Hobbyist Developers: Studying Notable Nintendo DS Homebrew Games

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ABSTRACT

Within game development are dichotomies such as commercial and non-commercial games or licensed and unlicensed games. Amateur hobbyist game developers often create unofficial games for platforms without the consent of the hardware publisher known as "homebrew" games. The following paper is a historical analysis of homebrew games for the Nintendo DS console, focusing on notable releases from these young developers. The games and project discussed were released from 2004-2013, when the handheld was still actively supported by Nintendo. This study reveals how amateur game developers developed the skills the needed to become professional programmers later, how developers from France had a notable influence on the community, and how these programmers were typically young adults or adolescents. This research contributes to video game history by exploring the releases of unofficial games and the budding scholarship on homebrew development.

Keywords

Video game history, historical analysis, amateur, hobby, game development

INTRODUCTION

As a form of mass media and entertainment, video games are commercial products. And while game development is sometimes divided into typologies such as the genre, they are frequently categorized by the labels of "AAA" or "indie," meaning games that are developed by large studios or those that are made by independent developers. And while game studies often explores these commercial games, those that have cultural relevance and influence, Keogh (2023) argues that more research should be done into non-commercial games. These types of games—made without profit motives as artistic acts—represent a subculture of game development. Through their cultural analysis, Keogh found that a growing number of game developers are marginalized by the industry and that the percentage of games made by amateurs is building.

Proceedings of DiGRA 2026

Part of these discussions into commercial and non-commercial games are licensed and unlicensed games. Hardware manufacturers such as Sony, Microsoft, Nintendo, and Valve require an approval process before allowing software to be published for their consoles and or platforms. This control means most video games for consoles are vetted through this quality assurance model, but not all. Homebrew game development is the term used for these unlicensed games, made by solo developers, and unofficially released for consoles. The following study focuses exclusively on the homebrew community and games for the Nintendo DS (NDS) handheld console, released in 2004. Not long after the console's release, hackers and developers had already created unofficial tools and libraries for publishing homebrew games, likely the fastest that unlicensed games have appeared for a closed platform. Through a historical analysis, the author found that these games explore topics of amateur and hobbyist game development and are relevant to game studies as case studies for non-commercial games.

LITERATURE

Below is the theoretical framework and the literature for studying NDS homebrew. It includes an exploration on using amateurism as a framework to study homebrew games, and how homebrew games can be seen as fan works that build a community. And lastly, it explains why unlicensed games exist and how that history explains homebrew game development.

Amateurs

Amateurs are mostly defined by what they are not: professionals. As anti-professionals, they can be individuals who engage in art or creation as a pastime rather than as a career. As a label, "amateurish" signals unqualified, unprofessional, and perhaps substandard (Knott, 2015). However, amateurs as hobbyists are foundational in the creation of the internet, especially in user-generated content and social media (Walsh, 2025). In fact, digital amateurs wield an equalizing force alongside experts through Web 2.0 participatory culture (Majumdar & Vadde, 2019).

The dichotomy of professionals and amateurs is tied up in capitalist rhetoric. Speaking about the alienation under capitalism, French theorist Henri Lefebvre said, "Let everyday life become a work of art!" (1968, p. 204). Not only does the economics of production require professionals, but the working class require artistic outlets because of the oppressive system. And yet amateur art and creation outside of work is still an extension of productivity. Late capitalism has made most forms of entertainment a prolongation of work where relaxation is supplemented with outputs and commodification (Adorno & Horkheimer, 1944).

Philosopher Bernard Stiegler conceptualized the amateur as part of the bourgeois class (2017). They argue that only those with the time and the means could devote energy and effort into becoming an amateur and adopt a semi-professional approach to their hobby. That amateurs practice an initiatory path, trying to use their hobby as gateway into professionalism (Ibid.). In addition, amateurs in particular gain their skills by mimicing the "masters" of the art, and that by copying they learn the skills and the

art (Dillet, 2017). In many ways, amateurs are fans and critics first, before they can become professionals and artists (Dillet, 2017; Majumdar & Vadde, 2019)

But other theories of amateurism stem from its etymology. Its Latin root, amator, means "the lover" or "the person who loves," signaling a connection to the love of art (Dillet, 2017). Amateurs are enthusiasts, who create art for art's own sake (Knott, 2015; Keogh, 2023). Their passion for the act in the absence of institutional recognition and monetary compensation is what define them as amateurs (Majumdar & Vadde, 2019). In this way amateurs are hobbyists who enjoy the process and not the product.

