into CBBS over an analog phone line using a modem. Once logged in, users had access to public bulletins, electronic messages, and file exchanges. Early BBSs had only one phone line, so users had to wait for people to log off before they could access the board. Once logged in, many were subject to time limits of 15 minutes to an hour. The 110 and 300 baud modems available in the 1970s resulted in particularly slow BBSs. The introduction of the 1200-bit/s modems in the early 1980s improved speed and led to a significant increase in the popularity of the systems. Most local BBSs were operated by private hobbyists known as system operators or SysOps. These systems were often located in homes or rental spaces, some with specialized hardware, multitasking software, or local area networks (LAN) for multiple phone lines, allowing simultaneous log-ins and real-time chat. The original BBSs ran on S-100 microcomputer systems, such as Altair, IMSAI, and Comemco with the CP/M operating system, and used custom software, often developed by the SysOps themselves. By the late 1970s, BBS software was available for all the major home computer systems, such as the Apple II, the Atari 400/800, and the TRS-80.

The early BBSs were ASCII text-based. Eventually, advances in home computers allowed for color and graphics capabilities. Early custom character sets resulted in compatibility issues between manufacturers, so not all BBS users enjoyed the same display. Unless a caller was using terminal emulation software written for the same type of system as the BBS, the display would default to a basic ASCII output. Both SysOps and users operated on a selection of different microcomputers, resulting in compatibility issues. In this regard, BBSs resembled the Internet today, contrasting with the proprietary mainframe systems that preceded them.

In 1981, IBM released the first DOS personal computer. Due to their immediate popularity, the majority of BBSs were soon DOS based. The transition to DOS also aided in the introduction of the first commercial BBSs, which charged a subscription fee or were offered by a business, such as PCBoard BBS, RemoteAccess BBS and Wildcat! BBS. Some BBSs offered special levels of access for those who paid extra or contributed extensively

to file exchanges. However, from their conception through the mid-1990s, most BBSs were offered free of charge. Some surviving BBSs in the mid-1990s converted over to the Internet, primarily taking on the appearance of forums. However, the Internet completely replaced and enveloped the boards by the end of the 20th century.<sup>15</sup>

Early BBSs were typically a local offering (dialing long distance incurred additional fees). Since early BBSs were frequently run by computer hobbyists, they were typically populated by users interested in technology. Many SysOps were converts from the amateur radio community; technology and radio were popular board topics in the early years. Active, close-knit communities sprang up around local BBSs. Since frequent users of the local BBSs often lived in the same area, “BBS Meets” or local get-togethers, where the users could meet face-to-face, were common, particularly with BBSs that offered chat rooms.

Eventually, a number of special interest boards joined the ranks. Boards could be found for most every hobby and interest, including politics, religion, personals, music, and alternative lifestyles. Many BBSs carried themes, reflected in their names and on their welcome screens. Common themes included castles, dungeons, spaceships, pirate ships, sanatoriums, and circuses. Some “elite” or “warez” boards exclusively offered pirated software and required membership in order to exclude law enforcement (“lamers”). Despite such efforts, some of the BBSs providing illegal content were investigated. On July 12, 1985, “The Private Sector BBS,” the official BBS of the grey hat hacker quarterly magazine *2600*, was raided by the Middlesex County, New Jersey, Sheriff’s Office in conjunction with a credit card fraud investigation. A BBS in Boardman, Ohio, “Rusty n Edie’s,” was raided by the FBI in January of 1993 for software piracy and later sued by Playboy for copyright infringement. In 1996, the SysOp of a BBS in Flint, Michigan, was charged with distributing child pornography.<sup>16</sup>

One legacy spawned by early BBS computer hacker subculture was the slang known as “leet” (l33t or l337) which comes from the word *elite*, referencing the membership-only BBSs frequented by hackers in the early 1980s. l33t is unique in its substitution of other characters to represent letters in a word. Once exclusive to hackers, l33t has since entered mainstream culture. Versions of l33t are still used today by gamers and some web communities. N00bs, or newcomers, to online gaming are challenged to learn the l33t speak frequently used by gaming veterans. Some could argue that a version of l33t is used by almost everyone who sends text messages or tweets today.<sup>17</sup>

In the 1980s, door games, both single-player and multiplayer, drew early online gamers. Bulletin board system doors allowed users to communicate

with external programs, such as games, so games offered through BBSs were referred to as “door games.” Some of first versions of these closely resembled board games. Players would submit their moves to the SysOp or Gamemaster, and their moves were updated and posted daily or several times daily. Unfortunately, this lag in update time resulted in conflicts, such as invading armies rushing in to discover their opponents had moved to a new location. Door games evolved, and soon many allowed for automation by the computer. Many BBSs with multiple phone lines for simultaneous log-ins offered ASCII text-based games that allowed users to compete or interact with each other in virtual environments. Some popular 1980s door games include *Trade Wars* (1984), a possible precursor to *EVE Online* (2003), *Usurper* (1985), *Space Empire Elite* (1987), *Legend of the Red Dragon* (LoRD, 1989), and *The Pit* (1989). A community and subculture of online gamers developed around text-based multi-user games, which were significantly influenced by pen-and-paper role-playing games (RPGs) such as *Dungeons & Dragons*. These virtual worlds were known as multi-user dungeons (MUDs).<sup>18</sup>

## MULTI-USER DUNGEONS

Gary Gygax and Dave Arneson turned their love of *The Lord of the Rings* (1954–55) into a table-top game named *Dungeons & Dragons* (*D&D*) in 1973. Unlike board games, *D&D* is a role-playing game that doesn’t employ a board. It requires an assortment of many-sided dice, character sheets, and sometimes a map, but play largely takes place in the imaginations of the players. Players construct characters by determining their attributes and race, which include Elves, Dwarves, and Halflings. Characters also have a class, similar to a profession, such as fighters, thieves, wizards, and clerics. One player serves as a Dungeon Master (DM), who constructs the environment and narrates the adventures.

