

EVERYTHING, BY EVERYONE

An archival perspective on the preservation of Flash media

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Title

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Abstract

This master's thesis examines and evaluates different ways of preserving media reliant on the now defunct Adobe Flash technology. The purpose is dual; both to examine and evaluate Flash preservation from an archival point of view, and to contribute to the existing research on Internet communities' preservation initiatives. The research and data collection for the thesis is focused on the preservation of games on the website Newgrounds, and of the webcomic *Homestuck*. The preservation projects are evaluated against a list of archival criteria based on current archival research and theory. Data on attitudes towards them and others' experiences of them is gathered from online sources using netnographic methods. The projects and attitudes toward Flash preservation are then discussed using Terry Cook's archival paradigms and Pierre Bourdieu's concepts of fields and cultural capital. Legal and ethical aspects of community preservation are also discussed, as the projects sometimes exist in legal grey areas, while at the same time providing unique and valuable preservation solutions. The study finds that Flash media has a low cultural capital, despite having been ubiquitous on the web for over a decade and shaping interactivity on the Internet. This contributes to the current low interest in Flash media outside dedicated communities, despite much of it meeting the criteria for classification as digital heritage. The research indicates that the community driven preservation projects examined preserve Flash media deemed important by each respective community, and may on a small scale even help keep Flash media alive. The thesis reaches the conclusion that while the preservation projects are created and maintained by people with high levels of technical know-how and passion, they sometimes lack the resources and the archival perspective in regard to aspects like longevity, accessibility, and metadata that an archival institution could offer. It is therefore important that communities preserving digital heritage both seek and receive aid from ALM institutions, and that ALM institutions in turn appreciate the potential for mutual exchange of knowledge.

Keywords

Adobe Flash, archives, archival science, digital media, digital preservation, Homestuck, Internet, Internet content, Newgrounds, software, virtual communities

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1. Introduction

The Internet is not static, but dynamic. This means two things for the archivist looking to preserve expressions of culture or other important documents that are born online: much of the material eludes traditional archival categorisation, and problems such as link decay may cause the content and information on a given website to be lost or eroded over time (Craven 2008, 22-23; Halsband & Grimm 2018, 119). The volatility of the Internet as an archival repository (cf. O’Sullivan 2005, 70; Fournet 2021, 120-121), and the rapid digitalisation of the world mean that archivists must wrangle entirely new kinds of beasts in their mission to preserve and make accessible the collective memory of humanity. For example, there is no way of knowing how many or which webcomics have been uploaded to the Internet since the launch of the World Wide Web in 1991, because there may be several webcomics that became defunct before webcomic indexing began (Halsband & Grimm 2018, 119). Moreover, one of the founders of the Internet Archive — which uses crawler software to preserve snapshots of the web — stated in 1997 that “[h]istorians have already found the material useful” (Kahle 1997, 82-83). Even if one takes a founder’s quote with a grain of salt, it is indicative of a will to preserve the web for posterity just six years after the launch of the public Internet.

The preservation of Internet-based media is something that has recently become an urgent question for those interested in Flash media, including the author of this thesis, who used to be an active consumer of it. While Flash media may not seem like an immediately familiar term to the reader, most users of the Internet during the 00s would have been exposed to Flash in one form or another. In fact, big mid-00s networks like YouTube relied exclusively on it (Salter & Murray 2014, 8). YouTube has since moved on to other tools for video embedding and playback, but the memories and impact of Flash media such as the games *FarmVille* and *Alien Hominid* (Salter & Murray 2014, 67-69), animations such as *Charlie the Unicorn* (Filmcow 2007) and comics such as *Homestuck* (Veale 2019, 1033-1034; Hussie 2018a) remain. Consumers of Flash media in different forms may not have been aware that they were relying on the Flash plugin or interacting with media created with Flash software until the plugin ceased to function and thus made itself noticeable (Salter & Murray 2014, 13). Nevertheless, fact remains that Flash was ubiquitous on the web for over a decade. Currently, the once all-encompassing Flash media is in dire straits, and a huge part of our digital heritage may just disappear without active intervention.