But not all amateurs are content to be outside of the economic system, especially as it relates to the video game industry (Keogh, 2023). And while there has been research into why amateur gamers professionalize into esports athletes (Hattingh et al., 2023), or the aspirational work of students in esports (Harris et al., 2022), there is little research into framing hobbyist developers as amateurs and their path toward professionalization. There are systemic issues in the transition from amateur to professional (Wong et al., 2024), and not every homebrew game developer becomes a professional.

Fan Works

While in many ways homebrew developers could be framed as indie developers, one notable point of difference is the types of games they make. A majority of homebrew games, especially the notable ones, are fan works with direct ties to existing intellectual property (IP). Thus, the literature on fan work is relevant as many of the homebrew games in this article are fan games.

Fandom is built through fan work, which is the production and maintenance of affective ties to the IP (Stanfill, 2017). Communities of fans arise as individuals collect and share these works in what Henry Jenkins calls "Participatory Culture" (Jenkins 2006 & 2012). To Jenkins, the defining aspect of fans and fandom is their collective nature of consumers as producers who share their love of the IP through their derivative creative work. This participatory culture is what has shaped Web 2.0 and how geek fandoms have become globalized and mainstream (Jenkins et al., 2015).

One of the main arguments for fan work is how it benefits the owner of the IP. These works made by fans produce material and non-material outcomes for the original companies and the fandom as a whole (Cote et al., 2024). Despite the legal right of IP owners to stutter or take down fan works; there is evidence that these fandoms benefit all of the stakeholders involved. In addition, the creative economy is built upon complementary labor that advances the careers of the creators, creates monetary value for the platform, and benefits the fans and audiences (Harris, 2022).

The relationship between players and game developers is complex, especially as fans are increasingly interested in creating fan work related to their favorite games (Brey, 2020). These relationships have been framed within the gift economy, where the playbour of the fans is given and shared freely (Ibid.). In fact, the definition and conceptual framework of "playbour"—the combination of play and labor—was built upon fan work and modding of original games (Kücklich, 2005). Thus, there is

significant literature on how these fans of video games have given back to the fandom, and the owners of the IP, through their labor and their love (Postigo, 2007).

Licensed and Unlicensed Games

The American market experienced the video game crash of 1983, where prices plummeted and players lost faith in the industry (Smith & Daum, 2016 June & 2016 July). With the success of the Famicom in Japan, Nintendo began planning their entry into the American market. Wishing to avoid the consequences of this crash, Nintendo created strict standards for third party publishers and directly controlled the production of cartridges for their American video game console (Smith & Daum, 2016 March), the Nintendo Entertainment System (NES). And to regain the public's faith in video games, they also implemented a seal of quality on every licensed NES game, ensuring that each game on their console met requirements for playability (McFerran, 2019).

The literature reveals that low-quality games hurt a console's viability as well as erodes public trust (Höglund, 2014). Thus, over time other companies tried to implement similar systems of quality assurance for their video game consoles. This includes software and DRM, as well as legal protections such as copyrights and patents (O'Donnell, 2014). Discussions of unlicensed versus licensed games matter, as the default for audiences is that games they purchase and play have undergone some quality assurance before being available on their chosen platform. Homebrew games then fall outside of this licensing.

Homebrew Games

Ethnographic research into the social groups for homebrew development have conceptualized how these communities fit within the broader video game history and indie game development. Two foundational texts that examined homebrew communities would be Brett Camper's (2005) dissertation on the Game Boy Advance (GBA) homebrew scene and Melanie Swalwell's (2021) book on early computer homebrew in Australia and New Zealand. Camper's research analyzed the cultural motivations that led to amateur game development, how it facilitates skill acquisition outside of canonical academic structure, and how amateur development opens access to professional mobility (2005). Their research captured contemporary homebrew developers who were making unlicensed games for a current platform and challenged the commercial focus of game studies research.

