

Survey of the Video Game Reissue Market in the United States

by Phil Salvador
for the Video Game History Foundation and
the Software Preservation Network

July 2023



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Conducted for the Video Game History Foundation and the Software Preservation Network,
in collaboration with the University of Washington Information School GAME Research Group

by Phil Salvador

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About the Video Game History Foundation:

The Video Game History Foundation (VGHF) is a non-profit organization dedicated to preserving, celebrating, and teaching the history of video games. VGHF advocates for a better future for video game history by bridging the gaps between video game fans, researchers, collectors, and the game industry.

About the Software Preservation Network:

The Software Preservation Network (SPN) is an independent, community-led membership association focused on ensuring long-term access to software through community engagement, infrastructure support, and knowledge generation. Guided by the belief that software is critical information infrastructure, SPN works to create a space in which organizations and individuals from industry, academia, government, cultural heritage, and the public sphere can contribute their myriad skills and capabilities toward collaborative solutions that will provide persistent access to software and software-dependent data.

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About the Author

Phil Salvador is the Library Director at the Video Game History Foundation. His research focuses on the history of the computer game industry with an emphasis on preservation and access; he serves on the Software Preservation Network Law & Policy Working Group, and his research on fan community documentation for orphaned video game works was published in *ROMchip: A Journal of Game Histories*. Prior to joining the Video Game History Foundation, Salvador served as Visual Media Collections Coordinator at the American University Library, managing the library's audiovisual preservation program as a founding member of the Academic Libraries Video Trust.

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Executive Summary

Video games are part of our cultural history. The video game industry and cultural heritage institutions agree that video games should be preserved for both entertainment and study. As part of that effort, a growing market has emerged for reissuing historical games, popularly called retro games or classic games.

Despite this, the availability of historical games is generally understood to be limited. This is due to a variety of factors, including technical constraints, complicated rights issues, rightsholder disinterest, and the long-term volatility of digital distribution platforms. The scale of this problem is troubling for anyone hoping to access games, but it is particularly critical for the cultural heritage field, which depends on the ability to access historical video games for research and must otherwise rely on unauthorized means to access them.

Although the game industry agrees with the cultural heritage field that preservation is important, they disagree about how severe this problem is and how to address it. Industry lobbyists in the United States have opposed new copyright exemptions for game preservation on the grounds that there is already a thriving reissue market. While a healthy market for certain game reissues does exist, it is overshadowed by the volume of games that remain unavailable.

To better inform discussions of these complex issues, we gathered empirical evidence about the state of the video game reissue market in the United States and what portion of historical games are actually still in commercial distribution. We believe this is the first major study to analyze the availability rates for a broad sample of historical games in this manner.

What We Studied

This study analyzed a dataset representing over 4,000 historical video games released in the United States before 2010 to determine whether they have been reissued or are otherwise still available through their rightsholders. The survey examined four sample groups, each representing a different segment of the diverse population of video games:

- A sample of all historical games released before 2010.
- Games for the Commodore 64, a platform that represents an **abandoned ecosystem** with the lowest level of commercial interest.
- Games for the Game Boy platform family, a **neglected ecosystem** with demonstrable commercial interest but declining availability.
- Games for the PlayStation 2, an **active ecosystem** with high recommercialization activity from multiple parties.

Key Findings

Historical video game availability is dire. Only 13 percent of classic video games published in the United States are currently in release. This figure is comparable to the commercial availability of pre-World War II audio recordings (10 percent or less) or the survival rate of American silent-era films (14 percent), two other mediums at risk.¹

Table 1. Game availability by ecosystem

Ecosystem	% in release
All historical games	13.27% <i>n</i> = 1500, ±2.5%, 95% CI
Commodore 64	4.50% <i>n</i> = 400, ±4.3%, 95% CI
Game Boy family	5.87% <i>n</i> = 1873, ±0.0%, 100% CI
PlayStation 2	12.00% <i>n</i> = 400, ±4.3%, 95% CI

These levels are consistent across platform ecosystems and time periods. All three platform libraries examined for this study have poor reissue rates, regardless of commercial interest (see table 1). Despite vastly different levels of platform-owner activity, the Commodore 64 and the Game Boy family ecosystems are both effectively abandoned, while our example of a commercially active ecosystem, the PlayStation 2 ecosystem, only reaches a reissue rate of 12 percent. Across all platforms, no five-year period from 1960–2009 rises above 20 percent availability (see figure 1).

Historically significant games with low commercial value are especially unlikely to be reissued. The reissue rate falls below 3 percent for all games released prior 1985, a period with high historical importance to the early game industry but minimal commercial activity. The Commodore 64—an important platform for the 1980s computer game industry—showed both the lowest availability rate and the lowest diversity of reissue sources out of any ecosystem we examined. This is evidence that **the interests of the marketplace do not align with the needs of video game researchers.**

Digital marketplace volatility threatens the availability of game reissues. While games do get reissued, the long-term instability of digital game distribution platforms means they often lapse out of release, especially in ecosystems where there is a low diversity of reissue sources. 6.5 percent of the Game Boy library was previously available only through Nintendo’s Virtual Console storefronts for the Wii U and 3DS platforms, but since those services shuttered in March 2023, those games are no longer available in any form. Other legacy digital stores that are still running, such as the PlayStation 3 and PlayStation Vita stores, have experienced such a degradation in service quality that users are effectively unable to purchase titles that are technically still in commerce.

¹ Tim Brooks, *Survey of Reissues of U.S. Recordings*, (Washington, D.C.: Council on Library and Information Resources and The Library of Congress, August 2005), 13, https://www.clir.org/wp-content/uploads/sites/6/pub133_57d70f6ed2bf1.pdf; David Pierce, *The Survival of American Silent Feature Films: 1912–1929* (Washington, D.C.: Council on Library and Information Resources and The Library of Congress, September 2013), 21, <https://www.clir.org/wp-content/uploads/sites/6/pub158.pdf>.

Takeaways

This is a systemic problem. Historical game availability issues are widespread across all platform ecosystems and time periods. No single company or platform owner is responsible for this reality. This is a crisis for the entire medium of video games.

While the reissue market is active, it's not enough. Publishers do reissue historical video games through a variety of formats, services, and products, but their collective effort has amounted to recommercializing or otherwise making available less than one-fifth of all historical games. As a result, nearly 90 percent of the game industry's historical output is inaccessible without acquiring vintage games and hardware from the expensive second-hand market, visiting library collections in person due to restrictions imposed by Digital Millennium Copyright Act,² or resorting to piracy.

The game industry must acknowledge this problem—and that libraries and archives can help solve it. While it may seem hard to reconcile the interests of the commercial marketplace with the needs of researchers, the first step is to agree on the facts and recognize the significant gaps that exist in the reissue market. Cultural heritage institutions can help close that gap by providing access to the overwhelming majority of games that remain unavailable.

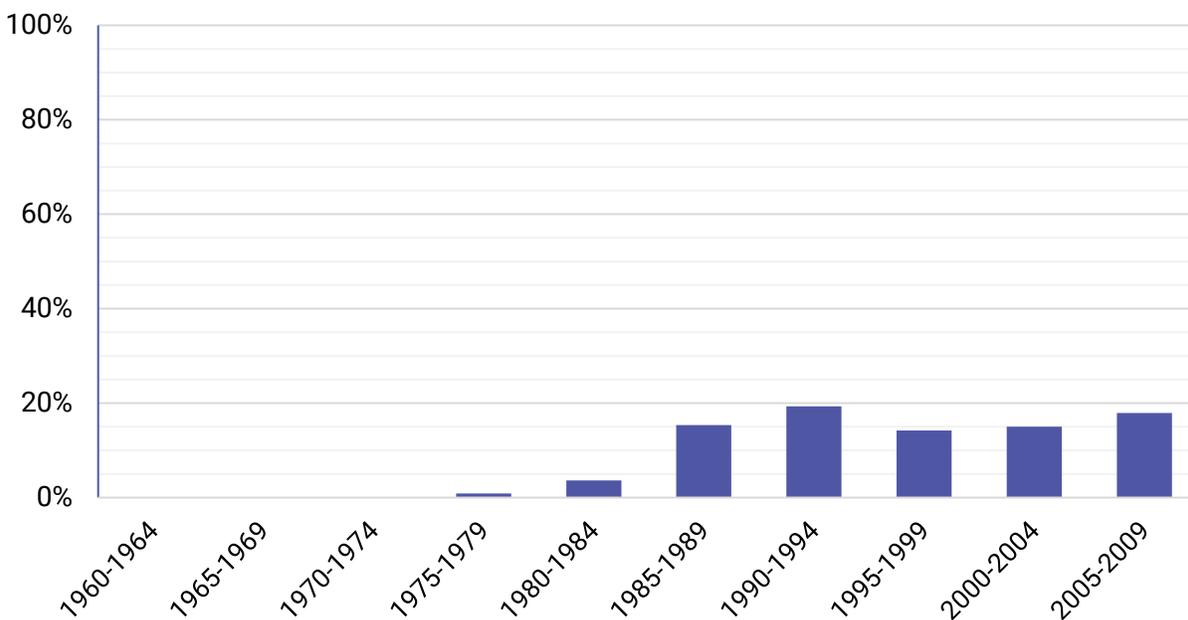


Figure 1. Availability rate of historical games, by period. One title erroneously listed in our dataset as a 2010 release has been recategorized as 2009 for this chart (see footnote 111).

² At the time of this study, exemptions under 37 C.F.R. § 201.40—which is revised every three years—limit the ability of libraries and archives to provide remote access to video games in their collections. See footnote 69 for further explanation.

Background

Cultural Importance of Video Games

Without argument, video games have emerged as one of the defining cultural mediums of the 21st century. The industry has grown to \$180 billion globally, larger than the movie business or American sports,³ with \$90.3 billion of economic output in the United States alone. Museums have begun collecting and showcasing video games as art objects, including the Museum of Modern Art⁴ and the Smithsonian American Art Museum (SAAM). Chris Melissinos, curator of SAAM's exhibit *The Art of Video Games*, declared video games "one of the most important art forms in the history of mankind."⁵ The video game industry agrees: a report published in 2019 by the Entertainment Software Association, the largest video game trade organization in the United States, declared that "Video games have grown to become an iconic component of American culture."⁶

Furthermore, industry leaders agree that games have become a culturally significant art form that deserves preservation, for both artistic and economic reasons. Phil Spencer, head of the Xbox brand at Microsoft, said in 2017 that video game preservation is important to the advancement of video games as a business and an artform. "Console games can get lost when hardware generations go away. It can become more challenging to play the games of our past," he said. "There's good business there for the content owners, but as players, it's nice to be able to understand how our artform has progressed."⁷ Meanwhile, the PlayStation team at Sony Interactive Entertainment established in 2022 what was described by an employee as an internal "Preservation team," working to "ensure our industry's history isn't forgotten."⁸

In short, there is wide agreement from all sectors about the value of preserving video game history. The cultural and historical significance of video games has become so widely established that we believe it no longer needs to be justified. What matters is how well that history is kept available.

Introduction to the Video Game Reissue Marketplace

In the recent past, the video game industry has made greater concerted efforts to reissue historical video games through a variety of methods and platforms. Most major platform owners have rolled

³ Simon Tripp et al., *Video Games in the 21st Century: The 2020 Economic Impact Report* (Washington, DC: Entertainment Software Association, 2020), 1, <https://www.theesa.com/wp-content/uploads/2019/02/Video-Games-in-the-21st-Century-2020-Economic-Impact-Report-Final.pdf>.

⁴ Jonathan Hilburg, "Never Alone Explores Five Decades of Video Game History at MoMA," *The Architect's Newspaper*, February 13, 2023, <https://www.archpaper.com/2023/02/never-alone-explores-five-decades-of-video-game-history-at-moma/>.

⁵ Chris Melissinos, "Why Gaming is Now for Adults and Art Lovers," *CNN*, November 11, 2016, <https://www.cnn.com/style/article/video-games-highest-form-of-art/index.html>.

⁶ Tripp et al., *Video Games in the 21st Century*, 4.

⁷ James Temperton, "The Inside Story of the Xbox One X," *Wired*, February 10, 2017, <https://www.wired.co.uk/article/xbox-one-x-inside-story-microsoft>.

⁸ Chris Scullion, "PlayStation 'Has Set Up a New Game Preservation Team,'" *Video Games Chronicle*, April 26, 2022, <https://www.videogameschronicle.com/news/playstation-has-set-up-a-new-game-preservation-team/>.

out their own subscription systems that provide access to emulated back catalogs of games from their historical console libraries, including Xbox Game Pass,⁹ PlayStation Plus Premium,¹⁰ and Nintendo Switch Online.¹¹ Individual games and franchises are frequently remastered for modern platforms, and in some cases, they are bundled together as compilation packs in the style of media reissue box sets. These collections are proven commercial successes. For example, Digital Eclipse is a game developer that specializes in high-quality game re-release compilations, modeled after the Criterion Collection for film.¹² In 2022, Digital Eclipse released *Teenage Mutant Ninja Turtles: The Cowabunga Collection*, a compilation of 13 *TMNT* video games that had fallen out of distribution; the game sold over one million copies within a year of release.¹³

Perhaps no single recent game reissue received as much acclaim and attention as the re-release of *GoldenEye 007*, a landmark first-person shooter, based on the 1995 James Bond film *GoldenEye*, that is often heralded as one of the most historically important video games of its era.¹⁴ In an unprecedented agreement, the shared rightsholders of *GoldenEye 007*—Microsoft, Nintendo, Rare Limited, Metro-Goldwyn-Mayer, Eon Productions, and Danjaq LLC—jointly agreed to reissue the game for both Xbox and Nintendo platforms in early 2023.¹⁵ The complicated rights situation for *GoldenEye 007* had previously held up efforts to reissue the game going as far back as 2006,¹⁶ and for years, the game was used as an example of the difficulties surrounding commercial video game preservation.¹⁷ The fact that several major companies both inside and outside the game industry

⁹ Gemma Ryles, “Xbox Adds an Extra 76 Classic Games to Game Pass,” *Trusted Reviews*, November 16, 2021, <https://www.trustedreviews.com/news/xbox-adds-an-extra-76-classic-games-to-game-pass-4179604>; “Xbox One Backward Compatibility,” Xbox Wire, Microsoft, last modified November 15, 2021, <https://news.xbox.com/en-us/xbox-one-backward-compatibility/>.

¹⁰ Jim Ryan, “UPDATE: All-New PlayStation Plus Launches in June with 700+ Games and More Value than Ever,” *PlayStation.Blog*, March 29, 2022, <https://blog.playstation.com/2022/03/29/all-new-playstation-plus-launches-in-june-with-700-games-and-more-value-than-ever/>.

¹¹ “Nintendo Switch Online,” Nintendo, accessed May 7, 2023, <https://www.nintendo.com/switch/online/nintendo-switch-online/>.

¹² Kyle Barr, “What Does It Take to Make the Criterion Collection of Video Games?,” *Gizmodo*, April 3, 2023, <https://gizmodo.com/digital-eclipse-preserves-game-history-with-style-1850224859>.

