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Preservation of the Video Game

Allison M. Hudgins

Archivists have witnessed the preservation pitfalls of aging paper, videotape, and film and may wonder what the future holds for the video games of this era. Will children fifty years from now be able to play Super Mario World? More importantly, will historians lose objects that have made a significant cultural impact on the society of the late twentieth century and early twenty-first? If a variety of institutions do not take up significant preservation efforts then the games of today could slip away more quickly than one might think.

In recent years video games have become objects that not only reflect the society in which they were created, but also shape the way that society learns, works, and plays. The U.S. Army uses video games as training simulators, studies are being conducted on the behavioral effects of multi-player cooperation games, and First Lady Michelle Obama has asked game designers to develop games that fight childhood obesity.¹ These new media materials are becoming objects of interest to historians,

¹ Samantha Murphy, "Gamers Hold the World at their Controls," *New Scientist* 206 (2010), no. 2761: 37-39.

educators, sociologists, artists, computer scientists, and in turn, archivists. Yet just as archivists begin to address preserving video games, they are finding that these materials face a multitude of preservation problems far different from other archival materials. The most urgent concern may be the rapid physical deterioration of games and the little time left to save certain formats, some of which have only a few decades before components break down. Other challenges include a lack of interest in their preservation, aggressive copyright protection, and high costs associated with their preservation. Yet, several promising projects have emerged that deliver some hope that these fragile materials will not disappear forever and with them information key to understanding a society deeply involved in digital worlds and the roots of an emerging art form.

Why Should We Preserve Games?

Archives have long worked to preserve the materials of governments, organizations, and individuals by selecting the materials that have enduring value to the creator and to future researchers. Often the materials selected are those objects that give a glimpse into the past by shedding light on a past culture, event, or institution.² Now archives and libraries are beginning to ask, could a video game be such an object? Have they risen so far in the culture to be considered useful enough to the future researcher to merit preservation?

Video games can be viewed in a few ways from the archival perspective. First, games can be an artifact worthy of preservation because of who authored them. Game corporations or game designers might maintain a corporate archive for their own purposes or even as an institution that allows the public to connect with the past accomplishments

² Helen R. Tibbo, "Archival Perspectives on the Emerging Digital Library." *Communications of The ACM* 44 (2001), no. 5: 69-70.

of the company. Several gaming companies report that they do in fact maintain an archive of their games.



Image courtesy of the author

Another reason that video games might begin to enter archives is that academic institutions are adding game design to their available programs of study. In turn, the institutions' libraries and archives are acquiring materials to support the curriculum, to document students' work, and as objects of cultural study. This surge of interest in gaming studies has been compared to the film studies programs that rose in popularity and number in the 1960s, and the resulting development of film scholarship. Archives then sought to obtain early works of film in order to support the sudden increase in scholarly attention.³ In much the same

³ Brennen Jensen, "At a University Archive, Yesterday's Cutting-Edge Video Games Play On," *Chronicle Of Philanthropy* 23, no. 12 (2011): 5.

way, academic archives could begin to see a need for the preservation of video games.

Another way that archivists might view a video game is as a cultural artifact. Archives with a wider mission to preserve materials that contribute to historical research might encounter these objects as artifacts that help depict life in the early twenty-first century, as video games become more prominently intertwined with modern culture. In an interview with *The Atlantic*, Henry Lowood, Curator for History of Science & Technology Collections and Film & Media Collections at Stanford University, said “The cultural history of our world is wrapped up in digital worlds, and in the future, if people want to understand our culture, they’re going to need documents and information.”⁴

Challenges to Preservation

Digital games face a number of preservation challenges, some similar to the challenges faced by other materials, some distinct to the format of the game. The most prominent of these challenges are the physical deterioration of the storage media the games exist on, the copyright rules dictating use of the material, the cost of preservation, and the lack of attention or interest that these materials encounter.

The most immediate preservation problem that video games face is the physical deterioration of the media on which the data is stored. As media storage formats age they develop “bit rot” or “bit loss,” a deterioration of data in the form of holes that appear in the code.⁵ Each part of code is vital for a program to work correctly and even minor decay can render a file unreadable. Bit rot can

⁴ Clay Risen, “Pac Rat,” *The Atlantic*, March 2010, <http://www.theatlantic.com/magazine/archive/2010/03/pac-rat/7911/>.