Swalwell's research emphasized how the computer game industry was built by amateur designers—"bedroom coders"—and the impact of their homebrew software (2021). Swalwell was able to capture and discuss the history of this community for 8-bit microcomputers after the fact, and their research also included historical analysis and interviewing the subjects years later. And while definitions of homebrew include the elements of amateurism, hobbyist serious leisure, and the fandom of non-commercial works, Swalwell created a five-point framework in order to define homebrew development. First is that it has to happen in a domestic (and not institutional) space, second those involved have to be self-taught programmers, third most homebrew games are made by a single person, fourth they were not published traditionally, and fifth their product is characterized by an experimental ethic (p. 3).

In many ways homebrew game development diverges from traditional or even indie development. Švelch found that homebrew games can be made not just for entertainment, but to showcase the developer's programming skills, to share messages to the homebrew community, or to comment on the current political climate (2013). More research has analyzed the modern practice of retro homebrew development. There are currently nostalgic developers making games for older and abandoned consoles such as the NES (Vanderhoef, 2017) or the Game Boy Color. And Wilde (2024) researched this phenomenon and provided a broad overview at nearly all consoles that currently have homebrew communities.

But returning to Camper and Swalwell, their research involved homebrew communities of the (then) current generation of video games: the GBA and the 8-bit computers. There are different motivations for amateur developers to make unlicensed games of a supported console, versus those who make games long after support is dropped by its manufacturer. The following paper is a historical analysis in line with Camper and Swalwell, looking instead at the homebrew community for the NDS during that handheld's lifespan.

METHODS

This article emerged from a larger project chronicling the history of NDS homebrew. The overall project included a mixed method approach to the historical analysis, where open-ended surveys were but a small portion. Situating this article with regard to the broader project, this article focuses exclusively on the interviews from game developers of homebrew games. There were 3 game developers who talked about their experiences making games as part of the community. As the literature review indicated, there are many different reasons and outcomes for amateur developers, that serious leisure has been categorized according to some of these uses and gratifications to reveal a depth to hobbies, and that there is a history of homebrew development with teenagers inside their home.

The larger project study of people from the NDS homebrew community drew on 14 asynchronous, open-ended surveys with developers of tools for homebrew development, hackers of the NDS hardware, as well as the game designers for some of the games released. The surveys included 10-12 open-ended questions that were tailored to each individual that was interviewed. While these questions were unique to each participant, some sample questions include "What are you proud of in your history with the DS?" "How do you think homebrew development was different back then compared to now?" "Who were key players in the community and why?" Responses to these questions were analyzed and used to supplement the other methods of historical analysis.

Participants who were determined as key individuals within the history were contacted by the author. These key figures were first identified by their screennames, and through journalistic sleuthing some were traced to their personal identification—typically emails or social media profiles. Others were recruited via snowball sampling, as individuals within the community would recommend their friends and contacts to the researcher.

The historical analysis relied upon internet archives, developer forums, personal blogs, and game databases. While some of these primary sources are still available today, many have shut down since the time period being studied (2004-2012) and the

Wayback Machine of the Internet Archive had to be consulted when broken hyperlinks arose. In particular, the forums for GBAtemp and GBAdev were analyzed as they were leading gathering places for NDS homebrew development. The PlayerAdvance forums were also analyzed to a lesser extent due to the author not speaking French and having to rely on machine-translation for the content posted there. Databases such as Gamebrew, Homebrew Hub, and Universal-DB alongside the news site DCEmu UK provided additional insight into the specific details about game releases. This historical analysis reviewed thousands of posts across these forums.

All of these sources were pieced together to triangulate a narrative about the games' histories and their development. These primary sources were used in particular with the analysis of *AlienDS* and *Aperture Science DS*, whose developers were not available for interview. But the developer of *Aperture Science DS* kept blogs that are archived online and they were interviewed for an online game magazine about the experience.

FINDINGS

Below are the results of the study into NDS homebrew games. It includes the historical analysis of four games and a project, their developers, and why they are emblematic of homebrew development. These case studies are tied to the above literature on amateurs, fan works, and homebrew games.