¹³ Konami (@Konami), “13 iconic TMNT titles, over 1 million copies sold! From lifelong fans, to newcomers experiencing the historic games for the first time -- we hope you’ve enjoyed,” Twitter, April 7, 2023, <https://twitter.com/Konami/status/1644324155125559298>.

¹⁴ “GoldenEye: The Declassified Report,” *Retro Gamer*, February 22, 2018, 21; Keith Stuart, “GoldenEye 007: The Beloved Classic That Reshaped Video Games,” *The Guardian*, January 27, 2023, <https://www.theguardian.com/games/2023/jan/27/goldeneye-007-classic-n64>; Adam Friedrich, “The Ongoing Legacy of Nintendo’s GoldenEye 007,” *Wisconsin Public Radio*, November 5, 2022, <https://www.wpr.org/ongoing-legacy-nintendos-goldeneye-007>.

¹⁵ Scottie Andrew, “Classic ‘GoldenEye 007’ Game is Coming to Nintendo Switch and Xbox,” *CNN*, January 25, 2023, <https://www.cnn.com/2023/01/25/tech/goldeneye-007-game-nintendo-switch-xbox-ccc/index.html>. Tom Warren, “GoldenEye 007 is Finally Coming to Xbox and Nintendo Switch,” *The Verge*, September 13, 2022, <https://www.theverge.com/2022/9/13/23162373/goldeneye-007-xbox-release-remaster-nintendo-switch>.

¹⁶ Phil Spencer (@XboxP3), “@leflus Goldeneye rights are so challenging, looked at this many times. Lot’s of different parties to work with, we’ve always given up.,” Twitter, December 8, 2015, <https://twitter.com/XboxP3/status/674375237622890498>; Sam Machkovech, “90 Bugs Left: Rare Devs Talk About the Nearly Completed *GoldenEye 007* Remake [Updated],” *Ars Technica*, February 8, 2021, <https://arstechnica.com/gaming/2021/02/ex-rare-devs-open-up-about-the-canceled-goldeneye-007-remake-for-xbox-360/>.

¹⁷ Waypoint, “Meet the Team Saving Classic Games | RESET,” YouTube video, January 29, 2021, <https://www.youtube.com/watch?v=uMM3DbBCVSU>; Thomas Whitehead, “Talking Point: Nintendo and the Industry Needs to Get Serious About Game Preservation,” December 25, 2021, <https://www.nintendolife.com/features/talking-point-nintendo-and-the-industry-needs-to-get-serious-about-game-preservation>.

agreed to resolve these issues is a hopeful sign that the game industry can work together to preserve its history.

Despite these advances, there is popular consensus among video game researchers, archivists, and fans that the availability of historical video games on the commercial marketplace remains poor.¹⁸ While there has previously been no empirical evidence to back up this impression, the regular cadence of news reports announcing video games falling out of release serves as an ambient reminder that access in today's marketplace is temporary and unpredictable.

Less than a week after the re-release of *GoldenEye 007* was announced, Microsoft separately announced that they would remove 46 legacy games from the Xbox 360 Marketplace digital game store, including major titles such as *Assassin's Creed III*, *Far Cry 2*, and *Lost Odyssey*.¹⁹ At the same time, users noticed a message on the Xbox support website suggesting that the entire Xbox 360 Marketplace would be shut down altogether within a few months. Although Microsoft would walk back this statement,²⁰ it shows that they had at least begun planning to sunset digital services for the Xbox 360 game console, which has been out of production since 2016.²¹

New availability for select titles does not mean progress toward broader access for the entire medium. For every commercial preservation success story like *GoldenEye 007*, countless other games either stay or lapse out of release. In fact, one of the catalysts for this study was the closure of the digital storefronts for the Nintendo 3DS and Wii U platforms in March 2023, which may have removed over one thousand titles from release (see “Challenges for Digital Game Availability”).

To demonstrate the extent of this problem and explain why the consensus about poor game availability exists, we have summarized the technological and legal constraints that discourage long-term video game availability—some dating back to before the existence of a healthy game reissue market.

¹⁸ Digital Preservation Coalition, *The BitList 2022: The Global List of Digitally Endangered Species*, November 2023, 115, <https://www.dpconline.org/docs/miscellaneous/our-work/bitlist/2790-bitlist2022/file>; Kevin Driscoll, “Abandonware ‘After Dark’—How Fair Use Powers Media Studies,” *University of Virginia Library, The Taper*, February 23, 2023, <https://thetaper.library.virginia.edu/2023/02/23/abandonware-after-dark-how-fair-use-powers-media-studies.html>; Brendan Sinclair, “Is Game Preservation a Losing Battle?,” *GamesIndustry.biz*, July 5, 2022, <https://www.gamesindustry.biz/is-game-preservation-a-losing-battle>; Justin Charity, “Video Game Streaming Is Still Struggling to Keep the Classics Alive,” *The Ringer*, July 29, 2022, <https://www.theringer.com/video-games/2022/7/29/23283028/video-games-cloud-streaming-ps-now-xbox-gamepass-problems>; Sam Machkovech, “PlayStation Plus’ Highest Tier Slams to an Apparent Halt on Classic Games,” *Ars Technica*, August 10, 2022, <https://arstechnica.com/gaming/2022/08/playstation-plus-highest-tier-slams-to-an-apparent-halt-on-classic-games/>; Whitehead, “Talking Point.”

¹⁹ Jenni Lada, “Blue Dragon and Lost Odyssey Being Delisted From Xbox 360 Marketplace,” *Siliconera*, January 31, 2023, <https://www.siliconera.com/blue-dragon-and-lost-odyssey-being-delisted-from-xbox-360-marketplace/>.

²⁰ Jay Peters, “The Xbox 360 Store Won't Be Closing Down, Despite What an Xbox Support Page Says,” *The Verge*, February 2, 2023, <https://www.theverge.com/2023/2/2/23583699/xbox-360-marketplace-microsoft-not-shutting-closing-down>.

²¹ Samit Sarkar, “Microsoft Ending Xbox 360 Production,” *Polygon*, April 20, 2016, <https://www.polygon.com/2016/4/20/11468032/xbox-360-production-ending-microsoft>.

Obstacles to Game Availability

Technical Challenges for Game Reissues

Reissuing a game on a new platform is not an easy or automatic process. Games are designed for specific platforms with unique system architectures, software requirements, and hardware features, which prevents them from being immediately compatible with other platforms. Particularly for older titles that were designed before game hardware became more standardized, reissuing a game requires it to be modified or redesigned.²² As an example, the 1993 first-person shooter *Doom* was released for nearly every home video game console in the 1990s; however, each version of the game had to be reworked for the unique technical specifications of each console, and as a result, they differ significantly in content and presentation.²³ *Doom* was an exceptionally popular game, which perhaps justified the resources necessary to release it on so many platforms. Most games are less popular than *Doom* was at the peak of its popularity and cannot justify that level of attention.

Continuing into the present day, it can be prohibitively difficult for a developer to port their games to another platform. Josh Fairhurst, CEO of Limited Run Games, a company that specializes in game reissues, estimates that porting a single historical game to modern platforms can cost \$350,000.²⁴ The ability to port a game to another platform also assumes that the developer still has access to their game's original source code, which is often lost or unavailable, especially for older titles.²⁵

The easiest and most cost-effective way to reissue games—particularly historical games—is by using emulation, technology that mimics the behavior of game hardware on a different platform. For example, a game developed for the Sega Genesis console, released in 1989, could be reissued on the Xbox Series X console by using a Sega Genesis emulator, without needing to modify the underlying game or have access to its source code. However, as Video Game History Foundation founder Frank Cifaldi explained in a series of talks presented at the annual Game Developers Conference, the video game industry has a long history of demonizing emulation technology for its association with piracy.²⁶ Emulation technology for games first became widely viable in the mid-to-late 1990s

²² Chris Scullion, "Miyamoto Acknowledges It's Easier than Ever to Offer Backward Compatibility," *Video Games Chronicle*, November 9, 2022, <https://www.videogameschronicle.com/news/miyamoto-acknowledges-its-easier-than-ever-to-offer-backwards-compatibility>. One exception to this rule is computer games, particularly Windows computer games. Computer games are usually designed to run on a wide variety of system configurations, and as a result, although this is not guaranteed, some older games are forward-compatible with present-day hardware and operating systems. In these cases, it may be possible to reissue a game as-is through digital computer game storefronts.

²³ John Linneman, "DF Retro: We Play Every Single Doom Console Conversion," *Eurogamer*, December 10, 2018, <https://www.eurogamer.net/digitalfoundry-2017-every-doom-console-port-tested-and-analysed>.

²⁴ Limited Run, "Carboncast Episode 1 | Limited Run Games," YouTube video, April 18, 2023, <https://www.youtube.com/watch?v=GdEke2CIgio>.

²⁵ Kyle Orland, "Saving Video Gaming's Source Code Treasures Before It's Too Late," *Ars Technica*, January 5, 2021, <https://arstechnica.com/gaming/2021/01/saving-video-gamings-source-code-treasures-before-its-too-late/>.

²⁶ GDC, "It's Just Emulation!: The Challenge of Selling Old Games," YouTube video, April 29, 2016, <https://www.youtube.com/watch?v=HLWY7fCXUwE>; GDC, "It's Still Emulation: Saving Video Game History Before It's Too Late," YouTube video, April 11, 2019, <https://www.youtube.com/watch?v=dp-DRU24J18>.

and faced immediate pushback, notably in the high-profile 1999 lawsuit *Sony v. Connectix*, in which major game publishers challenged protected fair-use emulation activity.²⁷

Although the industry has now widely embraced emulation as a way to reissue older titles, Cifaldi shows that the effects of the stigma remain. With the game industry having failed to develop its own open standards for emulation, game developers have needed to rely on emulators created by the unauthorized fan community, often secretly referencing or licensing them for official products.²⁸ Some game publishers still remain distrustful of emulation, in one case forcing Digital Eclipse to develop a bespoke non-emulation game engine in order to appease lingering concerns from one of their clients. While anti-emulation hysteria seems to be subsiding, Cifaldi paints the picture that years of anti-emulation stances from the industry stunted the growth of the game reissue market at the time when it was becoming technologically viable.²⁹

Licensing Challenges for Game Reissues

Resolving technical issues does not guarantee that a game can be reissued. Complex rights and licensing agreements for games and their content may also prevent them from being re-released. This is particularly true for games that were designed before there was a notion of a reissue market, when games were produced for a shorter shelf life and long-term availability was not an expectation or a concern.

For instance, the popular *X-Men* arcade game from 1992, developed by Konami, was not reissued until 2010 due to Konami's licensing agreement with X-Men rightsholder Marvel. The licensing agreement, which gave Konami the limited ability to distribute the game in arcades,³⁰ likely expired soon after the game's original release. Presumably, Konami only acquired a license for the years they expected to manufacture and distribute the game and did not plan to keep it in production for decades. Although the game was briefly relicensed and reissued for home consoles in 2010,³¹ it was delisted only three years later, again probably because Konami's license from Marvel had expired.³² In a case like this, the continual upkeep and cost of licensing agreements may deter publishers from keeping their games available over longer periods of time. As a result, if a player or researcher wants to access *X-Men: The Arcade Game*, the only authorized ways to play it are to have already purchased a digitally distributed copy of the game from 2010–2013 on a legacy game console that still works; to play the game on vintage arcade hardware that cannot be easily transported and requires ongoing specialized maintenance;³³ or to purchase a new licensed replica arcade cabinet at the exorbitant

²⁷ GDC, "It's Just Emulation!"

²⁸ GDC, "It's Still Emulation."

²⁹ GDC, "It's Just Emulation!"

³⁰ Jeremy Peeples, "Graveyard: X-Men (1992 Arcade Game)," *Hardcore Gamer*, April 18, 2019, <https://hardcoregamer.com/features/graveyard/graveyard-x-men-1992-arcade-game/328841/>.

³¹ Richard George, "The X-Men Return to the Arcade," *IGN*, June 28, 2016, <https://www.ign.com/articles/2010/10/09/the-x-men-return-to-the-arcade>.

³² "X-Men: The Arcade Game," *Delisted Games*, May 18, 2016, <https://delistedgames.com/x-men-the-arcade-game/>.

³³ Jon-Paul Dyson, "A Laboratory for Video Game Preservation," *The Strong National Museum of Play*, October 11, 2019, <https://www.museumofplay.org/blog/a-laboratory-for-video-game-preservation/>.

specialty-market price of \$749.99.³⁴ That might be acceptable for hardcore gamers or private collectors, but none of those options are reasonable for researchers.

Sometimes licensing issues can affect specific content used in games, which also impacts their long-term availability. For instance, the role-playing *Alpha Protocol* was removed from digital storefronts in 2019 due to the expiration of the game's music licenses, which the game's publisher Sega chose not to renew.³⁵ At the time of this study, *Alpha Protocol* remained unavailable, despite Sega fully owning the game's publishing rights.³⁶ In addition to licensed music,³⁷ similar content licensing concerns affect titles such as sports video games with complex trademark and likeness agreements³⁸ and games that use stock video footage.³⁹

Ownership Challenges for Game Reissues

Licensed content aside, the rights to the games themselves are also frequently mired in legal uncertainty. In a notable example similar to *GoldenEye 007*, the spy pastiche first-person shooter *The Operative: No One Lives Forever*, released in 2000, cannot be reissued due to an agreement that divided ownership of the game between three different companies, none of whom can prove who actually controls the rights.⁴⁰ Among those rightsholders are 20th Century Fox and Warner Bros., two multibillion-dollar media conglomerates that are no strangers to reissuing other forms of media going back decades. But because *No One Lives Forever* was released at a time before a digital reissue market for computer games existed, the publishers likely did not anticipate a situation where they would need to dispute their ownership of the game two decades later. This is not a marginal or obscure title: *No One Lives Forever* received critical acclaim, including four nominations and one win for a Game Spotlight Award at the first annual industry-hosted Game Developers Choice Awards.⁴¹

³⁴ "X-Men 4 Player Arcade Machine," Arcade1Up, accessed May 8, 2023, <https://arcade1up.com/products/x-men-4-player-arcade-cabinet>.

³⁵ Wesley Yin-Poole, "Alpha Protocol Pulled from Steam Due to Expiry of Music Rights," *Eurogamer*, June 20, 2019, <https://www.eurogamer.net/alpha-protocol-pulled-from-steam-as-sega-publishing-rights-expire>.

³⁶ Wesley Yin-Poole, "Alpha Protocol."

³⁷ Rhys Elliott, "Music Licensing in Games: Trials, Tribulations, and What's Next," *GamesIndustry.biz*, May 30, 2022, <https://www.gamesindustry.biz/music-licensing-in-games-trials-tribulations-and-whats-next>; Liz Surette, "Legal Guide to Music Licensing Contracts," *Game Developer*, May 16, 2017, <https://www.gamedeveloper.com/business/legal-guide-to-music-licensing-contracts>.