⁵ “SPS: Bit Rot,” *Software Preservation Society*, http://www.softpres.org/glossary:bit_rot (checked July 5, 2011).

happen for a number of reasons and it affects each format differently. Magnetic disks, like floppy disks and hard drives, are some of the most vulnerable media storage formats. Over time the magnetic properties fade, and the bit cells lose polarity resulting in weak signals and eventually a loss of data. Games were published on floppy disks until the mid to late 1990s, when newer storage media began to supersede floppy disks. According to the Software Preservation Society, floppy disks have a lifespan of approximately 10 to 30 years depending on storage conditions.⁶

Cartridge games, like Sega Genesis and Super Nintendo games, are more stable because they use Read-Only Memory (ROM) chips to store data. In *Before It's Too Late: A Digital Game Preservation White Paper* the authors write that, "ROM cartridges are made of durable material, and most commercial cartridge-based games are burned to masked ROM cartridges, which have considerably longer life spans than most other digital media."⁷ ROM chips are vulnerable to moisture and battery acid leaks but overall they are more stable than other storage formats.

There is a type of ROM that is much more susceptible to bit rot, called EPROMS, a reprogrammable ROM used mostly for prototype games. These formats use electrons to program the chip, setting the memory cells to either a 1 or 0 position. Over time the insulation around the chip breaks down and allows the electrons to escape, causing the memory cells programmed to the 1 position to

⁶ Ibid.

⁷ Judd Ruggill, et al., *What If We Do Nothing? Before It's Too Late: A Digital Game Preservation White Paper* (International Game Developers Association, 2009), http://www.igda.org/wiki/images/8/83/IGDA_Game_Preservation_SIG_-_Before_It%27s_Too_Late_-_A_Digital_Game_Preservation_White_Paper.pdf (checked July 5, 2011).

revert back to the 0 position. This loss of data eventually leads to corrupted files and an unreadable piece of software.⁸

Another major obstacle in the preservation of video games is copyright law. Game companies defend their intellectual property aggressively, and efforts to combat piracy can sometimes result in the unintended consequence of limiting access to their games, even for preservation efforts. In the past archives that led efforts to make games available to the public for play were required to wait until the copyright expired, and by that time the games might be lost, either because there were no copies available or the data had become corrupted rendering it irretrievable.⁹ Because of this problem an exemption to the Digital Millennium Copyright Act (DMCA) was granted in 2006, which allows archives and libraries to create preservation copies of obsolete computer programs and video games.¹⁰ While this exemption is a great boon to archives and libraries, it does not mean that industry support is not needed or that all copyright obstacles can be overcome. For one, there are Digital Rights Management (DRM) codes imbedded in some software which prevent copying or migration to new formats at the code level, even if this migration is legal and covered under the copyright exemption.¹¹ Games are also written to be difficult to copy,

⁸ "A Small Lesson in Bit Rot," *System Failure*,

<http://my.ais.net/~xtreme/SF/Bit-Rot/> (checked July 5, 2011).

⁹ Christopher Mims, "Our Rotting Video-Game Heritage," *Technology Review*, July 28, 2010,

<http://www.technologyreview.com/blog/post.aspx?bid=377&bpid=25538>.

¹⁰ "Billington Approves DMCA Exemptions," *Library Times International: world news digest of library & information science* 23, no. 3 (2007): 34.

¹¹ Ryan B., "The Video Game Industry and DRM – Time for a Change." *Yale Law & Technology* (blog), March 18, 2010,

in a proprietary language, and documentation of how the hardware functions is often kept secret. Ultimately this means that archives trying to preserve video games will run into problems they do not encounter with other copyrighted materials. Either they will be physically prevented from accessing the content of the game by DRM codes or stopped by the difficulty in reading the code itself. These protections make no distinction between an archives' fair-use copying and piracy.

Even if an institution is interested in preservation efforts, the costs are so high there are relatively few places doing this type of work. "Funding for an effective preservation infrastructure is severely lacking, and it's hard to convince cash-strapped agencies that saving video games is worthwhile," writes Clay Risen, contributor to *The Atlantic*. Preservation of any kind is expensive and video games require specialized efforts and technology to support their continued existence. Some institutions, such as the Software Preservation Project, solicit donated scans or original software in order to address the challenge of preserving the overwhelming number of commercially released games.¹²

Video games can also suffer from the attitude that they are too new to be in need of immediate preservation. However video games have a much shorter life span than books or film, which can last for decades, even if stored in less than optimal conditions. Worse, video games require complex, obsolete hardware, which faces its own preservation challenges, in order to be read and played. Waiting until these games are deemed old enough or culturally significant enough to be worthy of preservation is, in many cases, not an option.

<http://www.yalelawtech.org/ip-in-the-digital-age/the-video-game-industry-and-drm-time-for-a-change/>

¹² Risen, "Pac Rat." "SPS: About Us." *Software Preservation Society*, <http://www.softpres.org/about> (checked July 5, 2011).