Warcraft Tower Defense

The homebrew scene for the Game Boy Advance (GBA) served as the cornerstone for the NDS community. Yohan Lasorsa (developer of *Warcraft Tower Defense)* said their history began in 2002 before the NDS was released. Their foray into homebrew began when they saved up and bought a linker[1] for their GBA and discovered the homebrew emulators such as PocketNES and Goomba. They were drawn into the community and played other GBA homebrew titles such as *Uranus* (ZoneGN, 2002) and *Another World* (Eric Chahi, 2005). "At that time, I was always connected on GBATemp and PlayerAdvance forums, eager to try every new thing that was released."

This excitement carried over to the new handheld console, and when the NDS released in France on March 11, 2005 Lasorsa bought it. Later that year they also bought one of the first GBA-based flashcarts[2] for the NDS, the Supercard, in part because of how cheap it was. As mentioned previously, the momentum built by the GBA homebrew community meant that NDS homebrew games quickly started to come out and were released on the PlayerAdvance forums for the French community of developers. But it was the release of the PALib at the end of 2005 that inspired Lasorsa to finally attempt to make their own homebrew games. Their interest in programming as a hobby began at the very young age of 7, but it wasn't until now that they applied this interest into learning C (the language necessary to program for the NDS).

The PALib—or Programmer's Arsenal library—was a higher-level library released by French developer Mollusk (Boudeville, 2007) that received regular updates throughout 2006 (Mollusk, 2015). PAlib was an extension of libnds—the established toolkit [3]for making homebrew NDS games—but it targeted novice or beginner programmers (QuickJump, 2007) and paved the way for the wave of student homebrew developers for the NDS. Lasorsa, using the screen name of Noda, would

create small demos and "code experiments" with PAlib during 2006, but it wasn't until 2007 that they began working in earnest on *Warcraft Tower Defense* (WTD).

> *"I was in university at the time, and we were playing a lot of Warcraft 3 Tower Defense (W3TD) mods with my friends after classes. And during boring lectures in the auditorium, we often played multiplayer Mario Kart on our DSes—as it was easy to hide—and at some point a friend of mine said that it would be awesome if we could play W3TD mods on our DS!"* (Lasorsa, survey)

While studying abroad in Canada for their final year of university, Lasorsa found the time and motivation to finish their homebrew game, WTD. It had begun in August 2006 as Lasorsa mentioned on a whim from a friend's suggestion. While the game itself was coded entirely in C with PAlib, it also included an easy-to-use map editor that was coded in C#. The first version of the game took about a month to build, but the game's graphics took four times as long to create. The game relies upon pixelated (2D) versions of 3D assets from *Warcaft III* (Blizzard Entertainment, 2002), as well as reworked sprites from its 2D predecessor *Warcraft II* (Blizzard Entertainment, 1995). These graphics, along with the other borrowed assets such as sound effects, combine to give the homebrew game an air of legitimacy as a fan-game.

During development, WTD was entered into three game jams[4], with the first public beta release in January 2007. Following this beta release, it saw regular updates until the final one—v0.5—was released a year later in February 2008. WTD was a technical marvel, accomplishing technical challenges that the NDS development community thought was impossible. Speaking of what they're proud of Lasorsa said:

> *"Doing stuff that was deemed impossible at first! …because of the RAM limitations of the DS, implementing a real pathfinder in WTD for every critter was very challenging. I remember ending up very close to the memory limit of the DS, and the maximum grid size of WTD maps was decided because of that."* (Lasorsa, survey)

Their second and final homebrew game, *Marble DS,* was released in August of that year. Following their graduation from university and gaining full time employment, Lasorsa would move on from their hobbyist game development. Since then, they have worked as a software engineer for various companies in their home country of France.

Lone Wolf DS

Around this same time a different French developer also got involved in the NDS homebrew scene. Frédéric Calendini also was a NDS owner with a linker, and while they admit it was mainly used for piracy, it was collecting dust. So in 2007 they began toying with the idea of making a game for the NDS, but were struggling to find an idea. At first they made a few very small projects for themselves, but nothing significant. They still had a lot to learn about game design and programming, especially for the NDS.

Then in Summer 2007 they were visiting a childhood friend who still had some of the "Choose Your Own Adventure" books and Calendini became nostalgic. Growing up in the 1980s they read a lot of these gamebooks as the genre was called[5], and settled upon recreating one as their first NDS homebrew game. Speaking of this event and seeing the game books: "…since I was looking for a project on the NDS, I thought that

adapting an existing adventure book to this platform would be rather cool" (Calendini, survey). At the time there were already a few official NDS games that had used the concept of holding the console sideways, like an open book, and used the touchscreen for interacting with the story. Thus, the idea for creating a gamebook was born.