1.1 Problem background

Swedish gaming journalist Jimmy Håkansson (P3 Spel 2020, 00:47) stated in late 2020 that when the ongoing countdown in our web browsers ended, it would have ramifications that meant thousands of digital games would disappear forever. Håkansson was referring to the Flash-dependent browser games that would be rendered unplayable once Adobe stopped supporting and updating Adobe Flash Player. However, Flash games were not the only type of media to be affected by this decision; Adobe Flash was also used for other forms of media, including animations and website banners (Fiadotau 2020, Introduction, para. 6). While the animations are largely possible to preserve through the use of straightforward conversion tools the games, especially those created by hobbyists who lack preservation resources, find themselves in a different situation (*ibid.*, para. 8). The same goes for multimedia projects like *Homestuck*, a webcomic that alongside chat logs and hyperlinks contains both animation and browser game elements that relied on Flash pre-2018 (Veale 2019, 1033-1034; Hussie 2018a).

In December 2020, Adobe stopped supporting and updating the browser plugin Flash Player, used for playback of Flash media. As of January 2021, they actively block content from running in Flash Player (Adobe 2021). This means that without an emulator or equivalent technology, Flash content is now unplayable across the web, which in turn means the potential loss of thousands of expressions of digital culture. For instance, the website Newgrounds alone hosted around 80 000 Flash games at the end of the 2010s (Fiadotau 2020, Growing old on Newgrounds: Community discourses of technological change, para. 32). Mikhail Fiadotau argues that Flash games and Flashimations should be viewed as a reservoir of cultural expression, and that as such, they fall under the UNESCO definition for digital heritage (Fiadotau 2020, Introduction, para. 7). The UNESCO definition of digital heritage is “computer-based materials of enduring value that should be kept for future generations”, and examples of the digital materials in question include “texts, databases, still and moving images, audio, graphics, software, and web pages, among [other] formats” (UNESCO, n.d). As digital heritage is growing and is likely to become more central to the human experience (*ibid.*), archives and archivists must take an interest in the collection and preservation of said heritage. The vexing issue at hand, then, is firstly how to preserve Flash media, and secondly who should be and who is doing the preservation, both of which are the subject of this thesis.

1.2 Research purpose and research questions

When our digital heritage grows, so does the relevance of finding lasting solutions for preserving it for future generations. As stated above, Flash media, and Flash games in particular, are digital heritage objects that are currently at risk of being lost to time and neglect. Nevertheless, there is a variety of solutions designed to rescue and preserve different types of Flash content.

The purpose of this thesis is to analyse and evaluate several Flash preservation projects – focusing on the website Newgrounds and the webcomic *Homestuck* – from an archival point of view. The thesis also aims to contribute to the existing research on Internet communities' initiatives to preserve Internet-based media.

The research questions formulated for this thesis are:

- What methods, such as emulation or conversion, are used in Flash preservation projects?
- How successful are the projects if evaluated from an archival standpoint, considering aspects such as metadata and long-term preservation?
- What are the potential pitfalls and benefits when communities rather than institutions preserve digital media?
- What are the legal and ethical implications of initiatives by Internet communities to preserve ephemeral media?

1.3 Definitions

For a list of definitions, see appendix 1.

1.4 Disposition

This thesis is on the preservation of Flash media. To fulfil the research purpose and answer the research questions the thesis covers various solutions for, and aspects of, Flash preservation.

In *1. Introduction*, the research purpose and research questions are presented. The chapter also contains a short background on the Flash technology, and arguments as to why Flash media should be preserved for posterity. The thesis is then further situated within the archival field in *2. Literature review*, where relevant previous research is covered. Both relevant literature on preservation of media on the Internet and preservation of video games is summarised, as well as literature on copyright and legal aspects.

In 3. *Theoretical Framework*, the theories used for analysing the material are presented, as well as archival evaluation criteria based on current archival theory and research. The theories used in the analysis are Terry Cook's archival paradigms, Pierre Bourdieu's concept of cultural capital, and deontology. In 4. *Methodology and material*, the chosen methodology for this thesis, netnography, is presented. Furthermore, the material, material selection, and research ethics are discussed.

In 5. *Archival evaluation*, the chosen projects are examined against the archival evaluation criteria established in chapter 3. Both the projects and Flash preservation in general are then further discussed and analysed against the theoretical framework in 6. *Analysis*. In this chapter the results of the thesis are also discussed in relation to the research presented in chapter 2. Finally, the thesis is summarised, and the research questions are answered in 7. *Conclusion*.

1.5 What is Flash?

Flash, Macromedia Flash or Adobe Flash all refer to the same technology. It was a *de facto* standard for dynamic multimedia content online for most of the 00s, and a platform both for developing and distributing content. Flash Player was a web plugin that interpreted .swf files, but Macromedia, and later Adobe, also provided development environments to create these files (Salter & Murray 2014, 7). The development environment software introduced the programming language ActionScript, which was an important aspect of the cross-browser usability of projects developed in the Flash program (Salter & Murray 2014, 6, 39). This thesis does not go into more than necessary detail on how Flash functioned technically (for in-depth information on Flash's technical functions see Salter & Murray 2014).