During the late 1970s and into the 1980s, *D&D* had become a phenomenon, played in college dorms and office boardrooms after hours. It also inspired its share of controversy. Religious organizations and parent groups denounced the game as devil worship and dabbling in the occult. Pat Pulling formed the organization BADD (Bothered About Dungeons & Dragons) in 1982, after her son, who was an active *D&D* player, committed suicide. Pulling filed a wrongful death lawsuit against her son’s principal, who had “cursed” Irving during a game of *D&D*. BADD described *D&D* as “a fantasy role-playing game which uses demonology, witchcraft, voodoo, murder, rape, blasphemy, suicide, assassination, insanity, sex perversion, homosexuality, prostitution, satanic type rituals, gambling, barbarism, can-

nibalism, sadism, desecration, demon summoning, necromantics, divination, and other teachings.”<sup>19</sup> Similar fears are expressed today by parents and politicians about video games. Despite the controversy, *D&D* remained popular through the 1980s and continues to be played today, motivating a long list of films, cartoons, toys, comics, and books. *D&D* also served as a significant motivator for a long list of online games. Among the first of these were MUDs.<sup>20</sup>

The single-player game *Adventure*, created in 1975 by Will Crowther on the mainframe computer DEC PDP-10, was the first widely played adventure game. *Adventure* was expanded in 1976 by Don Woods and contained many references to *D&D*. *Zork*, also single-player, soon followed in *Adventure*’s wake, written the summer of 1977 for the DEC PHP-10 mini-computer and rising to prominence on ARPANET, which later became the Internet. Roy Trubshaw, a talented computer science undergraduate student at Essex University in the UK, started work on a multi-user spin of the adventure game in 1978 on the DEC PDP-10 in the assembly language MACRO-10. He named the game *Multi-User Dungeon*, or MUD, as a tribute to a variant of *Zork*, named *Dungeon* (1978), that he’d logged numerous hours playing. Trubshaw converted his MUD to BCPL, the predecessor to the C programming language, before a development was taken over by a fellow Essex University student in 1980, Richard Bartle. In 1980, when Essex University connected to ARPANET, MUD, which ran on the Essex University network, became the first online role-playing game, introducing MUDs (multi-user dungeons, multi-user dimensions, or multi-user domains) to the world. By the early 1990s, there were nearly 200 different multi-users games online, written in dozens of different development languages.<sup>21</sup>

Within the game, the player’s character, Super Freak, is stealthily exploring a maze of newly discovered caves. The air is humid and dank, the lighting dim, and the labyrinth of interconnecting tunnels difficult to navigate. A magic sword feels heavy in your hand, as you turn each corner in preparation for unwelcome surprises. If you encounter the wrong creature here, hours of work on your avatar will be lost in your virtual death. Your heart is beating quickly, your hands pause before typing new commands into your keyboard. You pray for the arrival of one of your many friends, represented by other characters, who could serve as allies. Along with thousands of other people from around the world, you are exploring a MUD.

MUDs, better known as the Essex MUD or MUD1 in later years, were entirely text-based. Players read descriptions of the environment, other players, nonplayer characters (NPCs), and events. MUDs were labyrinthine role-playing games in which the characters assume the identity of an

avatar, much like massively multi-player online role-playing (MMORPG) games today. They combined role-playing, interactive fiction, and online chat. Traditional MUDs were fantasy worlds populated by fictional races and creatures, many controlled by the players, similar to *Dungeons & Dragons*. However, themes and rules varied significantly. Some were set in science fiction universes or based on popular books and films. The object of the MUDs were to explore the virtual world, complete quests, kill monsters, and advance player-created characters. However, instead of being immersed in 3-D graphics, the players were prompted by a command line. Typed commands such as “east,” “west,” “say,” and “look” were used to interact with the virtual environment. According to Bartle, “The game was originally little more than a series of interconnected locations where you could move and chat.”<sup>22</sup> The importance of Trubshaw and Bartle’s experiment is not just its contribution to gaming but its introduction to a new era in multi-user virtual worlds.

Much like BBSs, most MUDs were administered and created by hobbyists who offered the service for free. However, many accepted donations or allowed players to purchase virtual items for their characters with real money to help manage maintenance costs. A few MUDs required a monthly subscription fee to play. MUDs could be accessed via a modem through telnet clients or custom clients designed specifically for MUDs. A few portals offered access to a selection of MUDs.

Due to the multiplayer functionality of these worlds, players were not always actively engaged with the game. MUDs quickly became active social communities, where friendships formed and relationships blossomed. Most MUDs offered forumlike boards where the players discussed topics both related and unrelated to the virtual world. Much like BBSs, players met face-to-face at gatherings attended by people willing to fly in from cities around the world. Many of these social connections, however, remained online, and MUDs soon attracted the interest of social scientists and journalists who became fascinated with the alter-ego assumption that was part of the game. They speculated about people adopting new identities, genders, or personalities through online networks, as well as the potential ramifications of virtual communities and what was perceived as an “addiction,” where people lived out their fantasies and carried on relationships through chat. These conversations continue today in reference to graphic-based online games.<sup>23</sup>

The MUD remained mainly an Essex University phenomenon in its early years. However, some were inspired to write their own MUDs, such as *ROCK* (based on TV’s *Fraggle Rock* [1983–87]), *MIST*, *BLUD*, and *UNI*. News of MUD reached the UK’s small community of BBS users, who played

the game through direct dial-up. However, the number of available log-ins was limited, and players were restricted to playing at night during off-peak hours when the system had cycles to spare. The demand continued to grow. The draw to MUDs expanded to the United States in the late 1980s with the growing popularity of personal computers with 300- to 2400-bit/s modems, which enabled players to log in to multiline BBSs and online services, such as CompuServe. In the 1990s, the first graphical multi-user games were created, such as *Meridian 59* (1995), *Ultima Online* (1997), *Lineage* (1998), and *EverQuest* (1999).

Widely played by college students, MUD was jokingly said to stand for “multi-undergraduate destroyer” due to the amount of time the students devoted to play.<sup>24</sup> Text-based MUDs still exist today, although they are now accessed through the Internet via DSL and digital cable connections. Graphical MUDs, or massively multiplayer online games (MMOs), such as *World of Warcraft*, are played by millions and continue to swell as a culturally, socially, and economically important phenomenon. Whereas early players were, for valid reasons, stereotyped as young, white, teenage and college-age males, recent studies reveal that the population of online gamers has grown significantly more diverse.<sup>25</sup>

### BBSS, MUDs, AND ECONOMICS

In the pioneering days of early microcomputers, bulletin board systems, and multi-user dungeons, there was little if any money to be made in online virtual experiments. A wide selection were offered free of charge by hobbyists, willing to incur the expense, with help from donations, for love of the medium. In the 21st century, digital game development is a lucrative industry. Game development companies seek to profit from creating virtual institutions consumers will find appealing. Digital games demand increasing technical capacity, to the joy of the hardware industry. The global digital game industry’s software sales were \$30 billion dollars in 2005, surpassing Hollywood’s revenues from worldwide theatrical film releases.<sup>26</sup> As the number of gamers and the appetite for faster, more complex and visually stimulating games increases, so will the profits of hardware and software development companies.