As the idea of writing a gamebook themselves seemed too daunting—especially since English was not their native language—Calendini instead hoped to adapt an existing book. Because of copyright issues they first looked into "amateur books," but soon found the Project Aon website which had digital versions of a popular gamebook series. The author of this series, the Lone Wolf books, had offered to allow some of his books to be published as freeware online. After securing authorization from the Project Aon team Calendini was able to publish versions of the series for the NDS, so long as the games were free to download and hosted on their website. Calendini decided to use this project of adapting a gamebook as a way to learn NDS development.

In September 2007 Calendini began work on creating the foundation for the Lone Wolf gamebooks. They credited both the Project Aon website and PAlib as being instrumental in the creation of the homebrew game. "In my case, it has been a life saver," Calendini said of the beginner-friendly toolkit (survey). After months of writing the code, including an XML grammar to handle the events and conditions of the system, version 1.0 of *Lone Wolf DS: Flight From the Dark* was released in March 2008. It was the first book in the five book series, all of which Calendini would work on and release over the course of two years. It won first place in the 2008 Neoflash Spring Homebrew Compo and spoke positively of the community and the reception he received:

> *"I'm extremely grateful to all the people who played those games, who sent donations or simply words of encouragement. The DS homebrew scene has always been a nice place to explore."* (Calendini, survey)

As mentioned previously, Calendini used the engine they developed to release four more books in the Lone Wolf series. They said it took about two weeks of full-time work to recreate the gamebooks for the NDS, but they only worked on the conversion project in their spare time. Following the conclusion of this project they moved on from NDS homebrew. Since then they continued their work in computer science in France before making a career change into becoming an independent publisher.

A Game A Week Project

Stepping back in time we can follow another homebrew developer who established a project much bigger than any one individual game. While at College, English programmer James Gamble and a friend—Ken—made a Star Trek fan game, which was credited with both of them as "J&K," or "JNK." This abbreviation stuck with Gamble, who embraced the nickname and made more JNK branded games while at college (despite the absence of the K). They were released in the late '90s for MS-DOS and were arcade-style games such as *JNKMaze*, *JNKSnake*, *JNKBlast*, and also *JNKPlat*. The latter one, *JNKPlat*[6], was a platformer game that featured a protagonist later called Platdude and was the most popular of Gamble's games they made in College. Based off a character glyph from the Amstrad CPC,[7] Platdude was an 8-bit styled character that would later become the mascot of Gamble's games as part of a franchise of puzzle platformer games.

After graduation, Gamble—under their screen name Jayenkai, an alphabetism for JNK—continued to learn to code, became involved in various online forums, and worked away at various games. "The fun of completing each game pushed me forward to start the next," they said in a blog post (Gamble, 2009). Then in 2005 they decided to share this enthusiasm and started the Wednesday Workshop challenge on the website Coders Workshop.[8] Each week he would post a challenging topic, coding style, or gameplay style for a prototype game, post it to the forum, and then members of the community would try to create games within the parameters and the week's deadline. Gamble themselves would participate occasionally, trying to submit a game every other week.

During this time Gamble was entertained by the idea of making NDS games, but it wasn't until June 2006 when Datel launched their "Max Media Dock" that Gamble got involved in NDS homebrew. This early flashcart[9] was embraced by the growing NDS development community, and in September 2006 Gamble began experimenting with the newly available PAlib. On October 17, 2005, Gamble released their first NDS game, a collection of word games titled *Stringy Things*. Then a few weeks later they ported their game *JNKPlat* to the DS. After that it was a year later when they would release three NDS homebrew collections of arcade games at the end of 2007, one of which was entered into a Christmas DS Coders competition.

These NDS homebrew games were part of Gamble's larger Wednesday Workshop challenge, and they continued to make prototypes for the PC in between their NDS releases. However, they noticed that the community response to their weekly workshops was dwindling, with less and less submissions. Thus Gamble made the decision to start their own weekly blog and host this challenge on their own: they launched A Game A Week on August 5, 2008 with their first game, *The Heist*. Just like their Wednesday Workshops, Gamble would commit to making small games and every week would see a new release (sometimes NDS homebrew, but more often not).