1.5.1 The rise and fall of Flash

Flash started life as a vector drawing program, which evolved into an animation and dynamic media tool for early websites. Flash was originally developed by FutureWave Software under the name Smartsketch, and later FutureSplash Animator. When FutureWave was acquired by Macromedia in 1996 the product was renamed Macromedia Flash. In 2005 Macromedia was acquired by Adobe, thus giving the software the name it is perhaps most well-known under: Adobe Flash (Fiadotau 2020, A Flash History of Flash para. 1–3; Kaplan et al. 2009 4-7; Salter & Murray 2014, 4–5). Flash gained popularity in the early days of the Internet because the files were comparatively small, and it was lightweight enough to function with low bandwidth and connectivity speed, which allowed it to offer a

multimedia experience that extended beyond what early HTML could support. This was part of why Flash had such a wide reach across the Internet, even though other technologies for multimedia browsing such as QuickTime existed alongside it. By 2002, the Flash plugin was estimated to be installed on 98% of web browsers. Early Flash was used mostly by animators, but with the release of Flash 5 and ActionScript as a programming language, creation of games was made easier and no longer stretched the program's capabilities (Salter & Murray 2014, 2-3, 38, 76-77; Fiadotau 2020, A Flash History of Flash para. 3-4). Soon enough, there was a boom in instructions on how to create in Flash. Part of its popularity and penetration also came from a supportive community of creators willing to welcome newcomers (Salter & Murray 2014, 52). The popularity of Flash also resulted in community sites such as Newgrounds – with the tagline 'Everything, By Everyone' – popping up and members using its affordances to comment and reflect on politics and current events in an interactive way (Fiadotau 2020, A Flash History of Flash para. 7).

Flash games are closely associated with casual gaming and social network games like Zynga's popular Facebook game *FarmVille*. This also means association with free games and varying quality. For a while, browser gaming was *only* associated with Flash games; the term 'browser-based game' and the distinction between different kinds of browser games did not come about until HTML and JavaScript could offer similar possibilities to Flash. Other than moving casual gaming into browsers, Flash games also allowed for creative freedoms that traditional ways of publishing games did not. None of the companies that owned the Flash technology ever policed the content created or distributed through the platform. Thus, content could be adult, political, sexual, or violent in ways that were - and are - not allowed by game publishers or app stores. This did not necessarily make the content subversive - it still often reflected a hegemonic male heterosexuality - but it was filling a niche not filled by other gaming platforms. Flash games also made meta comments on their respective genre, or on gaming culture in general. Some Flash games, such as Tom Fulp's and Dan Paladin's *Alien Hominid*, even made the leap from browser to console; Flash acted as an empowering force for independent single person game development (Salter & Murray 2014, 78, 80-88, 107-109 137-139). Flash games, and .swf files in general were also easily spread through file sharing sites. While this led to creator recognition and notoriety, they were rarely able to monetise their creations (Salter & Murray 2014, 74). Although it is less well-known, Flash was not only used for the free browser games it is nearly synonymous with. For instance, it was also used in the UI of some major games, like *Shadow of the Tomb Raider* and *XCOM 2* (Fiadotau 2020, A Flash History of Flash para. 19).

As technology for the web and hardware developed, use of Flash slowly fell out of favour. One example is the HTML5 standard that allows for interactive multimedia without third party plugins and is adapted for surfing the web using a mobile phone (Fiadotau 2020, A Flash History of Flash para. 13). Adobe themselves quoted new standards such as HTML5 and WebGL as reasons to end the life of Adobe Flash Player (Adobe 2021). Furthermore, in 2010 Apple announced in an open letter by Steve Jobs that they would not support Flash on iPhones or iPads (Jobs 2010). While some other smartphones promised Flash support, incompatible hardware was one of the nails in the coffin for Flash. Flash was always a pure software platform; rather than running on hardware, it ran on a virtual machine with the possibility to evolve and support the capabilities of its host system. This also means that Flash was dependent on hardware, operating systems, and browsers from other parties to run it (Salter & Murray 2014, 114, 123, 137, 140). While Flash media remained on the web after 2010, and Flash games continued being made, communities urged the switch to HTML5, and Adobe renamed the Flash software program Adobe Animate (Fiadotau 2020, A Flash History of Flash para. 18-20). In 2020, Adobe officially stopped supporting and updating the Flash Player, and as of 2021 they actively stop content from being played in it (Adobe 2021). Prior to this, the Flash player's backwards compatibility with earlier virtual machines had meant that content from as far back as the 90s could be run (Salter & Murray 2014, 144-145), but the end of the Flash Player means the slow death of Flash will be terminal without active intervention.