The American Dream persists, permeating all areas of our culture, transcending race, gender, and class. This dream promises infinite possibility, wealth, and prestige through hard work, labor, and production. It desires a higher level of material, political, or spiritual attainment. However, increasingly, capitalism, and the American Dream are failing to adequately reward increased production and labor in the real world.<sup>27</sup> In his *Theory of Wages*,

John Hicks, an economist of the early 20th century, attributes the main cause of migration to differences in economic advantage, primarily differences in wages.<sup>28</sup> People will migrate if they are better off as a result.<sup>29</sup> This concept applies to increasing migration to the virtual world. Today, we are witnessing a widespread and fervent extension of authorship rights, branding of cultural space, and aggressive protection of those brands. Due to the extension of branded space and the commoditization of culture, consumerism and citizenship are seemingly interchangeable concepts.

In the 1970s and 1980s, the success of BBSs and MUDs depended on the dedication and contribution of close-knit hobbyist communities. Early SysOps were BBS users, active participants in the communities they administered. MUDs were built by players, and players were inspired to take online games further as advancements in networking and computing technology propelled us forward. Much of this continues today as players continue to produce, actively fostering culture and creating large amounts of offline materials, such as guides, walkthroughs, discussion forums, websites, auctions, films, and clubs. Just as BBSs and MUDs benefited from the enthusiasm of their members, so do development companies today, who regularly enlist player communities in game production and encourage user-generated content. Player-driven game innovations and the contributions of “modders” who expand the game through the production of plug-ins and add-ons (mods), produce a significant amount of unpaid labor.<sup>30</sup>

Though game development companies benefit significantly from player innovation, we may be coming full circle, returning to an era when hobbyists imagine more possibility than perceived by commercial interests. We are seeing the emergence of an independent, open-source, grassroots video game development community, resembling the hobbyist communities of the 1970s and 1980s that spawned these experiments, much of which is utilizing the visual and immersive capabilities of synthetic environments to address social, political, and cultural issues. Perhaps, just as open-source development projects have challenged corporate control over software ownership by fostering open development communities that compete with commercial products, we will witness the intersection of open community-developed virtual environments that will aggressively compete with the products of game-development companies. As these virtual worlds expand, through increased migration to dreamscapes that satisfy needs that real life fails to quench, though these needs are currently defined in the context of capitalism and consumerism, perhaps the potential of these online cultures will then be fully realized—their power to reshape and reimagine the American Dream.

Despite persisting preoccupation with depictions of violence and enduring stereotypical assumptions about the gamer audience, online game analysis is no longer exclusively focused on effects or problematic implications. Online game analysis today also investigates their aesthetic, narrative, educational, economic, social, ideological, and technical characteristics. This broadening of perspectives is partly the result of the first generation to grow up with computer games now entering various academic disciplines. As the field evolves, games will not just be taken seriously, but will be taken seriously in a critical way. This doesn't mean the analysis will be made up exclusively of the voices of fans who play avidly and critics who have never played, but of analysts willing to thoroughly examine and critically discuss the various ideological, ethical, moral, political, sociological, and cultural contexts and manifestations of digital games and synthetic worlds online.

Yet another generation of "digital natives" are being born, who will grow up unable to conceive of a world without digital environments. It's important in this digital landscape to look back to the contributions of Seuss and Christensen of CBBS and of Trubshaw and Bartle of the Essex MUD, as they remind us what online communities and online games are really about. The communities that populate MMOs today are not dissimilar to the communities that grew up around the BBSs and MUDs of the 1980s. Online games were and remain active social cultures, with a language and rules of their own, places where friendship, collaboration, and innovation flourish. Populations will continue en masse to migrate to virtual environments not dissimilar to *World of Warcraft* and *The Sims*, where consumers shop, citizens debate, singles flirt, students learn, soldiers train, and artists create. Though the early BBSs and MUDs have evolved into a phenomenon seemingly swallowed up by game and hardware development corporations, political and media critiques of game content, and fears surrounding productivity and addiction, elements of the innocent text-based worlds accessible through analog phone lines decades ago persist among the players.

It's a joy that sometimes seems largely lost in examinations of the modern, commercialized web: that of connecting with strangers within your own metropolis or from across the world to play together and interact while on an adventure. To imagine the excitement that must have surrounded the first dial-in on a 300 baud modem into a local BBS or MUD is to step back to that early eager curiosity for what lies beyond the limits of our physical reality. Online gaming and the Internet have become economic tools, claimed by copyrights, brands, and bottom-lines. However, community continues to blossom, providing places where people with disparate interests, backgrounds, and allegiances intermingle, collaborate, and explore together.

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## APPENDIXES

### APPENDIX A: VIDEO GAME HISTORY

#### *Getting Things Straight*

{ Ralph H. Baer }

Just a bit of advice for young technologists and scientists: A tale about the Importance of Keeping Records.

Oscar Wilde may have written about the *Importance of Being Earnest*, but what young engineers and budding technologists and scientists should know about record keeping is a lot more important to their (future) success and self-esteem.

Technology graduates enter the field having been taught next to nothing useful and memorable about the patent system. Lifelong record keeping is an inseparable part of that system. Many will live to regret their lack of record keeping years later. This essay is a tale that—I hope—will shed some light of what happens in the real world when you take care of your notes and your formal records as a matter of daily routine . . . and what happens when you don't.

My experience with the patent system had its origins in lawsuits resulting from the simple fact that I came up with the seminal idea of using an ordinary home TV set as display on which to play games.

Video game history has been chronicled by many respectable historians, among them Lenny Herman, Steven Kent, Mark J. P. Wolf, J. F. Williams, Rusel DeMaria, and others, including myself. When I worked on my book, *Videogames: In the Beginning*, I relied mainly on written documents of David Winter—that most meticulous and knowledgeable collector of classical video games—and on assorted archival material. That material in-

cluded hardware and documents that David and I had been lucky enough to rescue from a slow, moldering death in legal storage, where the material had been quietly reposing for decades.

Let me jump ahead a bit: I learned many years ago that relying on memory is just not good enough when it comes to reconstructing an event. Human memory is like a piece of information that starts out on the web, already flawed, and continues to show up in new places—frequently edited on the basis of no direct insight at all—and, under different headings, in an ever-increasing number of sites, thus becoming the accepted wisdom.

In chronicling video game history in *Videogames: In the Beginning*, even I had to rely occasionally on anecdotal bits and pieces that were given to me verbally or that I collected from various sources, knowing that only some of it might reflect what actually happened. But I know better than to think of them as “facts,” and I mention their origin and leave it up to the reader to decide whether to take the source at their word.

Among such questionable sources of information were numerous recordings on audio tape, VHS videotape, CDs, and DVDs generated at trade shows, cable TV interviews, and so forth, that immortalize the sage pronouncements of industry mavens, engineers, programmers, and other seminal players. Many of these individuals did play important, even pivotal, roles in moving video games along in the early days of that industry. Some recordings were made during appearances at CGExpo or a similar retro-game show; or they were part of interviews that later appeared on public television or on game networks.