³⁸ Nicholas De Palma, "Sports Leagues and Video Game Licensing: Game Over or Game On? How Recent Rulings Could Possibly Devalue the NFL's Video Game Agreement," *Law School Student Scholarship* 92, https://scholarship.shu.edu/student_scholarship/97/. The iconic, over-the-top 1997 sports game *NFL Blitz* is a particularly thorny case: on top of the various trademark, likeness, and exclusivity agreements that can affect sports game reissues, it is widely believed that the National Football League and the Football Greats Alliance (which controls the likeness rights for many retired players) have refused to relicense the original version of *NFL Blitz* due to its extreme, unsporting, and violent content. Sam Machkovech, "NFL Blitz Arcade Games Will Relaunch as Arcade1Up Cabinet Exclusive," *Ars Technica*, August 15, 2022, <https://arstechnica.com/gaming/2022/08/nfl-blitz-arcade-games-will-relaunch-as-arcade1up-cabinet-exclusive/>; Owen S. Good, "NFL Blitz Comes Back, Without the Late Hits, in arcade form," *Polygon*, November 3, 2022, <https://www.polygon.com/23306194/nfl-blitz-arcade-cabinet-release-date-price-arcade1up>.

³⁹ Owen S. Good, "Metal Gear Solid 2 and 3 Pulled from Stores Over Licensing Issue," *Polygon*, November 8, 2021, <https://www.polygon.com/22770136/metal-gear-solid-2-3-takedown-removed-playstation-store-pc-gog>.

⁴⁰ Kirk Hamilton, "The Sad Story Behind A Dead PC Game That Can't Come Back," *Kotaku*, April 2, 2021, <https://www.kotaku.com.au/2021/04/the-sad-story-behind-a-dead-pc-game-that-cant-come-back/>.

⁴¹ "Archive - 1st Annual Game Developers Choice Awards," Game Developers Choice Awards, accessed May 8, 2023, https://gamechoiceawards.com/archive/gdca_1st.

Yet because the game’s stakeholders cannot work together, this artistically significant title will likely never be reissued and will become increasingly difficult to play as time goes on.

This is not an uncommon problem. A mass-scale case study for these types of ownership issues is the Stephen M. Cabrinety Collection at Stanford University Libraries (SUL), a collection of more than 18,000 game and software titles released from 1975–1995.⁴² According to Henry Lowood, curator for History of Science & Technology Collections at SUL, Stanford and the National Institute of Standards and Technology attempted to contact the rightsholders for every game held in the collection to proactively seek permission for preservation activities. For a significant number of games—Lowood estimates 20 to 30 percent—the documented rightsholders could not confirm that they controlled the rights to those titles. Accounting for other issues determining and contacting owners, Lowood estimates that up to half of the Cabrinety Collection could be considered orphaned works.⁴³ In addition to the challenges this poses for Stanford’s preservation efforts, the uncertainty about the ownership for these games means they may never have a pathway to recommercialization.

Of course, this all assumes that a game’s rightsholder is interested in reissuing a game in the first place. For any reason, the owner of a game can choose not to keep it in release, whether that is due to perceptions about the game’s commercial value, its quality, or just disinterest. In a notable example, Sega, the owners of the *Sonic the Hedgehog* franchise, withdrew ten *Sonic* titles from digital marketplaces in 2010 due to their poor quality in order to “increase the value of the [*Sonic*] brand.”⁴⁴ While some of those titles have since been reissued,⁴⁵ others have not. Sega has not commented on why they did or did not reissue certain titles, but presumably, they would not reissue titles they believed there was no longer interest in. This is their right; as the Entertainment Software Association stated in 2020, copyright owners not only have the right to reissue their games but also “the right to decide *not* to do any of those things.”⁴⁶ However, this is still a loss to the availability of historical titles.

The combined effect of these challenges is that even if a developer or publisher is interested in reissuing a game, they may not be able to. In a recent example, the developers of the Nintendo 3DS game *Gotta Protectors* commented that the 3DS’s unique dual-screen hardware and the high costs of porting the game have prevented them from reissuing it on other platforms.⁴⁷ Sometimes games will only be reissued if a specialty company focused on game re-releases actively attempts to resolve

⁴² “Cabrinety-NIST Project,” Stanford University Libraries, accessed May 11, 2023, <https://swap.stanford.edu/was/20160911021643/http://library.stanford.edu/projects/cabrinety-nist-project>.

⁴³ Henry Lowood, email message to author, May 11, 2023.

⁴⁴ Slingerland, “SEGA Removing ‘Poor’ and ‘Average’ Sonic Titles From Retail,” *Sonic Stadium*, October 7, 2010, <https://www.sonicstadium.org/2010/10/sega-removing-poor-and-average-sonic-titles-from-retail/>.

⁴⁵ Kenneth Shepard, “Sonic 06 Has Been Relisted on a Digital Store After Over a Decade,” *Fanbyte*, May 24, 2022, <https://www.fanbyte.com/games/news/sonic-the-hedgehog-2006-06-xbox-360/>.

⁴⁶ Entertainment Software Association, *Long Comment Regarding a Proposed Exemption Under 17 U.S.C. § 1201*, COLC-2020-0010-0156, February 9, 2021, 9, <https://www.regulations.gov/comment/COLC-2020-0010-0156>.

⁴⁷ 株式会社エインシャント【@AncientGames_JP】 (@AncientGames_JP), “本当はSteamなどで配信できると良いのですが、3DSは特殊なハードなので移植コストも大きいですし、当分はそっち方面をフォローするのは難しいです。いつの日か風向きが変わったら何かできると良いのですが...お約束は難しい状況です,” Twitter, March 26, 2023, https://twitter.com/AncientGames_JP/status/1640191195581407232.

these issues. For many years, the influential 1999 computer game *System Shock 2* could not be re-released because it was no longer compatible with modern platforms, the source code was lost, and the rights had been repossessed by an insurance company that did not show the interest or ability to reissue the game on their own. It was only re-released after a dedicated *System Shock 2* fan used their own resources to start a new company, Nightdive Studios, to address these problems for this specific title.⁴⁸ Since this is not the norm for the rest of the game industry, many games are simply never reissued.

Challenges for Digital Game Availability

In most of the examples in this study, when a game was reissued, it was distributed through digital stores or services, rather than physical media like a disc or a cartridge. In theory, digital distribution allows a larger number of games to stay in wide distribution without the expense of manufacturing physical products—a boon for commercial game reissues. However, as demonstrated by these same examples, when a game is published digitally, there is no guarantee it will stay in release.

While the industry does not keep track of which titles have lapsed from digital distribution, the community website Delisted Games has cataloged roughly 1,800 games that have been removed from digital storefronts as of April 2023,⁴⁹ including nearly 700 of those games that are permanently unavailable “to the broadest consumer market.”⁵⁰ Although Delisted Games editor Shawn Sackenheim says “the details behind the delistings are hard to confirm,”⁵¹ an informal survey of the website shows that delistings are usually related to ongoing rights and licensing issues, as well as online multiplayer games that have been discontinued.

Beyond just individual games, a large-scale threat to digital game availability is the closure of digital game platforms. As part of a game console’s natural lifecycle, the platform’s digital services will eventually be discontinued for budgetary and technical reasons. Although this is an understandable business decision, it can result in hundreds or thousands of games on their marketplaces being taken out of release. Previous examples of digital platform shutdowns include the Xbox 360 Indie Games marketplace,⁵² Google’s short-lived game streaming platform Stadia,⁵³ and the store for the PlayStation Portable console.⁵⁴

⁴⁸ Jared Newman, “How One Company Is Bringing Old Video Games Back from the Dead,” *Fast Company*, November 9, 2015, <https://www.fastcompany.com/3053050/how-one-company-is-bringing-old-video-games-back-from-the-dead>.

⁴⁹ “Delisted Games,” Delisted Games, Internet Archive, accessed April 21, 2023, <https://web.archive.org/web/20230421181421/https://delistedgames.com/>.

⁵⁰ “” List,” Delisted Games, Internet Archive, accessed April 21, 2023, <https://web.archive.org/web/20230421181905/https://delistedgames.com/extinct-list/>.

⁵¹ “About Delisted Games,” Delisted Games, accessed May 8, 2023, <https://delistedgames.com/about/>.

⁵² Vic Hood, “Xbox Live Indie Games Officially Closes 29th September,” *Eurogamer*, September 12, 2017, <https://www.eurogamer.net/xbox-live-indie-games-officially-closes-29th-september>.

⁵³ Tom Gerken, “Gamers Say Goodbye to Google’s Stadia as Platform Shuts,” *BBC*, January 18, 2023, <https://www.bbc.com/news/technology-64293595>.

⁵⁴ Liana Ruppert, “PSP Store Closes Next Week, But Sony Will Still Sell PSP Games Through PS3 And PS Vita,” *Game Informer*, July 2, 2023, <https://www.gameinformer.com/2021/07/02/psp-store-closes-next-week-but-sony-will-still-sell-psp-games-through-ps3-and-ps-vita>.

The largest major platform shutdown in recent memory is the closure of the digital stores for the Nintendo 3DS and Wii U platforms. Nintendo shut down the 3DS and Wii U eShops on March 27, 2023,⁵⁵ resulting in the removal of 2,413 digital titles.⁵⁶ Although many of these are likely available on other platforms, *Video Games Chronicle* estimates that over 1,000 of those games were exclusive to those platforms' digital stores and are no longer available in any form, including first-party Nintendo titles like *Dr. Luigi*, *Dillon's Rolling Western*, *Mario & Donkey Kong: Minis on the Move*, and *Pokémon Rumble U*. The closures also affected around 500 historical games reissued by Nintendo through their Virtual Console storefronts, over 300 of which are believed not available on any other platform or service.⁵⁷ The closure of 3DS and Wii U eShops was something like a mass extinction event for digital games, and the need to understand the impact of such a closure on the game reissue market is urgent.

Even when games do stay in release digitally, external market factors and competition can decrease their availability. For example, Microsoft has claimed that Sony Interactive Entertainment regularly pays game publishers to withhold their releases from non-PlayStation consoles and services to increase the desirability of their own platforms.⁵⁸ While this may not directly affect game reissues, it does reduce the diversity of game availability sources, and it shows that game platform owners are ultimately motivated by profit rather than long-term preservation and access concerns.

Challenges for Second-Hand Physical Game Availability

In lieu of the ability to purchase games from their rightsholders, players may instead try to acquire vintage games and hardware on the second-hand market. Even if this is possible (ignoring cases of digital-only games, which cannot be resold), acquiring vintage games is becoming increasingly difficult and prohibitively expensive. In the past few years—particularly since the COVID-19 pandemic—used video games and consoles have become desirable collector's items, with used game prices rising by 33% year-to-year in 2021.⁵⁹ The sudden price escalation has taken the video game community by surprise, leading to accusations of price-fixing against a variety of appraisal

⁵⁵ "Wii U & Nintendo 3DS eShop Discontinuation Q&A," Nintendo, accessed May 9, 2023, https://en-americas-support.nintendo.com/app/answers/detail/a_id/57847/~/wii-u-%26-nintendo-3ds-eshop-discontinuation-q%26a.

⁵⁶ The Completionist, "I bought EVERY Nintendo Wii U & 3DS game before the Nintendo eShop closes," YouTube video, <https://www.youtube.com/watch?v=ujHUMG0Uovs>.

⁵⁷ Chris Scullion, "These Are the 1,000 Digital-Only 3DS and Wii U Games Disappearing Next Week," *Video Games Chronicles*, March 22, 2023, <https://www.videogameschronicle.com/features/analysis-digital-only-wii-u-3ds-games/>.

⁵⁸ Matt Wales, "Microsoft Claims Sony Pays Developers 'Blocking Rights' to Keep Games Off Xbox Game Pass," *Eurogamer*, August 10, 2022, <https://www.eurogamer.net/microsoft-claims-sony-pays-developers-blocking-rights-to-keep-games-off-xbox-game-pass>.

⁵⁹ PriceCharting.com, "Retro Video Game Values Increase 33% Since the Start of COVID Lockdowns," *PR Newswire*, April 7, 2021, <https://www.prnewswire.com/news-releases/retro-video-game-values-increase-33-since-the-start-of-covid-lockdowns-301263836.html>; Aaron Greenbaum, "Why are Retro Games More Expensive than Ever?," *Den of Geek*, May 10, 2022, <https://www.denofgeek.com/games/retro-games-prices-market-bubble-explained-reasons/>; Kyle Orland, "Collectors are as Confused as You are About That \$1.56M *Super Mario 64* Sale," *Ars Technica*, July 18, 2021, <https://arstechnica.com/features/2021/07/collectors-are-as-confused-as-you-are-about-that-1-56m-super-mario-64-sale/>.

companies, auction houses, and resellers.⁶⁰ In short, supply is dwindling, prices are skyrocketing, and it is becoming harder to obtain products that were originally meant for broad public consumption.

In an extreme example, used copies of the Nintendo Entertainment System game *Little Samson* were previously sold for 99 cents by the game retailer FuncoLand during the 1997 holiday season.⁶¹ Due to the game's rarity, critical acclaim, and the fact that it has never been reissued,⁶² as of April 2023, used cartridge-only copies of *Little Samson* sell on the second-hand market for an average of \$2,750.⁶³ Although this is an unusually large price fluctuation, it helps illustrate how the demand from the game collecting market can drastically affect the value of video games over time.

Having a physical copy of a game and vintage hardware in working condition is also not a guarantee that the game is playable. Games released during the digital game distribution era may have content or features tied to online services, which may be (and regularly are) deactivated. According to researcher James Newman, this is sometimes employed by game publishers as a deliberate strategy to devalue used games, shorten their distribution window, and encourage sales of new titles,⁶⁴ which has ominous implications for preservation.

While used games were once affordable, functional, and plentifully available, it has now become unreasonable to expect researchers to acquire rare out-of-release titles on the second-hand market as a way to access them.

Effect of Game Availability Issues on Research

All these factors have led to low availability for historical games. This is disappointing on several fronts. For the popular market, this means historical games are often not available for recreational play. But for video game researchers and historians, this means that historically interesting games may not be readily available for research purposes. The cultural heritage community has acknowledged these concerns: the Digital Preservation Coalition, a non-profit organization that promotes best practices for digital preservation, identified “Old or Non-current Offline Video Games” as “Critically Endangered” in the 2022 edition of their annual BitList report on at-risk media formats. DPC identified a number of contributing factors echoed in this study, such as “[c]omplex hardware dependencies or bespoke hardware; low usage operating systems with no

⁶⁰ Andy Robinson, “Grading Firm Wata is Facing a Lawsuit for Allegedly ‘Manipulating the Retro Game Market,’” *Video Games Chronicle*, May 12, 2022, <https://www.videogameschronicle.com/news/grading-firm-wata-is-facing-a-lawsuit-for-allegedly-manipulating-the-retro-game-market/>; Jordan Devore, “Retro Game Prices are High Enough as is, Thanks,” *Destructoid*, September 3, 2021, <https://www.destructoid.com/retro-games-expensive-enough-without-price-fixing-scheme/>.

⁶¹ FuncoLand Holiday 1997 used game price guide (1997), Video Game History Foundation Library, Emeryville, California.