The attention that preservation receives from the gaming industry is mixed. Gaming companies, especially the larger ones, want to have access to past games and have the resources to maintain their own game archives. Often they have become aware of preservation threats after losing the source code of early games and have taken steps to preserve their works.¹³ Yet this awareness is not always pervasive. James Newman commenting in 2009 on the state of video game preservation in the U.K., writes that,

We have encountered shoeboxes under CEOs' desks and proud parents' collections of tapes and press cuttings. These are the closest things to a formalized archive that we currently have for many of the biggest British game development and publishing companies... [I]t is symptomatic of an industry that, despite its public proclamations, neither places a high value on its products as popular culture nor truly recognizes their impact on that culture.¹⁴

There is also an extreme pressure exerted by gaming companies to value the newest games and denigrate the older ones, so that when old games are made available for purchase they come at extremely reduced rates. In 1992 *The Legend of Zelda: A Link to the Past*, a Super Nintendo cartridge game, sold for about \$70. Today the same game can be downloaded through the Nintendo Wii virtual

¹³ John Andersen, "Where Games Go To Sleep: The Game Preservation Crisis, Part 3," *Gamasutra*, March 10, 2011, http://www.gamasutra.com/view/feature/6301/where_games_go_to_sleep_the_game_.php?page=1.

¹⁴ James Newman, "Save the Videogame! The National Videogame Archive: Preservation, Supersession and Obsolescence," *M/C Journal* 12, no. 3 (2009), <http://journal.media-culture.org.au/index.php/mcjournal/article/view/167> (checked July 5, 2011).

console for \$8.¹⁵ Very few game stores carry games older than a few years, and if they do the games are found in a bargain bin and are sold for a fraction of the original cost. Game companies view their own products as objects of instant obsolescence and spend their resources promoting the next newest game.¹⁶

The perceived low monetary value of these older games is damaging in at least two ways. First because gamers are unwilling to spend very much money on old games, game companies make little effort to keep them on the market, much less to provide a fully accessible catalog of their games. It is not surprising that profitable vintage games, like the *Zelda* series, are available but out of the thousands of games produced in the 1980s and 1990s only 413 are currently available on the Wii virtual console for North America and Europe.¹⁷ Second, because the value is so low, the perception by the general gaming public is that these games are numerous and expendable, when neither may be true.

In order for non-industry preservation projects to succeed there must be a level of industry support; whether it comes from companies giving the rights of financially unimportant games to archives or providing metadata and materials that contribute to the understanding of a game. In the introduction to *Before It's Too Late: A Digital Game Preservation White Paper* (2009), Henry Lowood expresses a similar sentiment directed at game developers,

If we fail to address the problems of game
preservation, the games you are making will

¹⁵ "The Legend of Zelda: A Link to the Past," *Nintendo.com*, http://www.nintendo.com/games/detail/5oMtHuB3aOHOawfC6brZ6myQY4fIQ_ (checked July 5, 2011).

¹⁶ Newman, "Save the Videogame!"

¹⁷ "Virtual Console Games Out Now," *Nintendolife*, <http://vc.nintendolife.com/games> (checked July 5, 2011).

disappear, perhaps within a few decades. You will lose access to your own intellectual property, you will be unable to show new developers the games you designed or that inspired you, and you may even find it necessary to re-invent a bunch of wheels.¹⁸

Encouragingly, it appears that these concerns are being addressed by the industry. In a survey conducted in 2010-2011 by *Gamasutra*, fourteen gaming companies responded to questions about their preservation policies. Microsoft for example reported that they keep multiple copies of materials in climate-controlled vaults in on and off site locations. It also plans to transfer games produced before 2000 to newer more reliable storage devices in order to avoid bit rot. Likewise, Capcom Japan reported that it has a process for preserving source code, but admits that, like many publishers, it had no preservation policy in place until the early 1990s. They also recognize that copying code to new storage media is not a permanent preservation solution, especially as the amount of data needed to run the game grows in size.¹⁹ Industry support, along with academic and non-profit institutions can all play a role in finding solutions to the preservation problems facing video games.

Preservation Solutions

The preservation of digital objects is often approached in two ways, either through migration or emulation.²⁰ An emulator is a program that recreates the

¹⁸ Ruggill, et al., ““What If We Do Nothing?””

¹⁹ Andersen, "Where Games Go To Sleep, Part 3."