Nobody watching these productions critically can be under the illusion that what you see and hear is a factual revelation from an unimpeachable source. Much of the stuff that passes for bona fide recollections is so fatally flawed as to boggle the mind.

#### CASE IN POINT: THE MAGNAVOX VIDEO GAME PATENTS INFRINGEMENT LAWSUITS

Let’s examine the numerous stories floating around about the various video game patent infringement lawsuits that were carried on by Magnavox and Sanders Associates, the owners of the seminal Baer patents and of the Baer, Rusch, and Harrison patents. Those lawsuits started in the mid-1970s and ran all the way through the 1990s, the last of them for past infringement only, since the patents had long since lapsed. Bally, Seeburg, Mattel, Activision, Nintendo, Data East, Taito, and others fought lengthy legal battles against the Magnavox/Sanders team in an effort to avoid having to pay license fees. They lost every one of those lawsuit, both in the initial actions

in various federal district courts and, finally, ignominiously, in the court of appeals. Then they had to pay up!

Such technically knowledgeable individuals as members of the original MIT team of *Spacewar!* hackers were repeatedly called on to appear for depositions or to serve as fact or expert witnesses during actual trials. Some of the individuals involved in the fascinating creation of the original Atari company made similar appearances. In most—maybe all—cases it can be assumed that they testified to what they believed to be true. In any event, many assertions they made way back then have become dogma through endless repetitions over the years.

Here is some background: By 1971, the Magnavox Company in Fort Wayne, Indiana, had acquired exclusive rights to the Baer, Rusch, and Harrison patents assigned to Sanders Associates. Under the Sanders-Magnavox license agreement it was Magnavox's responsibility to get all infringers of those patents under license through litigation or to negotiate license agreements with firms that did not challenge the patents.

The first Odyssey Model 1TL200 video game (then called a TV game) was first demonstrated to the public in September 1971 during a series of market tests. Groups of individuals were asked to play the games and express their preferences. After several changes, having been breathlessly rumored by Magnavox as an upcoming "Mystery Product," the Odyssey game system was officially demonstrated to the press and released to the public in May 1972. It went into distribution starting in the summer of 1972. Circuit-wise, the Odyssey game was nearly identical with the Baer/Harrison engineering model called the "Brown Box" of 1968. That TV game system played a variety of games, most importantly two-player sports games such as ping-pong and handball.

The video arcade game business had its genesis almost at the same time. The first generation of ping-pong-like arcade games were designed, built, and distributed in November 1972, Atari's *PONG* game being the first of many similar games. Parenthetically, they had their genesis in the fact that Nolan Bushnell, Atari's president, played the Odyssey's ping-pong game at a Magnavox dealership in May 1972, thus making *PONG* a knock-off of that Odyssey ping-pong game. Midway, Seeburg, and other arcade game manufacturers jumped into the ring and actually produced larger quantities of *PONG* knock-offs in 1973 than the 7,000 units Atari was able to produce and deliver to distributors that year. All of these competing games were variations of the basic two-player *PONG* games. Therefore, they all had manually controlled paddles and a machine-controlled ball. In later versions, the paddles became "soccer players" kicking a ball around, or they were "hockey players" with sticks hitting a puck. Same game, different

graphics plus minor changes in some of the crude screen graphics, such as the goals.

No matter what has been said or written about what the Sanders patents supposedly covered and how they were infringed, it all comes down to this simple definition:

The lawsuits were mainly about infringing on those claims in our patents that dealt with the interaction between machine-controlled and manually controlled symbols on screen. If there was a change in the path, direction, or velocity of the machine-controlled symbol immediately after “contacting”—that is, coming into coincidence with one of the manually controlled symbols on screen—then the game exhibiting these functions infringed our patents.

That’s it! That’s all there was to it. The two operative claims in one of the patents containing those constraints were potent because just about every video game on the market during the years of 1972 through about 1976 depended on those game elements.

You would never know that simple, basic fact by listening to what all those individuals thought they remembered when they were called to the witness stand during those lawsuits. As usual, what they remembered “most” was what their lawyers had drilled into their heads.

The first lawsuit, which Magnavox and Sanders initiated, was directed against Atari, Bally, Seeburg, and others that were joined in an effort to get our patents invalidated. I met Nolan Bushnell, then Atari’s chairman, and his lawyer on the steps of Chicago’s Federal District Court a few days before the action started. Bushnell had a subsequent meeting with Tom Briody, Magnavox’s director of patents; at that meeting, Bushnell decided to opt out of the impending suit. His company became our first licensee right then and there. He felt that by doing so Atari would be able to count on an even playing field; furthermore, Bushnell got an attractive paid-up license. The suit went forward against the other firms. They lost.

Why?

That first lawsuit (as well as all of the subsequent ones) dragged on for several weeks. I spent an entire week on the stand as a fact witness in most of this and the later cases. Invariably, I found myself being exercised through every scrap of documentation we had ever generated in the lab during the 1960s. There were about three linear feet of those. At first, a huge amount of time was spent bringing the judge up to speed on electronics basics and on television technology in particular. Subsequently, details of the circuitry we used in designing the Brown Box and then used in the

Odyssey game were belabored ad infinitum. In particular, the circuitry we had designed to play our so-called de/dt hockey games was given much undeserved attention. Some of that was an effort to befuddle the court with emphasis on the differences in hardware-design approaches and to deflect him from sticking to basics: Did the accused games have manually controlled symbols on screen and did they react in one way or another upon coincidence with machine-controlled symbols on screen? Period!

We invariably had all of our 1960s hardware on display in the courtroom, starting with the earliest TV Game No.1 on through the Brown Box, TV Game No.7. Also on display was the add-on de/dt game system to the Brown Box—our TV Game No. 8—that Harrison and I had started to develop in 1969. That unit was supposed to play a hockey game in which the puck on screen moved dynamically, that is, with a velocity and in a direction related to how it was “hit” and how hard it was hit. We called that type of game a “de/dt” (the derivative of voltage vs. time) game, because the puck’s velocity was the derivative of the voltage generated by the joystick controlling the hockey stick’s motion. Since that ball circuitry was designed to differentiate the analog joystick’s output voltage, the opposition lawyers spent an inordinate amount of time yammering about the analog nature of our circuitry versus the vaunted “digital” nature of the circuitry in their accused arcade games.