> *"Development on the DS was incredibly simple to do, once the homebrew community had evolved enough to make things happen… My personal style of game making lent itself incredibly well to the system, and I was able to get a lot of odd creations out of the capabilities during the time I spent with it."* (Gamble, survey)

Gamble admits that the NDS platform was ideal for their hobby of game making, allowing them to make small, arcade-style games with the help of PAlib. They've made 17 NDS hombrew games from 2006 until 2011, which included a sequel to *Stringy Things*, remakes of *JNKPlat*, and collections of arcade games. Their last two NDS homebrew games were *Sheep Goes Left DS* and *Spike Dislike DS*, both of which were released in August 2011. These two games were remakes of previous Windows games made for A Game A Week and would be remade and perfected for other platforms later. Their later iOS versions proved to be Gamble's most successful games.

Another important homebrew release was *JNKPlat DS* in 2008, which was an evolution of their Platdude franchise. It was the most polished entry in the series, and was according to Gamble "one of the most fun games I've made for the system" (survey). When asked about their history specifically with homebrew, Gamble discussed how NDS development taught essential skills and improved his programming ability.

> *"I learned how to keep everything self-contained. At the start of the Max Media Pro's life, there was no easy way to save data, so everything I coded needed to be playable within the environment of the game,"* (Gamble, survey).

NDS homebrew development came with restrictions from the console itself as well as the restraints of flashcarts that made the games playable on the NDS. These creative constraints were emblematic of the homebrew community as was this project. A Game A Week, while not a viral success has been uninterrupted for 17 years as Gamble would work at it full-time. At the time of writing, Winter 2025, it is still active with over 270 games published in its lifespan.

Alien DS

On October 12, 2008, Pablo Alsina (under the username Pac) posted on the GBAdev forum about their homebrew game, Alien DS. In this introductory post they mentioned that they were new to NDS development, had worked on this project for about a week, and wanted feedback. The reception was overwhelmingly positive, with some users providing suggestions on how to improve the FPS demo. Their reactions were that the prototype was far from perfect but was still impressive for what it accomplished: it was a 3D FPS game, had enemies to shoot at, and keys to unlock the next level (three levels in total).

Eleven replies and 25 hours later, Alsina published a second, revised version of their demo, this time acknowledging the feedback and making some changes. And after even more feedback, suggestions, and encouragement, Alsina published the third and final version of their game on October 26. According to their timeline–and the dates of their posts on the GBAdev forum–we can see that in total Alsina worked on Alien DS for three weeks during October 2008, published three different versions, and then abandoned their project. At the same time that Alsina published their final version they also edited their first post to include the same link to the final ROM file.

This third version is drastically different from their original in many ways and could be seen as a complete revision to the project. According to Alsina "This version should be considered a test, it only has one level and it's not even very good (it's the one I've used to try new things) but should give you an idea of the changes I've been introducing" (GBAdev forum post). Despite their acknowledgement that this test level wasn't very good, they still delineated many changes they made in their post.[10] In their post they again expressed their humility by acknowledging their inexperience to NDS development and that they had learned a lot through this process.

This homebrew game was notable because it was a good example of the capabilities of a homebrew 3D engine (the Nitro Engine). However, only two versions of this game have survived as the links in the GBAdev forum are dead. These appear to be the first version and the last version, which became the definitive one despite its radical changes from the previous two.

Aperture Science DS

The last notable NDS homebrew game to discuss is the technically impressive homage to *Portal* (Valve, 2007). Jordan Rabet—using the username Smealum—was a Parisian game developer and hacker involved in many Nintendo homebrew communities. Their first games, while unfinished, were for the GBA and started in January 2005, one

of which was based on the popular Japanese series *Naruto*. Later that summer, Rabet entered the first NDS homebrew game jam, and submitted their first NDS homebrew game *Earth Invaders.*[11] Built with an unreleased version of PAlib, Rabet was connected with its developer Mollusk, who also entered the toolkit in this jam (the NEO Coding Compo 2005). Rabet was a public and private supporter of PAlib, helping to contribute to its development as well as using it for making homebrew games.