1.5.2 Flash aesthetics and Flash media

In 2005, digital culture and computer science scholar Lev Manovich wrote on what he called 'Generation Flash', a new breed of media artist. Manovich (2005, 67) described it as "Bauhaus design in the service of information design". Furthermore, he claims that Flash aesthetics are *not* limited to work created in Flash or appearing on websites running on the Flash Player plugin. They can be created in QuickTime or other formats; the aesthetics, however, are named after, and associated with, Flash. Some of these particular aesthetics include the loop, vector nets, mathematically generated curves, minimalism, and themes of alien biology. Moreover, Manovich notes the potential for interactive artwork and games as a political tool, and as art that amplifies actions taken when interacting with it (*ibid.* 67-73, 76-77). Flash aesthetics are described by Salter and Murray (2014, 27-28, 72, 86, 108) as vector shapes and outlined images moving on tweens, saturated colour palettes, 2D, and single colour vector graphics. Flash was also used to create art exhibited in fine art spaces and works considered to be electronic literature, like

Daniel Benmergui's *I Wish I Were the Moon* and Jason Nelson's *Game, Game and Again Game* (Salter & Murray 2014, 89-92, 97-101).

1.5.3 Flash 99% Bad?

Flash always had its critics, as is evident in the article *Flash 99% Bad*, published by Jakob Nielsen in 2000. Nielsen (2000) points to problems such as the plugin's poor disability accessibility and search integration, which are valid critiques of the technology. Other critiques Nielsen has, such as the fact that he is of the opinion that Flash encourages gratuitous animation, are perhaps of a more personal nature since what is actually 'gratuitous' could be discussed *ad infinitum*. The article also does not consider Flash's applications for art and entertainment, stating "Flash is typically created by outside agents who don't understand the business" and "[those] interested in enhancing usability and their site's overall business presence [should] use Flash sparingly" (Nielsen 2000). This implies that Nielsen has only considered Flash content on business sites, and not creative portals such as Newgrounds. As Salter and Murray (2014, 8) point out, Nielsen is also singling out Flash as the culprit for design decisions that could also be made with other web technology. Even so, the Flash plugin was also criticised for security flaws and bugs (Fiadotau 2020, A Flash History of Flash para. 12). Fact remains that Flash was a polarising technology and is mostly remembered by some for semi-interactive ad banners and low-quality content, while others view it with nostalgia (Salter & Murray 2014, 80; Fiadotau 2020, A flash history of Flash para. 11, Growing old on Newgrounds: Community discourses of technological change para. 3 - 31). Furthermore, any critique against the platform does not negate the fact that its omnipresence on the Internet has in many ways shaped the modern web (Salter & Murray 2014, 151).

1.6 Why preserve Flash media?

So, why should we preserve Flash media? As argued above, Flash media in multiple forms - e-literature, art, animation, and games - comprise a digital cultural heritage. Flash is also worthy of preservation purely because of its impact on the Internet. As argued by Salter and Murray (2014, 151) Flash was a pivotal part in shaping the modern web and building the multimedia experience that the Internet is today. Not making an active preservation effort would mean losing an integral part of web history. Given the breadth of Flash content, from violent and pornographic to political commentary, from derivative works to works of fine art, Flash media could be said to paint an honest portrait of the human experience in the early days of the Internet. Perhaps rather than considering Flash a somewhat hyperbolic 99% bad, we should consider Flash 99% human, for all its flaws and dazzling animations.

2. Literature review

This chapter offers a brief overview of relevant research in fields that overlap with the preservation of Flash media. As the community in community archives generally does not refer to Internet communities, this research is not covered here.

2.1 On Flash

Not much is written on the preservation of Flash media specifically, with the exception of *Growing old on Newgrounds: The hopes and quandaries of Flash game preservation* by digital technologies scholar Mikhail Fiadotau, published in 2020. The article mainly examines the discourse around the preservation of Newgrounds' own content from an ethnographic perspective (Fiadotau 2020, Introduction, para. 10). Fiadotau points out that some of the problems that the Flash preservationist faces are site-locked games and copyright issues. Although the article touches on some aspects relevant for archives, such as metadata (Fiadotau 2020, Everything, by everyone: Preserving the legacy of Flash games, para. 12, 22), it is mainly focused on the response to Flash's end of life by Newgrounds users and mentions other preservation projects only in passing.