#### ANALOG VERSUS DIGITAL CIRCUITRY

All of those arguments had absolutely nothing to do with the price of tea in China. The lawsuits were not about de/dt games in the first place; the operative claims of our patents were those dealing with the interaction of manually controlled symbols and machine-controlled symbols . . . all totally independent of what circuit type might have been chosen to create the displayed symbols, or to detect their coincidence and cause their reaction to each other. On top of all that, most of the circuitry we designed to accomplish those functions was undeniably digital.

But once the seed is planted, a tree is on its way. Mother Nature may decide that it grow and grow, no matter the weather. So it is with misinformation: Plant the seed, and it just grows.

There is a long trail of misinformation circulating to this day that came out of those weeks of garbled testimony in the courtroom. Mr. Bushnell, appearing as a witness, as well as others, seemed to have been primed by the lawyers to make a big deal of the supposed fact that Odyssey’s circuitry was “analog” and their arcade games were designed and built with TTL digital logic ICs. To this day, I do not understand why our lawyers didn’t cut

off that line of attack early on. Consider this: The Brown Box and, therefore, the Odyssey unit, uses digital flip-flops for the reversal of the ball after coincidence. Both systems generate a digital coincidence (rail-to-rail) signal by AND-ing the rail-to-rail ball-and-paddle signals in diode AND gates. These are all DIGITAL circuits—no ifs, ands, or buts about it. Yes, these digital circuits were built with discrete components: transistors, diodes, resistors, and capacitors. That was the only cost-effective way to go in the mid-1960s. We tried to come up with a TTL integrated circuit design, but those ICs were too expensive and, above all, too power hungry. In *Video-games: In the Beginning*, I have reproduced the schematic of the digital IC design we came up with and then abandoned for those two reasons. So it isn't that we did what we did because we were dumb designers, but for good and valid reasons.

Furthermore, the ball-and-paddle symbol generators consist of four one-shots, two for horizontal and vertical positioning of a displayed spot on screen, and two for establishing the width and height of the symbols. Those are hybrid pulse-and-digital circuits and not analog circuits by anybody's definition.

There *was* a Channel 3 or 4 oscillator that was modulated by the sync and video signal of those machines. That was analog circuitry. The same stuff is in every fancy modern video game console to this day, or at least through recent history. Every home video game starting with my breadboards in 1967 uses an RF oscillator-modulator module and has for the last 30 years. It's just another thing I pioneered along with the use of joysticks, tethered hand-controllers, plug-in game cards, and light-guns for video games, or the use of digitized faces as well as interactive games using graphics and data living happily on shiny 12-inch discs and, eventually on the five-inch variety! All of which resulted in several issued patents but no takers . . . once again, technology too far ahead of the cost-benefit curve for the time.

There is more: The vertical and horizontal sync generator circuits were free-running multi-vibrators rather than the crystal-controlled oscillator-divider chains used in arcade games. The latter required a large number of ICs just for the job of sync generation, an option that was not open to us who had to design a cost-effective consumer product with mid-1960s components. Those multi-vibrators are pulse circuits, not analog circuits.

Enough of that!

All this quibbling about the difference in circuit design had nothing to do with the claims everybody infringed. It was just a red herring. The opposition's lawyers probably understood the nature and function of these elementary, early circuits. Conceivably, they dragged in all of that "analog

versus digital” stuff simply to snow the judge. How their well-prepared and often technically very astute technical expert witnesses could have been misled into repeating this evident nonsense beats me. I have heard straight-arrows like Alan Alcorn, the designer of Atari’s *PONG* game, and others repeat some of this stuff just recently. Bad information never seems to die.

After Bally et al. lost that first lawsuit in Chicago, the case went to the court of appeals, where the verdict was upheld and a lot of money changed hands, including substantial penalties. Mattel was next in the barrel, also in the Chicago court but with a different judge, who had to be educated in the technology elements all over again. We won; they lost. The case went to appeal, and they lost again. Something like \$16 million changed hands (in 1970s money—multiply that by 3.6 to get to our watered down currency, circa 2009).

After that, it was Activision’s turn in the barrel, with the same result in San Francisco’s Federal District Court and, later, in the court of appeals. Unfortunately, Activision went broke in the early 1980s before we could collect.

We also had no problem convincing the Canadian patent system, during a visit to Ottawa, and a London judge that we were entitled to royalties from infringers in Canada and Great Britain. Remarkably, the foreigners did not tolerate anywhere near as much dancing around the analog versus digital smoke screen. I got several largely enjoyable foreign trips out of those proceedings.

It wasn’t all fun and games. More than once, my Brown Box would quit working just before I was about to give a demonstration to the judge, and I had to run out during lunch recess to buy some tools and fix the darn thing. All that moving around from place to place didn’t do the old girl any good. I barely beat the judge’s return to the courtroom in Chicago on one such occasion and had a similar tight squeeze in San Francisco and in Ottawa.

### WHO REALLY INVENTED THE HOME VIDEO GAME?

Also at issue but not of major importance during the lawsuits was the opposition’s attempt to show that prior art negated my claims to have invented home TV games. As a matter of historical fact, my major contribution to the then nonexistent video game business in 1966 was the concept of making the home TV set into an interactive game terminal, though we certainly did not call it that. We just called it “TV games,” which it was. The lawsuits had only a minor relationship to that basic invention. Those lawsuits were all about infringing the so-called “hit” and “hitting” symbols and their interaction upon coincidence, which was covered by those two claims in our

'507 patent. I was pleased, however, to have Federal Circuit Judge Grady describe my '480 patent as the pioneer patent of the video game industry when he read his decision from the bench at the conclusion of the first trial. His decision, including that remark, appear in 201-USPQ. An article on 201-USPQ *Magnavox vs. Activision* appeared at PatentArcade.com on August 15, 2005; anyone interested in more detail on the court fights might go to [http://www.patentarcade.com/archives/2005\\_08\\_01\\_patentarcade\\_archive.html](http://www.patentarcade.com/archives/2005_08_01_patentarcade_archive.html).

Having explained what the lawsuits were really all about, let me sneak in and debunk another myth about the alleged superiority of the digital design used in early *PONG*-type arcade games versus those supposedly poor, unreliable, unstable, and uncontrollable analog circuits in the Brown Box and in the Odyssey game. These myths have been have been kicked around for decades like a soccer ball that never touches ground long enough for anyone to notice that it is full of hot air. When reminded of the fact that the concept for *PONG* was lifted from the ping-pong game that Nolan Bushnell played at a Magnavox dealership demo in May of 1972, there is this typical rebuttal: Yes, maybe playing the Odyssey game had something to do with *PONG*, but the Odyssey was a poor game by comparison. It was unstable; it was boring; the controls were unresponsive. It usually goes on from there and heads toward the digital-versus-analog bogeyman.