⁶² Joseph Shaffer, “Little Samson (NES) Review,” *Honest Gamers*, July 18, 2012, <http://www.honestgamers.com/10433/nes/little-samson/review.html>; Michael Plasket, “Little Samson,” *Hardcore Gaming 101*, September 23, 2017, <http://www.hardcoregaming101.net/little-samson/>; SNES drunk, “Little Samson: Why the Hype? - SNESdrunk,” YouTube video, December 15, 2022, https://www.youtube.com/watch?v=I1llzm_OxDg; Pat Contri, *Ultimate Nintendo: Guide to the NES Library (1985-1995)*, (The Punk Effect, September 9, 2016), 191.

⁶³ “Little Samson Prices NES,” PriceCharting, Internet Archive, accessed April 21, 2023, <https://web.archive.org/web/20230421035806/https://www.pricecharting.com/game/nes/little-samson>.

⁶⁴ James Newman, *Best Before: Videogames, Supersession and Obsolescence*, (Routledge: New York, 2012), 96-106.

emulation pathway; complex intellectual property rights; [...] loss of underlying code or gaming engine; [and] limited or no commercial interest.” The BitList entry acknowledges that “an active specialist market for older games” does exist, but as discussed, this market “skews [...] around commercial interests.”⁶⁵

In the absence of a fuller reissue market or other reasonable research options, piracy fills in the gap. For both consumers and researchers, piracy is one of the only methods—often the easiest method—for playing out-of-release games.⁶⁶ Researchers especially depend on unauthorized copies of games for scholarship and teaching,⁶⁷ often under fair use claims to reproduce and emulate games without rightsholder permission.⁶⁸

One alternative to piracy is to play out-of-release games in-person at a library. Federal regulations in the United States currently require researchers to access most games in library video game collections on-premises,⁶⁹ which can be impractical and expensive. The fan-sourced game statistics website HowLongToBeat reports that video games, on average, take around 20 hours to complete.⁷⁰ If a researcher wants to play through an entire game held by a library or archive, they may need to prepare for days or even weeks of travel, lodging, childcare, and other accommodations needed to visit a research collection.

There are a variety of reasons why members of the general public would pirate out-of-release video games. But for video game history researchers, piracy is often a last resort and necessity for proper study.

In response to these gaps, since 2012, the cultural heritage sector has petitioned the U.S. Copyright Office for greater exemptions to the Digital Millennium Copyright Act to allow libraries and archives to expand preservation- and access-related activities for video games. The Entertainment Software Association has consistently opposed proposals for these exemptions, arguing that

⁶⁵ Digital Preservation Coalition, *The BitList 2022*, 115.

⁶⁶ Zack Zwiezen, “So-Called Pirates Are Doing The Work When Publishers Fail To Preserve Their Games,” *Kotaku*, March 23, 2021, <https://kotaku.com/so-called-pirates-are-doing-the-work-when-publishers-fa-1846533244>; Timothy Geigner, “3DS, Wii U eShop Shutdown Leaves Archivists In The Wind, Hobbyists Pick Up The Pieces,” *Techdirt*, March 21, 2023, <https://www.techdirt.com/2023/03/21/3ds-wii-u-eshop-shutdown-leaves-archivists-in-the-wind-hobbyists-pick-up-the-pieces/>; Karl Bode and Emanuel Maiberg, “Nintendo Makes It Clear that Piracy Is the Only Way to Preserve Video Game History,” *Vice*, January 29, 2019, <https://www.vice.com/en/article/wjm5kw/nintendo-makes-it-clear-that-piracy-is-the-only-way-to-preserve-video-game-history>; Hayden Dingman, “Nintendo’s Ridiculous War on ROMs Threatens Gaming History,” *PCWorld*, August 11, 2018, <https://www.pcworld.com/article/402404/nintendo-suit-rom-emulation-game-preservation.html>; Benj Edwards, “Why History Needs Software Piracy,” *Technologizer*, January 23, 2012, <https://www.technologizer.com/2012/01/23/why-history-needs-software-piracy/>.

⁶⁷ James Newman, “Illegal Deposit: Game Preservation and/as Software Piracy,” *Convergence: The International Journal of Research into New Media Technologies*, 19, no 1, (September 2012), <https://researchspace.bathspa.ac.uk/795/>.

⁶⁸ Kevin Driscoll, “Abandonware ‘After Dark.’”

⁶⁹ Exemptions to prohibition against circumvention, 37 C.F.R. § 201.40(b)(18) (2022). The language in this exemption prohibits libraries from providing remote access to video games in their collections if that would require circumventing digital rights management protections, which are widely and commonly used by the game industry.

⁷⁰ “HowLongToBeat Stats,” HowLongToBeat, Internet Archive, accessed May 7, 2023, <https://web.archive.org/web/20230507000738/https://howlongtobeat.com/stats>.

expanding access to archival game collections would negatively impact the “vibrant and growing market for authorized ‘retro’ or ‘legacy’ games and consoles.”⁷¹

While there is clearly an active reissue market, given the considerable obstacles to re-releasing games, the actual extent of the reissue market is unclear. To advance this discussion, we need to gather empirical evidence about the state and scope of the reissue market.

Purpose of Study

The purpose of this study is to determine what percentage of historical video games have been reissued or remain in release in the United States, as well as examining descriptive characteristics of games that have been reissued to determine what types of games are more or less likely to be in release and their sources of availability. We believe this is the first major study to analyze the availability rates for a broad sample of historical games in this manner.

This study proceeds from the assumption that the availability of historical games is vital for promoting research on video games and video game history. Although this study has commented on the value of game reissues for general entertainment purposes, the primary purpose of this study is to understand how the state of the reissue market impacts the needs of scholars and researchers.

We intend this study to be relevant to ongoing arguments about copyright law for video games in the United States and chose to study only the American video game reissue market.

⁷¹ Kyle Orland, “Gaming Trade Org: For DMCA, ‘There’s No Such Thing as an Obsolete Game,’” *Ars Technica*, June 23, 2015, <https://arstechnica.com/gaming/2015/06/gaming-trade-org-for-dmca-theres-no-such-thing-as-an-obsolete-game/>; Kyle Orland, “Why Game Archivists are Dreading This Month’s 3DS/Wii U eShop Shutdown,” *Ars Technica*, March 15, 2023, <https://arstechnica.com/gaming/2023/03/why-game-archivists-are-dreading-this-months-3ds-wii-u-eshop-shutdown/>; ESA, *Comment Regarding a Proposed Exemption*, 2. As an aside, in cases where the Copyright Office approved these exemptions, the ESA has not opposed their renewal, suggesting that the exemptions did not actually cause the harm they predicted.

Methodology and Definitions

Introduction to Datasets

To examine the state of the video game reissue market, we needed a large dataset of historical video games which we could compare against the games currently available on the marketplace. For this study, we decided to use data from MobyGames, a community-run database of video game releases. Out of every game database we examined, MobyGames has the largest and richest corpus to work with for our research question. While any database of games will always be a work in progress, we believe MobyGames has the most active community of volunteers keeping the database as complete as possible.

We considered other databases, such as IGDB.com, an industry-favored video game database that provides game metadata to (and is owned by) the popular game streaming website Twitch.⁷² However, we found that these other databases tended to focus on current releases, while MobyGames had more comprehensive information about historical game releases (eg., at the time of designing this study in summer 2022, IGDB had information about approximately 290 games for the Commodore 64,⁷³ while MobyGames had cataloged over 5000 games for the same platform⁷⁴).

While we recognized concerns about whether a community-driven database could be considered less authoritative than a database managed by the industry itself, we found notable support for MobyGames from within the industry. In particular, the website was recently purchased by Atari SA, the current owners of the Atari brand, specifically for the depth of its metadata for historical games.⁷⁵ Atari SA CEO Wade Rosen, who previously served as CEO of Ziggurat Games, a company that specializes in reissuing out-of-commerce video games, has praised MobyGames as “a central repository” for information about historical video games⁷⁶ and noted its “sustained and important role in the documentation, celebration and preservation of video games.”⁷⁷ This gives us further confidence in MobyGames’ authority as a data source for our research.

Working with MobyGames Data

Because MobyGames data cannot be directly accessed by the public at the scale we needed, we worked with Tracy Poff, an engineer for MobyGames, to retrieve our datasets. Poff helped us

⁷² “About,” IGDB.com, accessed May 9, 2023, <https://www.igdb.com/about>; “Adding a Game or Game Cover Art to Twitch,” Twitch, accessed May 9, 2023, https://help.twitch.tv/s/article/adding-a-game-and-box-art-to-the-directory?language=en_US.

⁷³ “Commodore C64/128,” IGDB.com, Internet Archive, accessed October 29, 2022, <https://web.archive.org/web/20220702011822/https://www.igdb.com/platforms/c64>.

⁷⁴ “Game Browser » Commodore 64,” MobyGames, Internet Archive, accessed February 7, 2023, <https://web.archive.org/web/20220531072541/https://www.mobygames.com/browse/games/c64/>.

⁷⁵ “Atari Completes MobyGames Acquisition, Details Plans for the Site’s Continued Support,” Atari, March 8, 2022, <https://atari.com/blogs/newsroom/atari-completes-mobygames-acquisition-details-plans-for-the-site-s-continued-support/>.

⁷⁶ Giovanni Colantonio, “For Atari, Preservation Isn’t Just About Saving Old Games,” *Digital Trends*, April 14, 2022, <https://www.digitaltrends.com/gaming/atari-game-preservation-efforts/>.

⁷⁷ Atari, “Atari Completes.”

retrieve information about our areas of focus via the public MobyGames API, and when our queries were too complex to retrieve through the API, he directly exported the data for us from the MobyGames database.

Because we were studying the state of the American video game reissue market, we limited our datasets to include only games with a known official, historical release in the United States,⁷⁸ which is listed in the ‘releases’ property for each game in MobyGames. Due to how data is organized in MobyGames, this excludes games with an inherently international release, such as browser-based games distributed for free via the web.⁷⁹ To focus our study on the original releases of games, we also intentionally omitted game compilation sets and add-on content from our datasets. These items are cataloged as separate titles in MobyGames and are tagged with the genre keywords ‘Compilation’, ‘DLC / Add-on’, or ‘Special Edition’.⁸⁰

To provide more information for our volunteer researchers and better understand the chronological scope of our samples, we also retrieved data from MobyGames about the original release date for each game, based on the relevant platform for each dataset. By default, this information cannot be quickly retrieved from the output of the MobyGames API, but it can be determined by parsing the output with a custom script. To make the data easier to analyze, we simplified release dates to year only (excluding months and days, when provided).⁸¹

Due to the level of additional work needed to retrieve other information from MobyGames’ complex data structure via the public API,⁸² we chose not to retrieve information about the game’s developers, publishers, or technical characteristics.

Travis Brown, director of technology at the Video Game History Foundation, developed Python scripts for retrieving and processing data from the MobyGames API. In support of this study’s

⁷⁸ The MobyGames content standards disallow entries for illegally reproduced or modified versions of games, which aligns with our interest in studying only authorized releases. “MobyGames Standards,” MobyGames, accessed May 9, 2023, <https://www.mobygames.com/info/standards/>.

⁷⁹ Tracy Poff, email message to author, June 28, 2022. Anecdotally, MobyGames also appears to omit some amount of non-game software released for video game platforms, such as *InfoGenius Productivity Pak: Frommer's Travel Guide*, a digital travel guide released for the Game Boy handheld system in 1991. We could not locate a specific policy outlining MobyGames’ definition of a video game. However, Nintendo of America does include this title in their list of officially licensed Game Boy games. Cf. “Game Boy (Original) Games,” Nintendo, Internet Archive, June 10, 2004, https://web.archive.org/web/20040610031052/http://www.nintendo.com/consumer/downloads/dmg_games.pdf.

⁸⁰ Removing the ‘Compilation’ genre resulted in a small number of false positives, in which original games were removed from the datasets on the technicality of being compilation packages. For example, the title *Game & Watch Gallery 4* for the Game Boy Advance is a collection of minigames inspired by Nintendo’s line of *Game & Watch* electronic handheld toys from the 1980s. Although this game is substantially different from the toys it was inspired by, it is classified by MobyGames as a ‘Compilation’ and thus was not included in the data we retrieved from MobyGames.

⁸¹ To provide additional context for our researchers, we also included the URL for each game’s MobyGames entry, which they could use to verify specific information about each game. However, in the middle of this study, on February 20, 2023, MobyGames redesigned their website. As a result, the URL format for game pages is different than it was when we exported our dataset. MobyGames automatically redirects all old URLs to the new pages, so the practical impact of this change on this study is negligible. MobyReed, “The Next Chapter of MobyGames,” *MobyGames*, February 20, 2023, <https://www.mobygames.com/forum/3/thread/261072/the-next-chapter-of-mobygames/>.

⁸² Travis Brown, in discussion with the author via video call, June 28, 2022.

reproducibility and transparency, the Video Game History Foundation has released these scripts as open source alongside the publication of our study.⁸³

Scope of Study

Video games are a diverse medium spanning over half a century. As of June 15, 2022, the MobyGames database identifies 298,792 individual game titles (including compilation sets and add-on content) and 305 separate game platforms,⁸⁴ representing a wide variety of commercial interest levels and technical challenges for re-releases. Given the fractious nature of the video game market, we recognized that a simple sample of all historical video games cannot account for the full complexity of the state of video game reissues.

To this end, we identified four separate areas of focus for this study, each of which represents a different population or ecosystem of video games with a unique relationship to the video game reissue market:

- All historical games released in the United States.
- The Commodore 64, an “abandoned” game platform ecosystem with the lowest level of commercial interest.
- The Game Boy platform family (Game Boy, Game Boy Color, and Game Boy Advance), a “neglected” ecosystem with demonstrable commercial interest but declining availability.
- The PlayStation 2, an “active” ecosystem with high recommercialization activity from multiple parties.

We chose to study all four of these areas to present the most complete portrait of the diverse circumstances of video game reissues.

For studies of platform-specific ecosystems, we limited our study only to games published within the commercial lifespan of the platform. Historical game platforms have dedicated niche hobbyist communities that continue to develop homemade games for the platforms,⁸⁵ and in order to accurately study their ecosystems, we omitted games published after the platform was commercially discontinued.

⁸³ Scripts published at <https://doi.org/10.5281/zenodo.7996492>.

⁸⁴ “MobyStats,” MobyGames, Internet Archive, June 15, 2022, https://web.archive.org/web/20220615083315/https://www.mobygames.com/moby_stats.

⁸⁵ Fred Rojas, “Homebrew,” *Gaming History 101*, January 17, 2012, <https://gaminghistory101.com/2012/01/17/homebrew/>; David Buck, “Not Just Nostalgia,” *Tedium*, April 10, 2018, <https://tedium.co/2018/04/10/nes-homebrew-scene-history/>.

Table 2. Overview of ecosystems

Ecosystem	Ecosystem definition	Selected platform	Population size	Sample size
Historical games	N/A	N/A	27,627	1,500
Abandoned	Low interest, low activity	Commodore 64	1,830	400
Neglected	High interest, low activity	Game Boy family	1,873	1,873*
Active	High interest, high activity	PlayStation 2	1,683	400

*Due to the sudden decrease in Game Boy title availability in March 2023, we examined the Game Boy family ecosystem in full. See “Sampling Methodology” for details.