While only a teenager at the time, Rabet would continue to make other impressive NDS homebrew games including the combination *Orange Desert Online* and *Orange Desert Challenge* in January 2007. These two signaled a shift in Rabet's output toward 3D first person shooter (FPS) games and creating the first online multiplayer homebrew games. Later that year in August Rabet released *A Cup of Tea V8 (ACOTV8)*, which was another FPS game that gained recognition in another game jam. Each summer they continued to submit impressive NDS homebrew games to game jams such as *Legion* (2008), *Dawnseekers* (2009), *Arsenal* (2011), and finally *FPSMaker* and *A Cup of Tea - Super Yeti Edition (ACOTSYE)* in 2012.

Their many NDS homebrew games were groundbreaking technologically, since most homebrew was only 2D and Rabet was frequently making 3D FPS games. *FPSMaker* was the culmination of this work, a map editor for FPS games that ran on the NDS instead of a PC. While limited in scope and not the most intuitive to use, it was a milestone in NDS homebrew. Following this monumental release in September 2012 they wrote in their development blog about their next project. Machine translated from the original French:

> *"But what's really cool is that I've taken [the* FPSMaker*] engine and used it to create something I think is more interesting: a Portal clone for the DS. It's still very basic at the moment, but it's progressing, and I'm pretty confident. I think I'll have a fully functional demo of the portals to show before too long, and after that, it'll just be a matter of adding the other elements from the original (boxes, buttons, platforms to start with), making a nice menu, and maybe creating a place to share levels, and we'll have something pretty cool."* (Rabet, 2012)

Despite having an early version in 2012, it would take a full year of "very grueling" development before it was publicly released (Rabet, 2013). Released as *Aperture Science DS* on August 21, 2013, it was more of a fan-game than a recreation of Valve's game. It featured its own original backstory but followed a character from the official *Portal 2* (Valve, 2011) comic (Pitcher, 2013). Not only did this homebrew game include 14 original puzzle levels based on the portal-making mechanic from the original game, it also included a level editor to allow players to make their own.

Rabet outlined the difficulty in making a 2007 PC game work on the underpowered 2004 handheld in their blog. While the resulting game was impressive and playable, Rabet expressed a desire to continue to improve it through polishing and bug-fixes if they were motivated enough (Rabet, 2013; Pitcher, 2013). Their goal with *Aperture Science DS* was to build their skills and transform into a better programmer through the challenging hardware restrictions (Pitcher, 2013).

Just months after releasing this homebrew game, Rabet would then post about their breakthrough in Nintendo 3DS homebrew, the successor handheld to the NDS. Rabet would release one more NDS game (*DScraft*, 2014) but began to shift their attention toward hacking the 3DS and making custom firmware possible on that system. Later

they would also be pivotal in homebrewing the Nintendo Switch and worked as a security software engineer for a large technology company.

CONCLUSION

Through a historical analysis of these four notable NDS homebrew games and a project we see points of connection and difference. First is the dominance of French developers and their impact on the NDS homebrew. This coupled with their usage of PAlib emphasized that while the homebrew community was an international one, the French-dev forums, IIRC channels, and other social media shaped how amateurs and hobbyists were getting involved in game development. Calendini credited Lasorsa for their help in creating *Lone Wolf DS*, emphasizing once again how connected and supportive the community was. Early video game and computer game histories have been written about the developments in the United States and Japan but less has been written about the histories and games from France. These French histories and culture led to the NDS homebrew boom in the early 00s and would help to explain the phenomenon.

Second would be the ages of those involved. The theoretical framework of amateurism and amateur game-making notes that a common motivation is to learn new skills or self-improvement in preparation for careers. The literature supports why half of the above were students—Lasorsa in university, Rabet an adolescent—and the other half were in their late 20s or early 30s while making their homebrew games (Calendini and Gamble). These ages lend themselves to learning new skills, teaching themselves NDS game development, which would later lead to tangential careers in their futures.

Third would be discussions on fan works and the playbour of making homebrew games. As discussed, many of the notable homebrew games in this article are fan works tied to an existing IP. And perusing the catalog of NDS homebrew on databases reveals that many of these games were remakes, ports, sequels, or tied to an existing franchise in some way. Again, from the framework of amateurism we see that the process of learning from the masters is often mimicry.