Anyone who has actually played an Odyssey ping-pong game knows that it is totally stable and challenging on several levels: First of all, the use of its "English" controls allows both players to make life tough for their opponent by controlling the vertical path of the "ball" that just left their "paddle." Second, there is a variable-speed control that allows the contestants to select any speed they think they can handle. The same thing goes for the rest of the "ball" games. Those two features make an Odyssey ping-pong game challenging. As to the lack of scoring, "Real" tennis and ping-pong games have been scored by shouting out the score since time immemorial, so why bother with expensive on-screen scoring? We actually had rudimentary scoring in TV Game No. 2, *Anno Domini* 1967. It used a thermometer-like column and a graduated overlay, but we did away with that scheme in the Brown Box. As to the lack of sound, that was something else. We just didn't think of it. Everything is obvious in hindsight.

So much for the vaunted deficiencies of the first home video game. Now, it would be nice if this trip through video game history might clear the air about certain events that took place way back when. Hope springs eternal, but I, for one, know better than to bank on it.

The Bottom Line. The moral of the story is simple: If it ain't documented, it doesn't count.

Sanders/Magnavox would have been about \$100 million poorer if it hadn't been for all of those original documents gracing those courtrooms. If anyone is anxious to have a detailed look at these documents—hundreds of them—then go to these Smithsonian web pages and read to your heart's content: [http://invention.smithsonian.org/downloads/Baer\\_videogame\\_devt.pdf](http://invention.smithsonian.org/downloads/Baer_videogame_devt.pdf) and [http://invention.smithsonian.org/resources/fa\\_baer\\_index.aspx](http://invention.smithsonian.org/resources/fa_baer_index.aspx).

Once more: If it ain't documented, it doesn't count. Now this is something every young engineer should learn and practice starting at an early age. You can't roll the camera of life in REVERSE. Do it now.

## APPENDIX B: *THE MAGNAVOX CO. v. ACTIVISION, INC.*

1985 WL 9469 (N.D. Cal. 1985)

{ Ross A. Dannenberg }

In a case of infringement involving one of the earliest video game patents, Magnavox asserted its exclusive licensing rights on television console “ball-and-paddle” games like the classic *PONG*. The patent-in-suit was U.S. Letters Patent Re. 28,507, a reissue patent originally issued on April 25, 1972. The ’507 reissue patent was one of several related patents obtained by Sanders Associates, another Plaintiff in this case. In 1967, Sanders became the first to combine toys, games, and television, defining the brand new art of television video games. Sanders’s subsequent patents claimed exclusive rights on a large variety of television games. Two of the asserted claims in the ’507 patent read as follows:

51. Apparatus for generating symbols upon the screen of a television receiver to be manipulated by at least one participant, comprising: means for generating a hitting symbol; and means for generating a hit symbol including means for ascertaining coincidence between said hitting symbol and said hit symbol and means for imparting a distinct motion to said hit symbol upon coincidence.

52. The combination of claim 51 wherein said means for generating a hitting symbol includes means for providing horizontal and vertical control signals for varying the horizontal and vertical positions of said hitting symbol.

Deciphering the above legalese, the ’507 patent described a common gaming scenario: a player (the hitting symbol) moving around the screen and making contact with a ball (the hit symbol), sending the ball off in a different direction. Sanders, having become a TV console gaming pioneer, had now secured the rights to a set of actions that countless video game designers would want when creating sports games, combat games, and puzzle games, etc.

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Fig. A.1. Photo courtesy of David Winter, [www.pong-story.com](http://www.pong-story.com);  
(c) David Winter.

In 1971, Sanders sold the exclusive licensing rights under the '507 patent to Magnavox, who shortly thereafter introduced the first of the ball-and-paddle games, under the name "Odyssey." It didn't take long for other game designers to catch on. Atari released the television console classic *PONG* in 1975, after securing a license from Magnavox for the right to make and sell the '507-type ball-and-paddle game. More game designers flocked to this new market, and Activision was among the youngest and most ambitious of them.

Activision designed and manufactured television console games for the Atari 2600, the Commodore 64, and for IBM and Apple computers. It produced a Tennis, Hockey, and Grand Prix game, among others, which followed the general "ball-and-paddle" format covered by the '507 patent. When Activision failed to obtain a license from Magnavox before developing these games, Magnavox and Sanders filed this infringement suit. Magnavox had much at stake in this case; they had already made approximately \$40 million in licensing royalties based on the '507 patent and had no desire to be cut out of the loop. The stakes were raised even higher when Activi-

sion responded to the infringement action by promptly challenging the validity of the '507 patent with 9 pieces of prior art brought before the court. If the court invalidated the '507 patent, Magnavox risked losing its entire royalty stream, and being left completely behind by Atari and its television gaming competitors.

Fortunately for Magnavox, the '507 patent had previously endured and survived validity challenges in two previous cases. In *The Magnavox Co. v. Chicago Dynamic Industries*, 201 U.S.P.Q. 25 (N.D.Ill.1977) and *The Magnavox Co. v. Mattel, Inc.*, 216 U.S.P.Q. 28 (N.D.Ill.1982), the '507 patent had been challenged against many of the same pieces of prior art offered by Activision. However, since Activision was not a party to those cases, the judge in this case performed an exhaustive review of the technology and the cited prior art references before making an independent decision. In the end, as in the previous cases, the court found that the '507 patent was valid over the prior art. Activision now faced an uphill battle, proving that its games did not infringe the claims of the '507 patent. Activision's main argument was that the "means-plus-function" language of the claims (i.e., the means ascertaining coincidence, the means for imparting a distinct motion to said hit symbol, etc.) should be narrowly construed to apply *only* to the circuitry described in the language of the '507 patent. Game circuitry had, of course, changed significantly in the last 10 years, and Activision wanted Magnavox's claims to apply only to "slicer circuits that make sawtooth waveforms," the dominant circuit technology of 1970. Most modern games, including Activision's, now used a microprocessor design. The court, however, declined to limit the '507 patent: "The use of the microprocessor technology, which became available only after the invention of the '507 reissue patent ... does not alter the basic nature of those games or avoid the '507 reissue patent."