Total Population of Historical Games

As the main component of this study, we analyzed the release status of a random sample of all video games released in the United States prior to 2010.⁸⁶ We identified the 2010s as the beginning of an era when digital distribution for retail-scale video games became viable and widely adopted on home video game consoles.⁸⁷ Because of this shift in distribution methods, games released during or after 2010 tend to have stronger continuity in digital distribution, and game platforms released after 2010 have put more emphasis on supporting game compatibility across platform generations.⁸⁸ As a result, while games from 2010 onward do still fall out of release, they have thus far needed to be reissued less frequently. Games released prior to 2010, meanwhile, are more likely to have been released on an obsolete physical format such as cartridge, cassette, or CD-ROM; or if they were distributed digitally, they were released through an older digital platform, website, or distribution network that may no longer exist. It follows that these games are more likely to have gone out of distribution at some point, which makes them the most relevant population for this study.

We intentionally studied a broad and diverse sample of historical games from this period, not limited by platform or genre. While similar studies of the availability of works for other mediums have focused on narrower subsets of genres likely to have the greatest popular and scholarly attention,⁸⁹

⁸⁶ Exported from MobyGames on May 24, 2022.

⁸⁷ Brendan Sinclair, “Digital Distribution: A Diagnosis for Disruption,” *GameIndustry.biz*, March 1, 2019, <https://www.gamesindustry.biz/digital-distribution-a-diagnosis-for-disruption>; Liam Deane, “Digital Games Distribution is Ripe for Disruption,” *Game Developer*, March 10, 2023, <https://www.gamedeveloper.com/blogs/digital-games-distribution-is-ripe-for-disruption>; Eric Blancaflor and Jan Martín Gomez San Miguel, “Analyzing Digital Game Distribution in Gaming Industry: A Case Study,” *Proceedings of the 2nd Indian International Conference on Industrial Engineering and Operations Management*, August 2022: 676, <https://ieomsociety.org/proceedings/2022india/232.pdf>; Laurent Michaud, “Online Video Game: App Stores Digital Distribution,” *ID.ATE*, ResearchGate, https://www.researchgate.net/publication/337258067_Online_Video_Game_App_Stores_Digital_distribution.

⁸⁸ Rebecca Smith, “Phil Spencer Clarifies Project Scarlett Backward Compatibility... Again,” June 14, 2019, <https://www.trueachievements.com/n38138/project-scarlett-backward-compatibility>; “Backwards Compatibility Returns at the Right Time for the Video Game Market,” Nielsen, September 2020, <https://www.nielsen.com/insights/2020/backwards-compatibility-returns-at-the-right-time-for-the-video-game-market/>; Scullion, “Miyamoto.”

⁸⁹ Brooks, *Survey of Reissues*, 3.

video games are a medium inherently based on popular consumption, and we chose to look at a more comprehensive sample of what that medium represents.

Data retrieved from the MobyGames database by Tracy Poff identified a total of 27,627 video games released in the United States prior to 2010.⁹⁰ This figure counts platform-specific releases of each game as a single title, eg., the Sega Genesis, Super Nintendo, and arcade versions of *Super Street Fighter II* are all considered the same game. If every platform-specific release of a game is counted separately, the total number of games increases to 46,251.⁹¹ However, this figure is not applicable to how we defined whether a game is in release (see Appendix B: Discussion of Definitions).

Abandoned Ecosystem: Commodore 64

We define an "abandoned ecosystem" as a historical game platform that there has been minimal concerted attempt to recommercialize. Abandoned ecosystems are often the result of a lack of engagement from the platform's owner, leaving individual developers and publishers to reissue the games themselves. Abandoned ecosystems represent some of the largest gaps in video game availability, as there is a low likelihood of games from these ecosystems being reissued, either due to disinterest or because of the variety of rights and distribution issues and technical challenges like emulation that developers are required to navigate.

We identified the Commodore 64 computer (C64) as an example of an abandoned ecosystem. The C64 was one of the primary computer game platforms in the 1980s—notably the original platform targeted by major American video game publisher Electronic Arts⁹²—and is considered one of the most influential and historically important platforms of its era.⁹³ However, few C64 games released in the United States are available today. This is likely due to relatively low commercial interest in the platform's somewhat archaic library, as well as the dissolution of platform owner Commodore International in 1994, which fragmented the rights to the C64 intellectual property and has led to a complicated licensing situation for commercial C64 emulators.⁹⁴ There are a handful of services and products that feature a scattershot assortment of C64 games, such as THEC64 Mini, a microconsole produced by a third party unaffiliated with the current rightsholders to the Commodore brand, which includes a small library of licensed C64 titles;⁹⁵ and the retro game streaming platform

⁹⁰ As of June 28, 2022.

⁹¹ Tracy Poff, email message to author, June 28, 2022.

⁹² EA Staff, "30th Anniversary of Our First Games Shipped," *Electronic Arts*, May 20, 2013, <https://www.ea.com/news/30th-anniversary-first-games-shipped>.

⁹³ Bill Loguidice, "A History of Gaming Platforms: The Commodore 64," *Game Developer*, October 24, 2007, <https://www.gamedeveloper.com/business/a-history-of-gaming-platforms-the-commodore-64>; Tristan Donovan, *Replay: The History of Video Games* (Lewes: Yellow Ant, 2010), 102-103; Paul Drury and Andrew Fisher, "40 Years of the Commodore 64," *Retro Gamer*, September 29, 2022, 18-19; Nick Montfort, "Platform Studies at 10," *Post Position*, July 26, 2018, <https://nickm.com/post/2018/07/platform-studies-at-10/>.

⁹⁴ Mike Mika (studio head, Digital Eclipse), in discussion with the author, Emeryville, California, April 27, 2023.

⁹⁵ Elise Favis, "A Mini Version Of The Commodore 64 Is Coming In 2018," *Game Informer*, September 30, 2017, <https://www.gameinformer.com/b/news/archive/2017/09/30/a-mini-version-of-the-commodore-64-is-coming-in-2018.aspx>.

Antstream Arcade, which provides digital access to a library of C64 games⁹⁶ primarily from the United Kingdom.

Our dataset from MobyGames⁹⁷ identifies 1,830 games released for the Commodore 64 in the United States during the platform’s commercially active period from 1982–1994.

Neglected Ecosystem: Game Boy Family

We define a “neglected ecosystem” as a historical game platform with an active rightsholder who has allowed the platform’s games to fall or stay out of release, even if they have previously recommercialized the platform. Despite the growing interest in reissuing historical video games, games from a neglected ecosystem often remain unavailable or lapse out of release due to a variety of obstacles mentioned in this study, including technical difficulties, changes in the games’ ownership, rightsholder inactivity, or the discontinuation of digital storefronts and services where the games were once made available. Neglected ecosystems may appear to be active, but due to these limitations, they may be more like abandoned ecosystems in practice.

We identified the family of Game Boy handheld consoles—the original Game Boy, the Game Boy Color, and the Game Boy Advance—as a prime example of a neglected ecosystem. Although Nintendo, the owner of the Game Boy platforms, is commercializing a select library of Game Boy games through their Nintendo Switch Online (NSO) subscription platform, the availability of the Game Boy ecosystem as a whole has been deteriorating due to a combination of digital marketplace volatility, complex rights situations,⁹⁸ and neglect for individual titles. Nintendo previously offered 155 Game Boy titles in the United States through their Nintendo 3DS and Wii U Virtual Console storefronts,⁹⁹ which were shuttered on March 27, 2023.¹⁰⁰ In contrast, only 25 Game Boy titles had

⁹⁶ Kyle Orland, “The Streaming Service That Wants to Save the Retro Gaming Biz from Piracy,” *Ars Technica*, May 2, 2019, <https://arstechnica.com/gaming/2019/05/the-streaming-service-that-wants-to-save-the-retro-gaming-biz-from-piracy/>.

⁹⁷ Exported from MobyGames on May 24, 2022.

⁹⁸ A majority of Game Boy games announced for Nintendo Switch Online at the time of this study are owned by Nintendo, rather than games produced by third parties. While other Nintendo-owned titles will likely be made available through NSO over time, it is unclear whether more third-party Game Boy titles previously available through Nintendo’s defunct digital storefronts will be (or can be) relicensed for Nintendo’s subscription service. It is possible that differences in revenue for digital sales versus streaming licensing may influence whether or how they recommercialize their libraries.

⁹⁹ Editors of Wikipedia manually compiled a list of games from the 3DS and Wii U storefronts before they were closed. “List of Virtual Console games for Wii U (North America),” Wikipedia, last modified April 29, 2023, [https://en.wikipedia.org/wiki/List_of_Virtual_Console_games_for_Wii_U_\(North_America\)](https://en.wikipedia.org/wiki/List_of_Virtual_Console_games_for_Wii_U_(North_America)); “List of Virtual Console games for Nintendo 3DS (North America),” Wikipedia, last modified April 29, 2023, [https://en.wikipedia.org/wiki/List_of_Virtual_Console_games_for_Nintendo_3DS_\(North_America\)](https://en.wikipedia.org/wiki/List_of_Virtual_Console_games_for_Nintendo_3DS_(North_America)).

¹⁰⁰ Kate Gray, “When Does The 3DS And Wii U eShop Close? Nintendo eShop Closure Guide,” March 27, 2023, <https://www.nintendolife.com/guides/when-does-the-3ds-and-wii-u-eshop-close-nintendo-eshop-closure-guide>; Nintendo, “eShop Discontinuation.” Data collection for this study began prior to the closure of the 3DS and Wii U storefronts. Because we expected to publish this study after the stores had closed, we instructed our volunteer researchers to assume that 3DS and Wii U releases were no longer available.

been announced for NSO in the United States as of April 2023, when data collection ended for this study.¹⁰¹

While NSO is a new service that will continue to grow over time, the entropy of digital distribution, combined with Nintendo's deliberate vault-style release strategy, may have allowed over 100 Game Boy titles to fall back out of commerce with no guarantee that they will be reissued again. Because Nintendo's services remain the single largest distribution point for Game Boy titles, this is a clear case of a neglected ecosystem, despite the platform owner's interest and efforts.

Our datasets identify 1,873 games released for the Game Boy family of consoles in the United States during the platforms' commercially active periods.¹⁰² This includes:

- 509 games released for the original Game Boy from 1989–2003.
- 442 games released for the Game Boy Color from 1998–2003.¹⁰³
- 922 games released for the Game Boy Advance from 2001–2008.

Active Ecosystem: PlayStation 2

We define an “active ecosystem” as a historical game platform that is being actively commercialized by its rightsholder and its developers through a variety of services and reissue methods. An active ecosystem can take many forms. For example, a large number of developers may independently reissue games that were originally released for the platform. The platform's rightsholder may also run a digital service for redistributing these games under a unified brand, or they may release a dedicated microconsole with a curated library of games released for that platform. Active ecosystems have the greatest level of commercial interest and represent what the video game reissue market would look like under ideal conditions and full investment from rightsholders.

We identified the PlayStation 2 console (PS2) as a standout example of an active ecosystem. The PS2 is one of the most popular and best-selling game consoles,¹⁰⁴ and Sony Interactive Entertainment, the owner of the PlayStation platforms, has shown a continued interest in keeping PS2 games available and playable after the life of the platform. Their efforts began as early as the original model of the PlayStation 3 (PS3) console, which had near-total backwards compatibility with PS2 games,

¹⁰¹ Chris Plante, “Every Game Boy and GBA Game Now on Nintendo Switch,” *Polygon*, February 8, 2023, <https://www.polygon.com/23591771/nintendo-switch-online-game-boy-gba-games-list>; Liam Doolan, “Nintendo Expands Switch Online Game Boy, SNES & NES Service With Four More Titles,” *Nintendo Life*, March 15, 2023, <https://www.nintendolife.com/news/2023/03/nintendo-expands-switch-online-game-boy-snes-and-nes-service-with-four-more-titles>.

¹⁰² The original datasets from MobyGames, retrieved on May 24, 2022, identified 1,663 games (485 for Game Boy, 405 for Game Boy Color, and 773 for Game Boy Advance). In order to more accurately represent the complete population of Game Boy titles, these datasets were manually updated based on additional research to account for omissions and oversights in the MobyGames database. See Appendix A: Updates to Game Boy Datasets for details and rationale.

¹⁰³ A small number of Game Boy Color games were also backwards compatible with the original Game Boy system. The MobyGames database categorizes these as Game Boy Color titles.

¹⁰⁴ Alex Calvin, “How Sony's PlayStation 2 Took the World by Storm,” *GamesIndustry.biz*, January 6, 2020, <https://www.gamesindustry.biz/how-sonys-playstation-2-took-the-world-by-storm>.

and reissuing PS2 games through the PS3's digital storefront.¹⁰⁵ Since then, Sony has continued to explore new methods for reissuing PS2 games, such as a \$380 million investment in low-latency streaming technology¹⁰⁶ that allows Sony to provide access to PS2 games through their PlayStation Now streaming platform. Most recently, in March 2022, Sony announced PlayStation Plus Premium, a premium-priced subscription service that offers digital access to titles from the PlayStation 2 catalog as one of its marquee features.¹⁰⁷

Given Sony's confidence in the robustness of their digital platform offering—as well as the numerous PlayStation 2 titles that have been independently reissued by their rightsholders outside of Sony's services¹⁰⁸—we believe the PlayStation 2 is an ideal candidate for studying the best-case state of video game recommercialization.

Our dataset from MobyGames¹⁰⁹ identifies 1,683 games released for the PlayStation 2 in the United States during the platform's commercially active period from 2000–2013.

Samples and Statistical Methodology

This methodology was developed in consultation with the Data Learning Center at the Department of Research Informatics and Publishing at Penn State University Libraries. Sample sizes were determined for a <5% margin of error at a 95% confidence interval.

Sampling Methodology

Datasets used by this study were retrieved from the video game database MobyGames, which included a total population of 298,792 games as of June 2022.¹¹⁰

This study uses four samples based on the datasets we obtained:

1. A random sample of 1,500 video games from the general population of games released in the United States prior to 2010.

Because the complexity and scope of this query fell outside what could reasonably be achieved using the public MobyGames API, this sample was obtained directly from the MobyGames database by MobyGames engineer Tracy Poff on May 31, 2022. Poff provided

¹⁰⁵ Alice O'Connor, "PS2 Classic Coming to PSN in 'Only on PlayStation' Promotion," *Shacknews*, October 3, 2011, <https://www.shacknews.com/article/70424/ps2-classics-coming-to-psn-in-only-on-playstation-promotion>.

¹⁰⁶ Sharif Sakr, "Sony Buys Gaikai Cloud Gaming Service for \$380 Million," *Engadget*, July 2, 2012, <https://www.engadget.com/2012-07-02-sony-buys-gaikai.html>.

¹⁰⁷ Jim Ryan, "UPDATE."

¹⁰⁸ For one example, Square Enix, a major video game publisher, has independently reissued some of their most popular PlayStation 2 titles, such as entries the *Final Fantasy* and *Kingdom Hearts* franchises, on a variety of non-PlayStation platforms including Xbox, Nintendo Switch, and Windows computers.