Some limitations of this research include its narrow focus on the still available NDS homebrew games. Despite the best efforts of the researcher, archival evidence of the online community and their games released is deteriorating as online sources disappear. Other limitations are that this study focuses only on the notable games from the lifecycle of the NDS, modern homebrew games are very different as the handheld is no longer a current platform, but instead a retro one. And while this paper finds connections to previous scholarship on homebrew development by Swalwell (2021) and Camper (2005), its findings can't be generalized to all video game consoles. These findings aren't generalizable from only five cases; however they do support the growing literature on homebrew games. Further research should be conducted into additional homebrew communities, especially those for less-active consoles or platforms.

This research supports Swalwell's (2021) five-point framework for the definition of homebrew. As mentioned above, the developers were young and self-taught, making their games at home. Most of them released games by themselves (Rabet had a frequent collaborator), which were never traditionally published, and were experimental in nature. While Calendini mentioned in a blog post that they were

pursuing a publisher for their games, that never worked out due to licensing and the Lone Wolf IP. And as shown by Gamble's A Game A Week project, NDS homebrew was experimental, demos, and often tied up in pushing what the developers could do.

In conclusion, the power dynamics of platforms and publishers intersect with the development of amateur and hobbyist games. Cultural studies on non-commercial and unlicensed games contribute to the field as points of contrast with commercial game development. Interviews with homebrew developers and a historical analysis of their games reveals a community that makes games to learn game development, and that adolescents and young adults are drawn into this subculture. By studying the types of games made, who makes them, and how we create a richer history of video games and consoles.

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ENDNOTES

[1] A flashcart is a video game cartridge that uses flash memory to store games, apps, and other homebrew software to play on official hardware. For the GBA, software was programmed onto these cartridges with a device called a "linker." This additional hardware would then interface with a PC through a USB or other parallel plug. Linkers were common in early flashcarts for the GBA, but recent models would use digital media cards (SD, MMC, MicroSD, etc.) that would have software placed via a memory card reader.

[2] A flashcart is an unlicensed accessory sold by international companies that can store digital files such as homebrew software, or more likely pirated games.

[3] These toolkits or libraries are also called Software Development Kits (SDK). As a collection of tools, they typically include a compiler, debugger, and a software framework to facilitate the creation of applications (or video games in this example).

[4] The three game jams were the DS Dev Compo 2006, the Drunken Coders 2006 Christmas Coding Competition, and the Neoflash Spring Coding Compo 2007.

[5] "Choose Your Own Adventure" was a copyrighted phrase and the specific title of the series of books originally published by Bantam Books. Gamebooks were also sometimes called pick-a-paths.

[6] This original *JNKPlat* was released in late 1997.

[7] Gamble explained the origins of Platdude in an email: "Back in the days of the Amstrad CPC home computer, printing Chr$(249) would draw a silly little figure with a giant head. Platdude is my reinterpretation of that character, with a squarer head and slightly more natural sized limbs. I originally gave him the default Amstrad colours of Yellow, Bright Red and Cyan, but eventually opted to tone the bright colours down to an orange and bright blue."

[8] This challenge would move to Socoder.net after CodersWorkshop.com disappeared from the internet. From Socoder's website, it is the "spiritual third-in-line" of a list of websites that began with BlitzCoder. In 2004, BlitzCoder was purchased by CodersWorkshop, which was scrapped for some unknown reason, until the community found a new home at Socoder.net.

[9] Technically called a "Pass-through," this type of early flashcart required the usage of both Slot 1 and Slot 2 for the NDS. Users would insert the Max Media Player DS Cartridge into Slot 1, which when played would force the firmware to run code from the Max Media Dock, which was inserted into Slot 2 like a GBA game. The Max Media Dock used a Compact Flash card (pre-installed, but swappable for users) to store the homebrew software. These early flashcarts were called "Pass-throughs" because of this complicated procedure of having the NDS pass through the dummy DS cartridge and instead run the software through the GBA slot.

[10] These changes include a larger map size (from 32x32 tiles to 64x64) to compensate for the drop from three levels down to one, an improved map to work with the new level size, randomized enemy xenomorph placement, and additional decorations for the corridors and level.

[11] *Earth Invaders* was released on August 20, 2005, and came in 4th place in the Neoflash competition.