After holding that Activision's games did literally infringe, the court further noted that the Doctrine of Equivalents would have also applied in favor of Magnavox. Magnavox had enjoyed wide licensing and much commercial success based on the '507 patent. These facts justified a wide range of equivalents, and support the conclusion that Activision's games were substantially the same as those claimed in the '507 patent. Activision next argued that since Atari had acquired a license from Magnavox to develop games under the '507 patent, all purchasers of the Atari 2600 console had either an explicit or implied license to buy and use other games falling under the same patent. The court quickly rejected the explicit license argument, holding that Atari 2600 purchasers only had a license to use that gaming console, not to buy and use other infringing games. Similarly, Atari console buyers did not acquire an implicit license to buy and use Activision games. No evidence had been shown that any game purchasers relied on

this legal theory of implicit licensing while purchasing an Activision game. Further, any thoughts by purchasers concerning their freedom to use Activision games came from Activision itself and not from statements or actions of the Plaintiffs. The court similarly dismissed Activision's argument that using its games in an Atari console constituted a "permitted adaptation" of the license given to every purchaser. The only minor victory for Activision came when the court found that its infringement of the '507 patent had not been willful. Activision's founders, before starting the company, had brought their business plan to a patent attorney to seek legal advice regarding their proposed games. Since their counsel had failed to mention the '507 patent, Activision had acted reasonably in believing that there was no such patent.



## CONTRIBUTORS

**Jessica Aldred** is a doctoral candidate and researcher with the Hypertext and Hypermedia Lab at Carleton University in Ottawa, Canada. Aldred's research focuses on digital character animation and the growing intersections between cinema and video games in the age of media convergence. Her work has been published in *Animation, An Interdisciplinary Journal*, *Games and Culture*, and *Mediascape*..

**Ralph H. Baer** is an independent engineering consultant and internationally known inventor generally credited with creating the home video game console industry in the 1960s. Baer has been an active engineer for the past 60 years and has accumulated over 150 U.S. and foreign patents, many of which are in the consumer electronics area and have resulted in a variety of products, including many successful electronic toys and games. Typical of these is the *SIMON* game, an early single-chip microprocessor-controlled game that has been popular for over 30 years. Baer is the recipient of many professional honors, including the National Medal of Technology, which was presented to him by the president of the United States in 2006, an honorary doctor of laws degree from Pierce Law Center, and many other significant professional awards.

**Brett Camper** designs, studies, and writes about computational media, with a particular interest in media history, games, user interfaces, mapping, and computer graphics technologies. His work as an independent software developer includes "8-Bit NYC," a web map that re-envision New York in the style of a 1980s video game, and "Trees Near You," an iPhone application that maps and tracks over half a million trees in New York City. Camper previously served as the research manager of MIT's Education Arcade, and is currently the director of product management at Kickstarter, a

crowdfunding platform for creative endeavors. He holds an MS in comparative media studies from MIT, where he studied the homebrew community surrounding Nintendo's Game Boy Advance handheld platform.

**Karen Collins** is Canada Research Chair in Interactive Audio at the University of Waterloo, where she teaches game design and sound for interactive media. She is the author of *Game Sound* (MIT Press, 2008), and the editor of a collected volume about interactive audio, *From Pac-Man to Pop Music* (Ashgate, 2008).

**Ross A. Dannenberg** is an intellectual property attorney with Banner & Witcoff Ltd. in Washington DC, and handles a wide-range of intellectual property issues, with experience in Internet, video game, telecommunications, and computer software-related issues. With a background in computer science, Dannenberg has prepared and prosecuted hundreds of patent applications in a variety of technical fields, and also has experience with IP enforcement, copyrights, licensing, entertainment, and matters related to trademark and domain name, concentrating in the video game industry. Dannenberg is an adjunct copyrights professor at George Mason University School of Law, is the founding Chair of the American Bar Association's IP Section Committee on Computer Games and Virtual Worlds, and is the editor-in-chief of the PatentArcade.com blog. Dannenberg currently serves on the steering committee of the Intellectual Property Rights SIG of the International Game Developers Association, speaks extensively at legal conferences regarding video game IP law, is a fellow of the American Bar Foundation, and is a principal editor of the book *Computer Games and Virtual Worlds: A New Frontier in Intellectual Property Law* (2011). Dannenberg's representative clients include multinational software, networking, and telecommunications companies, a virtual world publisher with a user base of over 4 million users, video game developers and publishers, and emerging technology companies.

**Leonard Herman**, a.k.a. The Game Scholar, fell in love with video games the first time he played *Pong* at a local bowling alley in 1972. A programmer and technical writer by trade, Herman founded Rolenta Press in 1994 to publish his book, *Phoenix: The Fall & Rise of Videogames*, the first serious book on video game history, which, in 2008, *Game Informer* magazine called the second best book about video games ever written. Herman has written articles about video games for *Electronic Gaming Monthly*, *Edge*, *Games*, *Videogaming Illustrated*, *Official U.S. Playstation Magazine*, and many other magazines. He has also written chapters for books such as Su-

percade and *The Video Game Explosion*, and has edited Ralph Baer's book *Videogames: In the Beginning*. In 2003, Herman was given a Classic Gaming Expo Achievement Award. An advisor to Videotopia and the forthcoming Video Game History Museum, Herman resides in New Jersey with his wife, Tamar, and their sons, Ronnie and Gregory. He is currently working on the fourth edition of *Phoenix*.

**Erkki Huhtamo** is professor of media history and theory at the University of California Los Angeles, Department of Design | Media Arts. He holds a PhD in cultural history and has published extensively on media archaeology and media arts. His new book, *Illusions in Motion: A Media Archaeology of the Moving Panorama and Related Spectacles*, is forthcoming in 2012 from the MIT Press.

**Carly A. Kocurek** is a doctoral candidate in American Studies at the University of Texas at Austin. Her current research focuses on the relationship between early video gaming, the production of masculinity, and the social and economic upheaval of the 1970s and 1980s. She holds an MA in American studies from the University of Texas. She is co-author of *Republic of Barbecue: Stories Beyond the Brisket*, and a former senior editor of *Flow*, an online journal of television and media studies. At present, she is completing a series of oral history interviews related to early video game culture.

**Sheila C. Murphy** is an associate professor in the Department of Screen Arts & Cultures at the University of Michigan. Her work and teaching are centered around new media theory, video games, Internet media, and cultural reception. She recently completed her book, *How Television Invented New Media* (Rutgers University Press, 2011). She believes that video games are crucial to understanding contemporary media culture and to the study of new media, as video game systems truly were the first "PCs." Her next project explores how geek culture emerged alongside cute culture online—from sprites to StrongBad and beyond.

**Ed Rotberg** has been in the game business since 1979. He began his career at Atari and has worked as producer, designer, programmer, and executive manager at various times in his career. He was one of the founders of Videa, which was eventually acquired by Bally Midway. His career has also included a two-year stint at Apple Computer. His body of work includes titles at Atari: *Atari Baseball* (1979), *BattleZone* (1980), and *Star Wars* (1983); at Atari Games: *Blasteroids* (1987), *S.T.U.N. Runner* (1989), *Shuuz* (1990), *Steel Talons* (1991), and *Guardians of the Hood* (1992); at Bally Midway:

*Snake Pit* (1984); at 3DO: *Station Invasion* (1994) and *IMSA Racing* (cancelled); at Silicon Entertainment: *NASCAR Silicon Motor Speedway* (1997); at THQ: *MX Superfly* (2002) and *WWE CrushHour* (2003); and at Mine Shaft Entertainment: *High Heat Baseball 2002* (2001), *Pocket Kingdom: Own the World* (2004), *Blazing Angels: Squadrons of WWII* (2006), *Pro Series Golf* (2008), and *Tilt-a-Ball* (2009).