¹⁰⁹ Retrieved from MobyGames on May 24, 2022.

¹¹⁰ "MobyStats," MobyGames, Internet Archive, April 3, 2023, https://web.archive.org/web/20220615083315/https://www.mobygames.com/moby_stats.

a list of MobyGames database ID numbers for games matching these criteria,¹¹¹ which we then used to retrieve a detailed dataset.

Based on the total of 27,627 games in this population, our results for this sample have a 2.5% margin of error with a 95% confidence interval.¹¹²

2. A random sample of 400 games released in the United States for the Commodore 64, representing an “abandoned ecosystem.”

This sample was randomly selected from the complete set of Commodore 64 games released in the United States during the life of the platform using the “Randomize range” feature on Google Sheets; the first 400 randomized games were selected. Based on the total population of 1,830 games matching these criteria, our results for this sample have a 4.3% margin of error with a 95% confidence interval.

3. The complete dataset of 1,873 games released in the United States for all three Game Boy family platforms, representing a “neglected ecosystem.”

Given the decrease in the number of Game Boy games in release in the United States following the closure of the Nintendo 3DS and Wii U eShops in March 2023, we decided it was worthwhile and feasible to determine the release status of every Game Boy family game released during the life of these platforms rather than using a random sample.

In order to represent the complete population of Game Boy family titles as accurately as possible, our datasets for the Game Boy, Game Boy Color, and Game Boy Advance were manually updated based on additional research to account for omissions and oversights in the MobyGames database. See Appendix A: Updates to Game Boy Datasets for details and rationale.

4. A random sample of 400 games released in the United States for the PlayStation 2, representing an “active ecosystem.”

This sample was randomly selected from the complete set of PlayStation 2 games released in the United States during the life of the platform using the “Randomize range” feature on Google Sheets; the first 400 randomized games were selected. Based on the total population of 1,683 games matching these criteria, our results for this sample have a 4.3% margin of error with a 95% confidence interval.

¹¹¹ While this study was already in progress, we identified a single game in this random sample, *Just Sing!*, that is listed as having been released in 2010. Based on the game’s packaging, it appears to have been copyrighted in 2009 but published in the United States in 2010, resulting in this discrepancy. Given this unusual borderline case, and in the interest of reproducibility and maintaining the integrity of the original data, we did not replace this game in our dataset.

¹¹² This margin of error does not significantly change when using the larger figure of 46,251 platform-specific releases referenced in “Scope of Study.”

Additionally, we included descriptive statistical summaries of the games in these datasets, their sources of availability, and other contextual information about game availability that was documented by our researchers.

Data-Gathering Methodology

Due to the plethora of competing storefronts for digital and physical games, there is no single source of data for determining whether a game is currently in release. As such, we needed to manually check the release status for each game in our samples.

Information about the release status of each game was collected twice: once by a team of volunteer researchers from the Video Game History Foundation’s community of video game history subject specialists, and again by a team of student researchers from the University of Washington Information School.¹¹³

Each volunteer researcher was assigned one or multiple chunks of 100 games to examine. Researchers determined whether each game is or is not currently in release based on our definition of a game’s release status. To assist in their research, we provided our volunteers with a list of storefronts, services, and publishers that these games would most likely be available from.

To aid in the verification of this study, our researchers recorded the source of the game’s distribution, the date of their determination, their name, and any contextual notes that clarify the game’s release status. For the purposes of this study, if a reissue of a game had been announced but was still forthcoming at the

Definitions

These are brief definitions for specialized terms used in this report. For more detailed definitions and examples, see Appendix B: Discussion of Definitions.

Digital distribution. A method for distributing games through digital storefronts or services, rather than through physical media such as discs or cartridges.

Historical game. A game produced for a platform or operating system that is no longer in production or being supported. Many of these games have fallen out of release due to the discontinuation of their original platform.

Historical game platform. A game platform or operating system that is no longer in production or being supported.

In release. For the purposes of this study, a game is considered to be “in release” if the game, or a version of the game derived from its original release—including emulated, modified, or re-implemented versions of the original game—is reasonably, readily, and legally available from the game’s rightsholder, either in physical or digital format, for a currently produced or supported game platform. This does not include remakes of the game or versions of the game that are substantially different from the original.

Microconsole. A dedicated video game console that includes a curated library of historical video games, usually focusing on a single video game platform and usually produced by the platform’s rightsholder.

Port. A version of a game that has been rewritten, modified, or emulated to run on a platform other than the one it was originally designed for.

¹¹³ The staff from the Video Game History Foundation pre-reviewed 218 games from our datasets (particularly for the Game Boy family), partially to ensure that our definitions of release status were suitable for our researchers and partially to figure out how to work with unusual game distribution sources, such as Antstream Arcade, which is not searchable without registering for the service.

time of the study, it was considered in release, and the researcher noted this in their spreadsheet.

Each team of researchers worked from a separate Google Sheet containing the datasets for this study, where the individual members of each team collaboratively recorded their findings. After each team had completed their research, discrepancies between the two datasets were manually resolved by the staff at the Video Game History Foundation, who also reviewed each team's results for accuracy. VGHF staff examined all entries where researchers added a note about the game's availability, as these were the most likely to be unusual or uncertain cases.

Data was collected from January 31–April 15, 2023. Any changes to game availability after those dates was not captured in this study. In the interest of reproducibility and transparency, we accompanied our publication of this study on the research repository Zenodo with our instructions for volunteer researchers and the final remediated dataset.¹¹⁴

¹¹⁴ Volunteer instructions and data published at <https://doi.org/10.5281/zenodo.7996492>.

Results

Total Population of Historical Games

From our sample of all games published in the United States before 2010 ($n = 1500$), 13.27% of historical games ($\pm 2.5\%$, 95% CI) are in release.

Table 3. Availability of historical games, by period

Period of original release	Games in sample (%)	Games from period in release (%)
1960–1964	1 (0.07%)	0 (0.00%)
1965–1969	2 (0.13%)	0 (0.00%)
1970–1974	17 (1.13%)	0 (0.00%)
1975–1979	112 (7.47%)	1 (0.89%)
1980–1984	219 (14.60%)	8 (3.65%)
1985–1989	169 (11.27%)	26 (15.38%)
1990–1994	269 (17.93%)	52 (19.33%)
1995–1999	225 (15.00%)	32 (14.22%)
2000–2004	240 (16.00%)	36 (15.00%)
2005–2009*	246 (16.40%)	44 (17.89%)

unavailable, we found that other editions originating from different platforms had been reissued more frequently (36 of 382, or 9.43%). eg., while the original arcade version of the 1979 shoot-'em-up game *Galaxian* is widely available, the Commodore 64 version is not.

This fits our definition of an abandoned ecosystem. Despite the historical significance of the Commodore 64 platform, the game library has largely been commercially abandoned and titles are rarely reissued.

Averaged over five-year periods, the percentage of historical games in release ranges from 0.89% to 19.33% (see table 3).¹¹⁵ Based on these averages, there is a dramatic change in game availability before and after 1985. Pre-1985, the average reissue rate is 2.59%; from 1985–2009, the average reissue rate is 16.49%.

Abandoned Ecosystem: Commodore 64

From our sample of Commodore 64 titles published in the United States ($n = 400$), 4.5% of Commodore 64 games ($\pm 4.3\%$, 95% CI) are in release.

The vast majority of reissued Commodore 64 games in this sample (15 of 18) were only available through a single distributor, Antstream Arcade. For games that were

¹¹⁵ For this analysis by period, one game released in 2010 but copyrighted in 2009, which was erroneously included in our sample (see footnote 111), was counted as a 2009 release.

Neglected Ecosystem: Game Boy Family

From our study of all known Game Boy family titles, ($n = 1873$), 5.87% of Game Boy games ($\pm 0.0\%$, 100% CI) are in release. See table 4 for a breakdown by platform.

Table 4. Availability for Game Boy games, per platform

Platform	Games in release (%)
Game Boy	29 (5.70%)
Game Boy Color	12 (2.71%)
Game Boy Advance	69 (7.48%)

121 of the 155 Game Boy family titles that were previously available on the Nintendo 3DS and Wii U Virtual Console storefronts in North America are no longer available in any form¹¹⁶ (see “Shutdown of Nintendo 3DS and Wii U Storefronts” for details).

These results match our definition of a neglected ecosystem. Despite Nintendo’s active interest in continuing to reissue Game Boy family titles, the reissue rate for the platforms is only slightly improved over our results for the abandoned Commodore 64 ecosystem (and in fact is within the Commodore 64 sample’s margin of error).

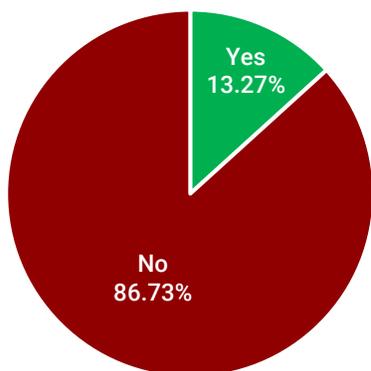


Figure 2. Availability rate of historical games. ($n = 1500$, $\pm 2.5\%$, 95% CI)

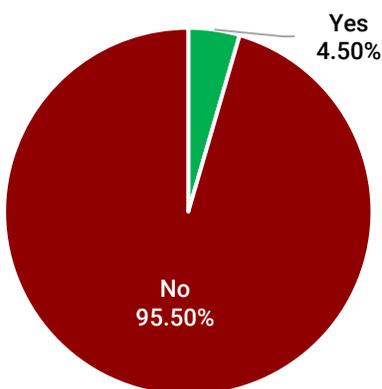


Figure 3. Availability rate of Commodore 64 games. ($n = 400$, $\pm 4.3\%$, 95% CI)

Active Ecosystem: PlayStation 2

From our sample of PlayStation 2 titles published in the United States ($n = 400$), 12.0% of PlayStation 2 games ($\pm 4.3\%$, 95% CI) are in release.

Although we did not identify every source of availability for each game, our findings show a high diversity of game sources for PlayStation 2 games, including Steam store for PC, the PlayStation Store for PlayStation 4 and PlayStation 5 consoles, the PlayStation Plus Premium subscription service, the Microsoft Store for Xbox consoles, the Nintendo Store for the Nintendo Switch console, the Epic Games Store for PC, and Apple’s App Store for iPhone and iPad. This indicates a high level of commercial activity beyond a single platform owner or service.

Relative to the other platforms we examined, the PlayStation 2 does fit our definition of an active ecosystem, with games being reissued at a higher rate through a wider variety of services, stores, and platforms. However, we were surprised

¹¹⁶ This figure includes 47 Game Boy titles, 25 Game Boy Color titles, and 49 Game Boy Advance titles.

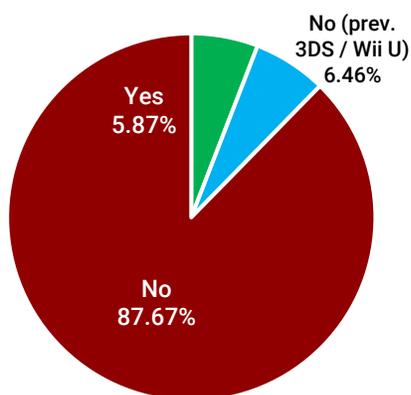


Figure 4. Availability rate of Game Boy games, including titles at percentage of titles previously available on the Nintendo 3DS and Wii U Virtual Consoles. ($n = 1873$, $\pm 0.0\%$, 100% CI)

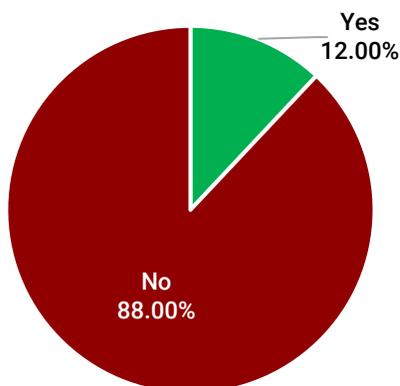


Figure 5. Availability rate of PlayStation 2 games. ($n = 400$, $\pm 4.3\%$, 95% CI)

that the availability rate for PlayStation 2 games was so low, roughly statistically even with the reissue rate for all pre-2010 video games. That said, it is more than double the reissue rate of the Game Boy family libraries, indicating a relatively high level of commercial interest and activity.

Specific to the PlayStation 2 ecosystem, technical issues with legacy digital storefronts prevented a portion of the games in this sample, which are still technically in commerce, from being accessed by layusers (see “Service Degradation of PlayStation 3 and PlayStation Vita Storefronts”).

Degradation of Digital Game Platforms and Reissue Availability

In the process of collecting data for this study, we experienced several disruptions to legacy digital game stores that affected access to a significant number of game reissues. We offer our observations on these problems due to their scale and their impact on the results of this study.

Shutdown of Nintendo 3DS and Wii U Storefronts

As discussed in “Methodology and Definitions,” the Nintendo 3DS and Wii U digital stores were shut down by Nintendo on March 27, 2023, removing an estimated 1,000 digital-only titles from release, including several hundred games released through Nintendo’s Virtual Console storefronts in North America. Since these store closures were scheduled to take place during the data collection phase of this study, we instructed our volunteer researchers to assume that 3DS and Wii U releases were no longer available and to note when they appeared in our dataset.

Although we anticipated these store closures, their impact on the study was larger than expected. As mentioned earlier in this section, the 3DS and Wii U store closures removed 121 Game Boy titles from release. Based on our total assessment of the Game Boy ecosystem, these delistings comprise 6.46% of the entire Game Boy library—slightly more than the 5.87% of Game Boy titles that remain in release. In effect, the Nintendo 3DS and Wii U store closures in March 2023 removed the majority of all Game Boy reissues at that time from the marketplace.

Service Degradation of PlayStation 3 and PlayStation Vita Storefronts

During this study, we also discovered that the PlayStation 3 and PlayStation Vita digital stores had experienced such a degradation in service quality that they were effectively unusable. Even though these legacy digital storefronts remain online, digital games for these platforms are practically unavailable due to serious technical issues.

The PS3 and Vita stores are a major source of game reissues. According to lists compiled by fans, between both platforms, a total of 266 PlayStation 1 games,¹¹⁷ 104 PlayStation 2 games,¹¹⁸ and around 304 PlayStation Portable (PSP) games¹¹⁹ were made available in North America as of April 2023, in addition to remastered versions of individual titles, such as *God of War II HD* and *Killzone HD* on the PS3. In response to public outcry, Sony committed to keeping the PS3 and Vita storefronts open indefinitely in 2021.¹²⁰ However, the Video Game History Foundation staff and volunteers found that we could not access the stores using a new PlayStation Network (PSN) account, which instead returned an error message.

According to posts on Reddit discussion groups for PlayStation users,¹²¹ the issue appears to be related to new security measures enabled for PSN accounts starting in 2016,¹²² which are not supported on the PS3 or Vita.¹²³ As a result, the platforms have been experiencing prolonged network issues. We discussed these issues with Video Game History Foundation community members, who noted that this problem has been ongoing for months or perhaps years, with no sign that these aging legacy PSN services will be (or can be) updated to resolve it. While Sony has not acknowledged these network issues, we consider the widespread experiences of players to be valuable and trustworthy for understanding this situation.