²⁰ David Anderson, Janet Delve, and Dan Pinchbeck., "Toward A Workable Emulation-Based Preservation Strategy: Rationale and Technical Metadata," *New Review Of Information Networking* 15, no. 2 (2010): 110-131.

functions of one system in another, usually newer system. Video game systems, for example, come with built in emulators, typically for the system directly preceding it. Migration is the process of copying data from an old media storage format, such as a floppy disc onto a newer more accessible format, such as a DVD.

There are however difficulties with both of these solutions. First, the cost of migrating data from format to format can be exorbitant and there is a risk that some of the data will be lost. Second, when not developed by the game companies most emulators are illegal and are often used for piracy. Even if an institution were able to develop or acquire a legal emulator, emulated games are not necessarily suitable for preservation. Emulators only include the bare code of a game. The context, the physical hardware, the TV or computer that runs the game, the packaging, and the instruction booklet are lost. Furthermore, because emulators are not usually developed commercially they become obsolete and are usually discontinued before they are perfected. Emulators are also not usually designed for preservation. The game may not be transferred correctly, resulting in poor quality or glitches. There is also no metadata associated with the game and most of these emulators and ROMS, the game format that emulators read, are stored on temporary servers. Leaving games to be preserved by independent emulators then is a poor option.²¹

Some institutions have begun to develop strategies for preserving games, for example the Internet Archive's Classic Software Preservation Project (CLASP) project. CLASP operates a dark repository, collecting original consumer materials for preservation but keeping its holdings restricted until the copyright expires or the rights are granted to the archive. In order to preserve games, they

²¹ Christopher Mims, "Our Rotting Video-Game Heritage."

make perfect digital copies with help from their technical partners the Software Preservation Society (formerly the Classic Amiga Preservation Society). These institutions focus on the magnetic disk formats like those used in the Atari ST.²² In order to preserve these formats they are “creating tools that can read a disk at a very ‘low level.’ In fact, they can literally pick the bits off the disk surface.”²³ They have also set standards for preserved games, discounting hacked or cracked versions or re-releases, as these versions often have missing sequences, music, or changes that affect game play. In the future they hope to release a public catalog with basic metadata on the holdings.²⁴

Henry Lowood of Stanford University has been involved in video game preservation since 1998, when very few others considered the project worthy of consideration. Since then he has become co-Principal Investigator in a project funded by the Library of Congress, “Preserving Virtual Worlds”.²⁵ The project aimed to develop preservation standards for digital games and interactive fiction. They selected eight case study games with varying creation dates, original hardware, and rights status in order to gain a better understanding of the challenges associated with preserving games. The project identified several steps that archives, libraries and museums can take to preserve

²² “SPS: About Us,” *Software Preservation Society*, <http://www.softpres.org/about> (checked July 5, 2011).

²³ “Welcome to CLASP,” *The Internet Archive*, <http://www.archive.org/details/clasp> (checked July 2011).

²⁴ Henry Lowood, “Play History with Games: Steps towards Historical Archives of Computer Gaming,” (Presentation, Electronic Media Group Annual Meeting of the American Institute for Conservation of Historic and Artistic Works, Portland, Oregon. 14 June 2004.): 6, 11, <http://cool.conservation-us.org/coolaic/sg/emg/library/pdf/lowood/Lowood-EMG2004.pdf> (checked July 5, 2011).

²⁵ Henry Lowood, “Henry Lowood,” *Stanford University*, <http://www.stanford.edu/~lowood/> (checked July 5, 2011)

games, including developing metadata standards, collection management policies, and reaching out to game designers and gamers in order to encourage active participation in the preservation of their materials and culture.²⁶

Also at Stanford University is the Stephen Cabrinety Collection in the History of Microcomputing, part of the Department of Special Collections at Stanford University Libraries, consisting of retail software, hardware and video games, mostly from the 1980s and 1990s. The Stanford Special Collections website offers a publicly accessible list of game in the collection, complete with publisher information, date of publication, and operating system. In the future they also hope to include scans of box images and manuals.²⁷

Another archive interested in the preservation of video games and their documentation is the University of Texas Videogame Archive, which collects materials related to the game making process and a special focus on the beginnings of game development. The archive, which operates as part of the Dolph Briscoe Center for American History, takes donations including hardware, software, promotional materials, art, and papers related to the daily business of game creation.²⁸

In 2007 Richard Garriott, creator of the *Ultima* series, and other early game designers, including Warren Spector, creator of *Wing Commander* and *Deus Ex*, approached the University of Texas archives about

²⁶ J. McDonough, R. Olendorf, M. Kirschenbaum, K. Kraus, D. Reside, R. Donahue, A. Phelps, C. Egert, H. Lowood, & S. Rojo, *Preserving Virtual Worlds Final Report* (2010), 5-15.