**Tim Skelly** is the author of the classic Cinematronics vector-based arcade games *Star Hawk* (1978), *Sundance* (1978), *Warrior* (1979), *Rip-Off* (1980), *Star Castle* (1980) and *Armor Attack* (1981). His nonvector games for D. Gottlieb/Mylstar include *Reactor* (1982), *Insector* (1983), and *Screw Loose* (1984). Today, these games are highly prized by collectors. He is an artist and illustrator of several books and magazine articles and is the author of *Shoot the Robot, Then Shoot Mom* (1983), a book of cartoons about classic arcade games. In 1985, as part of a small group of friends and fellow game veterans, he co-founded Incredible Technologies. While there, he was responsible for the visual aspects of all products. He devised and created the primary screen displays for Virtual Worlds' original *BattleTech Center* (1990) and for that project designed the Mad Cat and other Clan OmniMechs. During his time at Incredible Technologies, he took an interest in human-computer interface issues and, drawing on his video game experiences, became active in the HCI community. After a stint as art director with the SEGA Technical Institute, where he contributed to *Sonic the Hedgehog 2* (1992), he was recruited to be one of the first researchers in the Microsoft User Interface Research Group. While at Microsoft, he lectured often on campus and at conferences on the topic of "Seductive Interfaces" his research into how user interfaces affect the user. Partially because of that work, he was appointed to the 1996 Panel on Human-Computer Interface Technologies by the U.S. government. He helped found Microsoft's Life-like Computer Character Conference and has contributed to conferences held by the AAAI, ACM SIGGRAPH, and ACM SIGCHI, presenting tutorials on interface design. He has been a member of the advisory board and a contributor to Wiley's *Handbook of Interface Design* (1997), and for a number of years was a member of the editorial advisory board for Morgan Kaufmann's series of user interface-related books.

**Carl Therrien** is a guest lecturer in the video game studies program at Université de Montréal. He recently completed a PhD thesis about the formal and psychological aspects of immersion in fictional worlds and is pursuing a postdoctoral project on the history of video games. Major publications include two chapters in Mark J. P. Wolf's *The Video Game Explosion: A*

*History from PONG to PlayStation and Beyond* (Greenwood Press, 2007), a historical contribution in Bernard Perron's anthology on *Horror Video Games* (McFarland & Company, 2009), an article on the playful nature of contemporary cinema in *Narrativity: How Visual Arts, Cinema and Literature Are Telling the World Today* (Dis Voir, 2006), and contributions to many conferences (DiGRA, CGSA, Interacting with Immersive World).

**Staci Tucker** is a master's student and teaching fellow of Communication and Society in the School of Journalism and Communication at the University of Oregon. Her research encompasses a range of topics surrounding the intersection of media technologies, identity, and community, including online games. Her current projects include an examination of harassment and discrimination based on gender, race and sexual orientation in massively multiplayer online games, as well as an analysis of how data storage structures and online forms impact categories of identity. She's served in various positions as an online manager, programmer, designer, and server and database administrator since 1998. These positions include technology consulting roles in newspapers, media, and education.

**Zach Whalen** is an assistant professor in the Department of English, Linguistics, and Communication at the University of Mary Washington. His continuing research and teaching focuses on new media with a specific focus on video games, typography, textual theory, and comics. With Laurie N. Taylor, he co-edited *Playing the Past: History and Nostalgia in Videogames* (Vanderbilt University Press, 2008). His articles have appeared in *Refractory*, *Game Studies*, *Work and Days*, and *Flow*. He has also contributed chapters to *Music, Sound and Multimedia* (Edinburgh University Press, 2007) and *The Meaning and Culture of Grand Theft Auto* (McFarland, 2006). His current project, *The Videogame Text*, adapts his 2008 dissertation on typography and textuality in video games into something book-shaped. Its present form may be viewed at [www.thevideogametext.com](http://www.thevideogametext.com).

**Mark J. P. Wolf** is a professor in the communication department at Concordia University Wisconsin. He has a BA (1990) in film production and an MA (1992) and PhD (1995) in critical studies from the School of Cinema/Television (now renamed the School of Cinematic Arts) at the University of Southern California. His books include *Abstracting Reality: Art, Communication, and Cognition in the Digital Age* (2000), *The Medium of the Video Game* (2001), *Virtual Morality: Morals, Ethics, and New Media* (2003), *The Video Game Theory Reader* (2003), *The Video Game Explosion: A History from PONG to PlayStation and Beyond* (2007), *The Video Game*

*Theory Reader 2* (2008), *Myst and Riven: The World of the D'ni* (2006), the two-volume *Encyclopedia of Video Games* (2012), and two novels for which he has begun looking for an agent and publisher. He is currently working on a book on the theory and history of imaginary worlds. He has been invited to speak in North America, Europe, Asia, and Second Life, and is on the advisory boards of Videotopia and the *International Journal of Gaming and Computer-Mediated Simulations*, and several editorial boards including those of *Games and Culture*, *The Journal of E-media Studies*, and *Mechademia: An Annual Forum for Anime, Manga and The Fan Arts*. He lives in Wisconsin with his wife, Diane, and his sons, Michael, Christian, and Francis.

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**MARK J.P. WOLF** is a professor in the communication department at Concordia University Wisconsin. His books include *Abstracting Reality: Art, Communication, and Cognition in the Digital Age*; *The Medium of the Video Game*; *Virtual Morality: Morals, Ethics, and New Media*; *The Video Game Theory Reader*; *Myst and Riven: The World of the D'ni*; *The Video Game Explosion: A History from PONG to PlayStation and Beyond*; *The Video Game Theory Reader 2*; and the two-volume *Encyclopedia of Video Games*. He is also founder of the Landmark Video Game book series and the Video Game Studies Scholarly Interest Group within the Society of Cinema and Media Studies.

Contributors: Jessica Aldred, Ralph H. Baer, Brett Camper, Karen Collins, Ross A. Dannenberg, Leonard Herman, Erkki Huhtamo, Carly A. Kocurek, Sheila C. Murphy, Ed Rotberg, Tim Skelly, Carl Therrien, Staci Tucker, Zach Whalen, Mark J. P. Wolf

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