Sony does not offer a solution to this problem or inform users that their security settings may affect access to network services. We were only able to access the PS3 and Vita stores by using a

¹¹⁷ “List of Downloadable PlayStation Games (North America),” Wikipedia, last modified April 11, 2023, [https://en.wikipedia.org/w/index.php?title=List_of_downloadable_PlayStation_games_\(North_America\)&action=history](https://en.wikipedia.org/w/index.php?title=List_of_downloadable_PlayStation_games_(North_America)&action=history).

¹¹⁸ “List of PlayStation 2 Classics for PlayStation 3,” Wikipedia, last modified December 3, 2022, https://en.wikipedia.org/wiki/List_of_PlayStation_2_Classics_for_PlayStation_3.

¹¹⁹ dumlaox, “Complete list of PSP/minis/PSone Games Playable on Vita,” Cheap Ass Gamer, Forum Post, February 23, 2012, <https://www.cheapassgamer.com/topic/281768-complete-list-of-pspminispone-games-playable-on-vita/>.

¹²⁰ Jim Ryan, “PlayStation Store on PS3 and PS Vita Will Continue Operations,” *PlayStation.Blog*, April 19, 2021, <https://blog.playstation.com/2021/04/19/playstation-store-on-ps3-and-ps-vita-will-continue-operations/>.

¹²¹ u/MrShadowDUH, “Can’t log into PSN on my PS3 anymore,” Reddit post, April 30, 2020, https://www.reddit.com/r/PS3/comments/gavyqr/cant_log_into_psn_on_my_ps3_anymore/; u/ToastyBaguette641, “Problems with PS Store on PS3,” Reddit post, December 16, 2021, https://www.reddit.com/r/playstation/comments/ri352f/problems_with_ps_store_on_ps3/; u/tinyvast-com, “Here’s what to try if you can’t log in to PSN on your PS3 using a Device Setup Password. This may also work if it’s just the PS Store that logs you out of PSN.,” Reddit post, June 8, 2022, https://www.reddit.com/r/PS3/comments/v7t591/heres_what_to_try_if_you_cant_log_in_to_psn_on/; u/SpaceyBS, “Can’t sign in into ps store on vita,” Reddit post, November 8, 2021, https://www.reddit.com/r/vita/comments/qpwtkc/cant_sign_in_into_ps_store_on_vita/.

¹²² PlayStation (@PlayStation), “2-step verification feature for PlayStation Network accounts launches tonight, offers additional security: <http://play.st/2c96IUh>,” Twitter, August 25, 2016, <https://twitter.com/PlayStation/status/768674279101575172>.

¹²³ “2-Step Verification,” PlayStation, accessed May 10, 2023, <https://www.playstation.com/en-us/playstation-network/two-step-verification/>.

workaround recommended by Reddit users.¹²⁴ Effectively, it is only possible to access the stores by relying on unofficial community support. This is a significant barrier for new and non-technical users.

Despite these game catalogs still theoretically being in commerce, in practice, we believe they are not reasonably available.¹²⁵ This means that as many as 674 PlayStation games reissued in North America may have fallen back out of release—over four times the number affected by the Nintendo 3DS and Wii U Virtual Console closures. In our study, these technical issues affected 4 of 400 entries in our sample of PlayStation 2 games (1.0%), as well as an assortment of PlayStation 1, PlayStation 2, and PSP titles in our sample of pre-2010 historical games (12 of 1500, or 0.8%).

¹²⁴ u/MrShadowDUH, “Can’t log into PSN.”

¹²⁵ See footnote 151 for an explanation of the term “reasonably available.”

Summary of Findings

Our study shows that most historical video games are no longer in release. Compared to studies of other creative mediums, the availability rate of pre-2010 video games (13 percent) is similar to the commercial availability of pre-World War II audio recordings (10 percent or less)¹²⁶ or the survival rate of American silent-era films (14 percent).¹²⁷ Those studies, which describe the state of their mediums as “urgent”¹²⁸ and “alarming,”¹²⁹ deal with creative works that are over a century old. While video games are a younger medium—99.5 percent of the games in our sample were released in the last 50 years—they are already facing a similar availability crisis to media from the turn of the 20th century.

The dire state of availability is consistent across platform ecosystems and time periods. All three platform libraries examined for this study—the Commodore 64, the Game Boy family, and the PlayStation 2, representing a range from 1982–2013—have poor reissue rates, regardless of the level of commercial interest in the platform. Despite Nintendo’s active efforts to recommercialize the Game Boy family, the reissue rate for Game Boy games (5.9%) is similar to the reissue rate for Commodore 64 titles (4.5%), meaning both platforms are effectively abandoned. Of the three platforms we studied, the PlayStation 2 library has the highest reissue rate, though it only reaches 12 percent, which is slightly below (and roughly statistically even) with our results for all pre-2010 video games.¹³⁰ Availability rates never rise above 20 percent for any five-year period examined in this study.

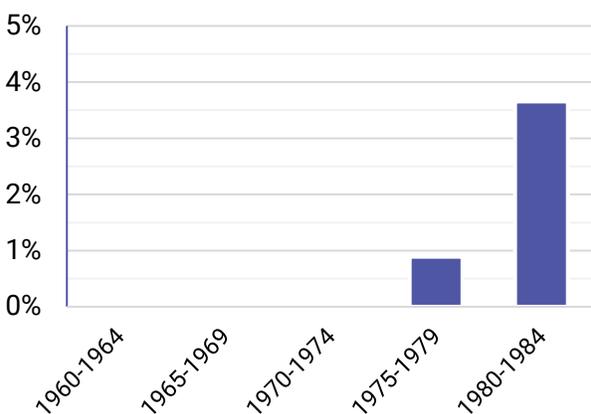


Figure 6. Availability rate of historical games, by period, 1960–1984.

Notably, video games from the early formative period of the game industry have the lowest availability of any range in this study. In our overall sample, games released prior to 1985 have an especially poor reissue rate of 2.59% (see figure 6). More granularly, only 1 of the 132 games in our sample released before 1980 has been reissued. Additionally, the Commodore 64—an important platform for the 1980s computer game industry—showed both the lowest availability rate and the lowest diversity of reissue sources out of any ecosystem we examined. This early period of the game industry is among the most

¹²⁶ Brooks, *Survey of Reissues*, 13.

¹²⁷ Pierce, *The Survival of American Silent Feature Films*, 21.

¹²⁸ Brooks, *Survey of Reissues*, 14.

¹²⁹ Pierce, *The Survival of American Silent Feature Films*, viii.

¹³⁰ The fact that the reissue rate for all pre-2010 video games is fairly close to the reissue rate for our most active ecosystem implies that there are ecosystems with higher levels of commercial activity not identified in this study (see “Directions for Future Study”).

significant for video game researchers and historians: Mark J. P. Wolf, editor of the volume *Before the Crash: Early Video Game History*, argues that the North American video game industry crash from 1983–1985 “separates early and later video game history as dramatically as the coming of sound separates sound film and silent film in film history.”¹³¹ Yet these games also are the least commercially available. This demonstrates that the interests of the marketplace do not currently align with the needs of researchers.

Although we found that digital distribution is the primary method of distributing game reissues, we also noticed several warning signs that commercial digital distribution is not a long-term guarantee of availability, particularly when there is a low diversity of reissue sources. In fact, we identified several cases where games that were digitally reissued have already fallen back out of release. Previously, 6.56% of the Game Boy family library was only available through the now-shuttered Nintendo 3DS and Wii U Virtual Console storefronts and is no longer available in any form. In another instance, over 600 PlayStation game reissues on the PlayStation 3 and PlayStation Vita stores are practically inaccessible due to technical issues, despite still theoretically being in commerce. Games released from 2005–2009—the beginning of the era of digital distribution¹³²—showed no major increase in availability over earlier periods, suggesting that digitally distributed games may fall out of release as easily as other formats.

From the samples in this study alone, we identified another case where low reissue source diversity will be a risk factor in the future. A single game service, Antstream Arcade, accounts for the majority of all Commodore 64 game reissues; without the presence of Antstream Arcade, the reissue rate for our Commodore 64 sample would have dropped to an abysmal 0.75%, setting up the service as a single point of failure for the entire Commodore 64 ecosystem. Other ecosystems, not examined in this study, may have their own single points of potential marketplace failure.

Conclusions

The results of this study are striking, but unfortunately not surprising. By examining a variety of platform ecosystems representing different eras and platforms, we have proven that the poor availability of historical games is not the fault of any single company or platform owner. Regardless of the level of commercial interest or rightsholder activity, the same issues recurred across all samples: low reissue rates, particularly for older titles valuable to researchers, and platform volatility that causes digitally reissued games to fall back out of release. This is a systemic problem and a crisis for the entire medium of video games.

¹³¹ Mark J. P. Wolf, *Before the Crash: Early Video Game History*, (Detroit: Wayne State University Press, June 2012), 2.

¹³² Although we identified 2010 as roughly the start of the digital distribution era, the platforms and infrastructure for digital game distribution were rolled out a few years earlier. 2005–2006 saw the release of three major game consoles that natively supported digital game distribution: the Nintendo Wii, the PlayStation 3, and the Xbox 360. 2005 also marked the first year when the game store Steam distributed titles published by external developers, marking the beginning of its long run as the most dominant digital computer game store. Rich Stanton, “Full Steam Ahead: How Valve’s Platform Just Gets Hotter,” *Eurogamer*, August 21, 2012, <https://www.eurogamer.net/full-steam-ahead>.

The video game industry has undeniably taken strides towards reissuing more historical titles, which should be commended. But it's not enough. Collectively, the game industry has recommercialized less than one-fifth of all historical games, leaving nearly 90 percent of their historical output unavailable from the rightsholders. And as more legacy digital game stores offer signs that they are preparing to shut down,¹³³ even more games and reissues will be endangered.

As a result, researchers interested in playing historical titles ignored by the commercial industry are left with few options. They can try to acquire vintage games and hardware from the increasingly prohibitively expensive second-hand market; they can go to great lengths to use library collections in person for extended periods of time; or—perhaps the path of least resistance—they can resort to piracy. This is not an acceptable state for such a culturally important medium.

Ultimately, like any media business, the game industry has its own commercial priorities, and they cannot be expected to carry the responsibility for preserving every video game. Instead, the commercial industry and cultural institutions must work together to fix the future of game preservation. While it may seem hard to reconcile the interests of the marketplace with the needs of researchers, the first step towards solving this crisis is for the game industry to acknowledge that the commercial market on its own cannot meet those needs or close the preservation gap. With greater tools and support, libraries and archives can help improve access to the overwhelming majority of games that fall outside the commercial interests of the game industry and have not been—and may never be—reissued.

Directions for Future Study

These results offer numerous paths for future research to examine specific aspects of the game reissue market more closely.

This study preselected three platform ecosystems with varying levels of commercial activity to analyze their reissue rates. Besides conducting surveys of additional platforms, future research could also do the inverse, looking at which games are reissued, determining their platforms of origin, and finding which ecosystems are most and least commercially active. This is especially interesting as all three ecosystems examined by this study are below the availability rate of our overall sample, suggesting other ecosystems (such as computer games, which may be easier to reissue, see footnote 22; or platforms with the most viable commercial emulation options) may be exceptionally active, while others may be even less active than the Commodore 64.

Although this study broadly concludes that the commercial market's interests do not necessarily align with the needs of researchers, additional research can explore more specific collections of historically interesting titles and whether they have been reissued. Researchers could develop criteria for identifying historical significant games (eg., aggregating published lists of influential or well-

¹³³ Peters, "The Xbox 360 Store"; Jay Peters, "Sony Didn't Close the PS3 and Vita Stores, But It's Making it Hard to Shop at Them," *The Verge*, October 6, 2021, <https://www.theverge.com/2021/10/6/22713526/sony-ps3-vita-buy-games-credit-debit-card-paypal>.

received games), then determine their release rates and identify commonalities between unavailable titles.

This research also leaves unanswered questions about the availability rates of digital-only games and the makeup of digital store catalogs. Future studies could examine these areas and draw more detailed conclusions about the extent to which digitally distributed games and digital game services are at risk, including games released during or after 2010.

Given the importance that libraries, archives, and museums will likely play in providing access to commercially unavailable games, future studies could look more closely at the specific unavailable games and abandoned ecosystems identified in this study and determine what percentage of them are currently held in archival gaming collections. Researchers could also examine the collections of specific institutions and determine what percentage of their holdings are out of release.

Appendices

Appendix A: Updates to Game Boy Datasets

Our data source for this research, MobyGames, is continually updated by community members to represent a more complete set of historical video games. On June 28, 2022, around when we first retrieved our datasets, the MobyGames database included 27,627 video games released in the United States prior to 2010.¹³⁴ By the conclusion of the data-gathering phase of this study in April 2023, that number had grown to 28,743, an increase of 4.04 percent.¹³⁵ MobyGames is a dynamic, constantly growing database, which we decided was acceptable for the randomized samples used in this study.

However, we also decided to study the Game Boy family ecosystem in full, rather than as a random sample. We recognized that some titles were likely missing from the Game Boy datasets we retrieved from MobyGames, and in an effort to represent the ecosystem as completely as possible, we identified the remaining titles by exploring additional data sources.

We determined missing games by comparing the MobyGames data against other publicly accessible lists of Game Boy titles released in the United States, specifically:

- Lists of Game Boy family titles released in North America compiled by editors on Wikipedia.¹³⁶
- The catalog on the game collection tracking website PriceCharting.¹³⁷
- The Game Boy enthusiast community website Game Boy Database.¹³⁸
- Nintendo of America’s own internal list of approved Game Boy and Game Boy Color titles, published around 2004.¹³⁹

A missing game was only added to the dataset if we could find evidence of a physical copy, usually by finding a photograph on the auction site eBay. American releases were identified by the product codes on the game cartridges, which end in “USA,” indicating the game was released in the United States. If necessary, we were also able to identify US-release games by the content rating on the

¹³⁴ Tracy Poff, email message to author, June 28, 2022.

¹³⁵ Tracy Poff, email message to author, April 15, 2023.

¹³⁶ “List of Game Boy Games,” Wikipedia, last modified May 4, 2023, https://en.wikipedia.org/wiki/List_of_Game_Boy_games; “List of Game Boy Color Games,” Wikipedia, last modified May 4, 2023, https://en.wikipedia.org/wiki/List_of_Game_Boy_Color_games; “List of Game Boy Advance Games,” Wikipedia, last modified May 7, 2023, https://en.wikipedia.org/wiki/List_of_Game_Boy_Advance_games.

¹³⁷ PriceCharting, last accessed May 10, 2023, <https://www.pricecharting.com/>.

¹³⁸ Game Boy Database, last accessed May 10, 2023, <https://www.game-boy-database.com/>.