²⁷ "The Stephen M. Cabrinety Collection in the History of Microcomputing." *Stanford University*, <http://library.stanford.edu/depts/hasrg/histsci/index.htm> (checked July 5, 2011).

²⁸ "The UT Videogame Archive: Mission." *The Dolph Briscoe Center for American History The University of Texas at Austin*, <http://www.cah.utexas.edu/projects/videogamearchive/mission.php> (checked December 4, 2011).

donating their personal papers and works with the goal of preserving these materials related to the early history of video game design. They were concerned that these materials would be lost and that examples of early gaming making materials might prove useful to those studying the roots of an art form. The University of Texas Videogame Archive has grown to include 1,500 video games, more than 150 boxes of industry documents and many hardware devices. Though not usually set up to allow patrons to play these games, the archive does host special exhibits of their vintage games like at a recent Explore UT event, when local school children were invited to experience games from the 1980s and 1990s.²⁹

Preservation of the Gaming Experience

While some archives focus on preserving the documentation of game creation and of the game itself, others are working to preserve something far more ephemeral: the gaming experience. Games do not arrive as lines of code alone, but exist in a context, both social and physical. Without these contexts the gaming experience can be significantly different from the original experience. The social context is the culture in which the game was created and the references that it makes to knowledge players are assumed to have. People removed from this social or cultural context will miss some of the communication occurring between contemporary designers and players. This removal of the social context occurs with many types of archival materials and archivists and scholars have experience reconstructing this sort of information. In contrast, retaining the physical context may prove to be more unfamiliar ground.

The physical context could be anything from the cartridges or optical discs, to the game packaging, player's

²⁹ Jensen, "At a University Archive, Yesterday's Cutting-Edge Video Games Play On."

guides, art books, as well as contemporary technologies needed to play the game, and if the games are removed from that context the gaming experience will be altered. How then can an archivist recreate the gaming experience when the technologies needed to play the games are long gone? One example of how to solve this problem comes from a group at the Georgia Institute of Technology. Ian Bogost, a professor at Georgia Tech, and a group of students created an emulator which allows Atari 2600 games played on a modern LCD monitor to look fuzzy and blurred as they did on an old CRT TV. This emulator allows a modern audience to experience games the way they were played in the 1970s, and to be played the way that the game designers intended. Game designers purposely used the blurry TV screens of the day to program color gradients, and took the ghosting images into account when animating characters.³⁰

Other efforts aim to record the look of a game by creating video of game play. The main proponent of this effort is the Machinima Project at the Internet Archive. The website defines Machinima as, “filmmaking within real-time, 3D virtual environments, often appropriated from existing video game engines.”³¹ Archivists have experience with preserving video and this option offers future generations a look at games that may no longer be available. This static record of the game is no replacement for the interactive game itself, but it may supplement other preservation efforts.

³⁰ Chris Kohler, “Atari 2600 Emulator Simulates Old-School TV Images,” *Wired Magazine*, April 2009, <http://www.wired.com/gamelifelife/2009/04/atari-emulator/>.

³¹ “Welcome to Machinima.” *The Internet Archive*, <http://www.archive.org/details/machinima> (checked July 5, 2011).

Conclusion

Games are challenging to preserve; they are complex technologies that require expensive and difficult to maintain systems, yet they are a part of this culture, and as vital as film to previous generations. In fact, video games share many of the same qualities as film from the perspective of an archivist. They both must overcome copyright considerations, as most are produced by large companies and individual artist's rights must be respected, they require technologies to view the works, they are media that exist to be experienced and that experience cannot be exactly recreated or preserved, and they often need advocates for their preservation.

In 2006 Lowood and a committee of game designers and journalists released a game canon, much like the National Film Registry's list of culturally significant films. The games are: *Spacewar!* (1962), *Star Raiders* (1979), *Zork* (1980), *Tetris* (1985), *SimCity* (1989), *Super Mario Bros. 3* (1990), *Civilization I/II* (1991), *Doom* (1993), the *Warcraft* series (beginning 1994) and *Sensible World of Soccer* (1994).³² The games were chosen for their innovations, like the first multiplayer game, or first of a genre, like *SimCity*, which was the first god-game, a game that gives the player control over a world. Efforts like these promote the legitimacy of video games as artifacts of cultural importance and will aid preservation projects, convincing skeptical institutions that time and money should be expended to save these vulnerable pieces of our culture.

³² Heather Chaplin, "Is That Just Some Game? No, It's a Cultural Artifact," *New York Times*, March 12, 2007, <http://www.nytimes.com/2007/03/12/arts/design/12vide.html> (checked July 5, 2011).

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