¹³⁹ “Game Boy,” Nintendo, Internet Archive. “Game Boy Color Games,” Nintendo, Internet Archive, June 10, 2004, https://web.archive.org/web/20040610021821/http://www.nintendo.com/consumer/downloads/cgb_games.pdf. Notably, Nintendo of America has categorized non-game software titles such as *InfoGenius Productivity Pak: Frommer’s Travel Guide* as “games,” despite their exclusion from MobyGames (see footnote 79 in “Introduction to Datasets”).

packaging assigned by the Entertainment Software Rating Board, the video game industry regulatory body for North America; or by the oblong Official Nintendo Seal used to authenticate products approved for release by Nintendo of America, to distinguish them from European releases which used a circular seal.¹⁴⁰ As before, we omitted game bundles in which multiple standalone Game Boy titles were sold together, even if that bundle pack had a unique product code.

The final audit identified 211 additional titles: 24 for Game Boy, 38 for Game Boy Color, and 149 Game Boy Advance. In most cases, titles were missing from the MobyGames dataset because they were assigned genre tags we had chosen to omit from our data;¹⁴¹ because they had only been cataloged for their Japanese or European releases; because they fell outside the scope of what MobyGames defines as a video game;¹⁴² or because they had not yet been included in MobyGames when our datasets were retrieved.



Figure 7. A copy of *Tumble Pop* listed on eBay by user `ds_vintagegames_electronics`. The product code is printed on the upper-left corner of the cartridge label.

For example, the Game Boy version of the game *Tumble Pop* was released in North America in 1992. At the time of this study, only the Japanese release of the game had been cataloged in MobyGames,¹⁴³ which prevented it from being captured by our API query for games known to have been released in the United States. We identified *Tumble Pop* through the list of Game Boy titles on Wikipedia, verified the existence of an American version of *Tumble Pop* on PriceCharting,¹⁴⁴ then located a copy of *Tumble Pop* on eBay with the product code DMG-T6-USA, confirming that it was released in the United States (see figure 7).¹⁴⁵

Additionally, we identified and removed one false positive in the MobyGames data, *Jimmy White's Cueball* for Game Boy Color. The game was released in Europe with the product code CGB-BJWP-EUR.¹⁴⁶ However, the corresponding American release (CGB-BJWP-USA, hypothetically) does not appear to exist, and we could not locate this version of the game on PriceCharting or any auction site. Based on historical press coverage, we determined that the American version of *Jimmy White's Cueball* was suddenly canceled only one month before its

¹⁴⁰ “Official Nintendo Seal,” Super Mario Wiki, last modified May 1, 2023, https://www.mariowiki.com/Official_Nintendo_Seal.

¹⁴¹ In particular, the ‘Compilation’ genre tag, which we omitted from our data in order to automatically filter out repackaged editions of existing games, had been applied to 38 Game Boy family titles that constitute original works, such as *Game & Watch Gallery 4* (see footnote 80 in “Introduction to Datasets”).

¹⁴² As discussed in “Introduction to Datasets,” we could not find a formal policy for what MobyGames does or does not consider a video game, versus what they consider non-game software.

¹⁴³ “Tumble Pop,” MobyGames, Internet Archive, February 28, 2023, <https://web.archive.org/web/20230228231304/https://www.mobygames.com/game/24846/tumble-pop/releases/>.

¹⁴⁴ “Tumble Pop,” PriceCharting, last modified December 22, 2022, <https://www.pricecharting.com/game/gameboy/tumble-pop>.

¹⁴⁵ “Tumble Pop Nintendo Game Boy game cartridge with manual RARE!! AUTHENTIC TESTED,” eBay, Internet Archive, <https://web.archive.org/web/20230228013337/https://www.ebay.com/itm/265587311996>.

¹⁴⁶ “Jimmy White’s Cueball,” MobyGames, Internet Archive, February 28, 2023, <https://web.archive.org/web/20230228233430/https://www.mobygames.com/game/54584/jimmy-whites-cueball/releases/>.

scheduled release date;¹⁴⁷ the record on MobyGames seems to be based on outdated information about the game's release status taken from an entry on the long-running game press website IGN.com.¹⁴⁸

Since our analysis of the Game Boy ecosystem is meant to be based on a complete population and not a random sample, we felt it was appropriate to incorporate these updates into the final remediated dataset. In the interest of transparency and reproducibility, in our published data, we added a note to each of these games identifying that they were added post hoc, as well as including the complete list of the missing titles as a separate dataset. Because volunteer researchers had already been assigned their sections of the MobyGames dataset by the time these additional games were identified, the games were added after volunteers completed their work, and their release status was determined by Video Game History Foundation staff.

At the time of publication, we had begun submitting updates for these titles to MobyGames in order to increase the site's accuracy for future study. Due to the long waiting list to approve changes to MobyGames, these corrections may not be incorporated into the database until over a year after this study is published.

¹⁴⁷ IGN Staff, "Jimmy White's Cue Ball," *IGN*, May 20, 2012, <https://www.ign.com/articles/2000/05/25/jimmy-whites-cue-ball>; "Select Games," *Tips & Tricks*, August 2000, 69.

¹⁴⁸ "Jimmy White's Cueball," *IGN*, last accessed May 10, 2023, <https://www.ign.com/games/jimmy-whites-cueball>.

Appendix B: Discussion of Definitions

Digital distribution. A method for distributing games through digital storefronts or services, rather than through physical media such as discs or cartridges. This allows users to download or stream games directly to their devices. Since the late 2000s, the game industry has largely pivoted to this type of digital game distribution, which as of March 2023 accounts for 94 percent of game revenues.¹⁴⁹ While all video games are digital in nature, we use the terms “digital distribution” to refer to this specific mode of publishing that does not involve physical copies of titles.

Historical game. A game originally produced for a platform or operating system that is no longer in production or being supported. Many of these games have fallen out of release due to the discontinuation of their original platform. These are often referred to as “retro games” or “classic games” by the gaming community. The exact definition of a retro or classic game is difficult to define and frequently debated, but for this study, we examined games released before 2010. Every game included in this study was at least 14 years old at the time of publication. Given the rapid obsolescence of game technology, we feel this is a reasonable period to consider a game historical rather than current.

Historical game platform. A game platform or operating system that is no longer in production or being supported. When a game platform manufacturer releases the next generation of their game console line, they will typically continue manufacturing the older platform for several years. In most cases, the manufacturer will announce the discontinuation of the older platform, clearly denoting that the system is no longer supported and can be considered historical.

This distinction is more difficult to make when evaluating a long-running operating system, such as Windows or Apple’s iOS. However, there is no dataset in this study that requires us to determine whether any version of an operating system is considered historical.

In release. For the purposes of this study, a game is considered to be “in release” if the game, or a version of the game derived from its original release—including emulated, modified, or re-implemented versions of the original game—is reasonably,¹⁵⁰ readily, and legally available from the game's rightsholder, either in physical or digital format, for a currently produced or supported game platform. This does not include remakes of the game or versions of the game that are substantially different from the original.

In the interest of a broad definition of “in release” that acknowledges the efforts by video game publishers to keep games available in any form, this study does not address questions about whether

¹⁴⁹ Deane, “Digital Games.”

¹⁵⁰ We chose the term “reasonably available” because of its widespread use in making fair use determinations about the commercial availability of copyrighted works and its explicit use in the Code of Federal Regulations when discussing exemptions in the Digital Millennium Copyright Act for preserving video games and computer software. 37 C.F.R. § 201.40 (2022). We did not attempt to define this term further and left its application up to the discretion of our volunteer researchers.

re-releases or remasters of games are derivative works. Essentially, if any release of the original game is commercially available, it is considered to be in release.

However, because of the complex differences between different editions of games, we did not attempt to define what makes two versions of a game “substantially different.” Major attributes we identified are whether or not the versions of the games are functionally similar, whether they have notably different features, whether the differences between versions are due to significant technological differences between their platforms, and whether these versions of the game could be substituted for one another for general research purposes.¹⁵¹ Essentially, a version of a game could be considered a separate release if it is a unique expression of the original work.

We left the first determination of whether a game is in release to the discretion of our volunteer researchers. When it was unclear whether two versions of a game were “substantially different,” we encouraged our volunteer researchers to count them as the same release. To assist with the reproducibility of this study, we included detailed notes about our determinations for unusual and borderline cases.¹⁵²

We have included several examples of this definition of “in release”:

- A substantially different version of a game for another platform is not considered the same game. eg., the original arcade version of *Mortal Kombat* is substantially different from the Game Boy version of *Mortal Kombat*. The original *Mortal Kombat* has detailed live-action graphics and is notable for its fast-paced, extreme violence; the Game Boy version of *Mortal Kombat* is a separate version of the game redesigned for the platform’s low-end hardware, with significantly reduced, less-violent content. The release status of the arcade version of *Mortal Kombat* does not affect the release status of the Game Boy version, and vice versa.
- In almost all cases, a version of a game released for the original Game Boy platform is considered a separate game. The Game Boy had significant technological differences from other game platforms on the market, most notably a low-resolution monochrome screen, which required games to be redesigned for the platform.
- The distinction between separate versions is not always made in the MobyGames database used by this study. eg., these two versions of *Mortal Kombat* are treated as the same title in MobyGames, despite being substantially different. In these cases, when dealing with a dataset for a specific platform, we looked at the release status of that platform’s version of the game; otherwise, we looked at the release status of the original version of the game.

¹⁵¹ We acknowledge there are research reasons to study less significant differences in content or presentation between versions of games, particularly in the context of platform studies or close reads of individual titles. Our broad definition of “in release” for this study is not meant to disregard those other uses but rather to give us the most broadly applicable reading of game availability.

¹⁵² Data published at <https://doi.org/10.5281/zenodo.7996492>.

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- In a similar example, the arcade version of *Marble Madness* and the Game Boy Color version of *Marble Madness* are very similar and contain roughly the same content. However, the limited resolution of the Game Boy Color required the game to be redesigned to fit on the platform's screen. Despite their similarities, this version of the game should be considered a separate game from the original.
 - As a counterexample, Nintendo republished several Nintendo Entertainment System (NES) games on the Game Boy Advance platform as part of the "Classic NES Series" collection. Despite minor presentation differences to fit the games on the Game Boy Advance's screen, these versions of the games are effectively identical to the originals and would be considered the same game. For instance, although the Classic NES Series version of *Metroid* is not in distribution, we would still count the game as being in release because the original NES version is available.
 - A complete remake of a game, not using the code and assets of the original version, is considered a separate release. eg., *Shadow of the Colossus* was released for the PlayStation 2 in 2005. An enhanced version of the game, released for the PlayStation 3 in 2011, is considered a re-release of the original game. However, *Shadow of the Colossus* was also re-created from scratch for the PlayStation 4 in 2018 by a different developer. While the 2018 remake is very similar and faithful to the original *Shadow of the Colossus*, it is considered a separate game from the 2005 original and its 2011 re-release.
 - However, a reconstructed version of a game that is practically identical to the original would be considered the same game. eg., *Sonic Origins* is a game from 2022 that includes new versions of the first three *Sonic the Hedgehog* games that have been completely reconstructed from the ground up. Although these are technically not the original games anymore, they are still functionally identical to the originals and, with a few notable exceptions, use the same audiovisual assets. For the purposes of this study, *Sonic Origins* would be considered a reissue of the original *Sonic the Hedgehog* games.
 - The inclusion of a game in a compilation set counts as the game being in release, but the compilation set may also be considered a separate game. eg., the compilation set *Mega Man Legacy Collection* includes the first six *Mega Man* games. Because *Mega Man Legacy Collection* is currently available to purchase, these six games are considered to be in release. However, *Mega Man Anniversary Collection*, a similar but distinct compilation set produced ten years prior to *Legacy Collection*, is no longer available and is not considered to be in release. *Legacy Collection* and *Anniversary Collection* are separate games with separate release statuses, regardless of the availability of their constituent games.
 - Likewise, an enhanced version of a game with significant additional features is still considered a re-release of the original game, but it is also considered a separate game that may itself not be available. eg., *Super Mario Bros. Deluxe* for the Game Boy Color (*SMBDX*) is

a re-release of the original *Super Mario Bros.* game from 1985 that includes a substantial number of new modes and features, enough to distinguish it as its own game. As such, *SMBDX* would be considered a re-release of *Super Mario Bros.*, but *Super Mario Bros.* being in release does not mean that *SMBDX* is also in release.

- New versions of games based on the same source material are considered separate games. eg., different video games based on the board game Monopoly were released for the Nintendo Entertainment System in 1991; for PlayStation in 1997; and for the Nintendo 64 in 1999. Although these are all adaptations of the same board game, they are distinct video games with their own designs, developed by different people. The release status of one version of *Monopoly* does not affect the others.
- Occasionally, historical games will be re-released in limited quantities in their original format by a specialty publisher for the game collecting market. eg., a game originally released for the Super Nintendo Entertainment System may be reissued in limited quantities as a Super Nintendo cartridge. Because the hardware needed to play these games is no longer in production—and because of the deliberately limited quantities of these releases—we do not consider these to be reissues for the purposes of this study.
- A game that has been released into the public domain, has been released in its entirety as open source (including all game content), or is being distributed for free with the consent of the rightsholder is only considered to be in release if the game is readily available for a user to play on a current platform (eg., a user can download and play the game rather than needing to compile it from source code).
- No distinction is made in this study between games that were originally distributed through retail, digital storefronts, mail-order, shareware, freeware, or any other distribution or sales method. The focus is entirely on whether the game is currently legally available from its rightsholder.

Microconsole. A dedicated video game console that includes a curated library of historical video games, usually focusing on a single video game platform and produced by the platform’s rightsholder. The games on these platforms are usually presented via emulation rather than reproducing the game console’s original hardware. For example, in 2016, Nintendo released the NES Classic Edition, a miniature console mimicking the form factor of the original Nintendo Entertainment System, which included emulated copies of 30 popular Nintendo Entertainment System games. The NES Classic Edition is credited with popularizing the concept of microconsoles¹⁵³ and was followed by systems such as the Sega Genesis Mini, the PlayStation

¹⁵³ Devindra Hardawar, “PlayStation Classic Review: A Disappointing Dose of Nostalgia,” *Engadget*, December 12, 2018, <https://www.engadget.com/2018-12-12-sony-playstation-classic-review.html>; Damien McFerran, “The Micro-Console Revolution Isn’t Over Quite Yet, It Would Seem,” *Nintendo Life*, August 10, 2021, https://www.nintendolife.com/news/2021/08/the_micro-console_revolution_isnt_over_quite_yet_it_would_seem; Andrew Webster, “Sega Genesis Mini Review: The Best Tiny Console Yet,”

Classic, and the multi-platform Evercade handheld. Sometimes these products are also known as “mini consoles” because, like the NES Classic Edition, they physically resemble a smaller version of the original platform.

Port. A version of a game that has been rewritten, modified, or emulated to run on a platform other than the one it was originally designed for. Because of technological differences in game platforms, a port might look, play, sound, or feel significantly different from the original game, particularly historical game consoles with wider differences in platform specifications. In other cases, a port may be essentially identical to the original, apart from aesthetic tweaks to fit the specifications of the platform. Whether a port would be considered the same game as the original game depends on the extent of those changes.