There is some academic research on Flash before its end of life, most notably the book *Flash: Building the Interactive Web* (2014). The authors are digital media and arts and humanities scholar Anastasia Salter and games and interactive media scholar John Murray. Much of the history of Flash in the section above is based on Salter and Murray's work, and the book gives an in-depth description of Flash as a platform and as software. As Flash was still an active technology at the time of authoring the book, it only includes a short section on Flash preservation, in which they note that should the Flash player stop being part of the ecosystem of the web, this would complicate the preservation as previously the media player's backwards compatibility ensured the playability of older works. Moreover, they point out that most web-based media, including Flash content, faces the challenge of storage and accessibility often being dependent on dedicated communities. As HTML5 was already on the rise in the early 2010s, they also note that Flash emulation projects had begun at the time of writing (Salter & Murray 2014, 144-146). The authors do point out a potential reason for the relative lack of research on Flash: many of the end products relying on the software and its plugin rendered it invisible to the point where a user may only notice Flash if it were malfunctioning. Salter and Murray

(2014, 13) write that the existent literature on Flash usually studies the communities around it, or instructs people on how to use it, but Flash itself - due to its transparency - is not the object of critical study. This is also the case for Fiadotau's article as mentioned above and, to some degree, for this thesis.

2.2 On the preservation of web-based media

There is more extensive research on the preservation of web-based and electronic media in general. This research is covered in the following section.

As early as 1994, prominent Canadian archival theorist Terry Cook (1994, 301-303, 307-308) stated that electronic records needed new and different approaches than paper records; a shift in the mindset of the archivist was required. Among other things Cook (*ibid.*, 310-314) pointed out that the electronic record does not reflect the same singular physicality as the paper record, and that creatorship and context become more fluid if there is no singular fixed object to archive. Cook's sentiments and the prevalence of 'paper minds' in the archival profession are echoed in further research on e-archives by Swedish ALM and digital cultures scholar Ann-Sofie Klareld, and information systems and technology scholar Katarina Gidlund. They state that in the late 2010s there was still a lack of competence in e-archiving in Swedish municipalities, and that treatment of digital records as equivalent to paper ones, or even printing them out to preserve them was still occurring (Klareld & Gidlund 2017, 100-101). Digital culture scholar Pelle Snickars (2010, 304) has also pointed out that the European ALM sector has been lagging in its use of the web.

Similar repetition can be found in research dealing with web-based media specifically. Archival student Catherine O'Sullivan (2005, 54, 70-73) points to online problems like link decay and the risk that much content could be lost at once should its hosting service be shut down, as well as the need for a new archival mindset. She calls for intervention and preservation efforts by traditional archives to solve some of the problems surrounding preservation of web-based media. Ethnomusicologist Adele Fournet observes the same problems 16 years later. Fournet (2021, 120-135) recognises the potential for marginalised groups to represent themselves online, but also the unreliability of hosting services run by private companies as the only archive for a given group or project. She also calls for a partnership between institutions and creators to enable long-term preservation. Furthermore, in 2018 librarians Megan Halsband and Stephanie Grimm argue that webcomics is a different medium to print, and recognise that they are deserving of preservation, but that archives and libraries largely have not concerned themselves

with them. They also recognise that webcomics come with specific technical issues, like alt-text, that need to be considered when archiving them, and mention the need to consider both ethics and copyright. They also call for collaboration between communities and institutions (Halsband & Grimm 2018, 119-121, 123-133, 138-139). Information scientist Anthony Cocciolo (2016, 68-70) argues that emails are the successors to letters and are an important historical resource worthy of institutional preservation. He also points out that although digital tools are helpful, human intervention is necessary especially in the appraisal stage (*ibid.*, 78-80).

As is evident, professionals from different parts of the ALM field recognise both the difficulty and the necessity in archiving born digital records and media, as well as the potential for collaboration between communities and ALM institutions.

2.2.1 Copyright law, orphan works and abandonware

Writing from a UK legal and economic perspective, law scholar Dennis Khong (2007, 63-66, 71-72) argues that abandonware creates social problems as digital objects become unavailable. He points out that an effective solution is to allow third party copying of abandoned work and distribution of commercially unavailable orphan works. This, he argues, does not distort the ex-ante incentive to create, and the copyright owners only suffer a potential windfall loss. He also points out that abandonment may be a factor in convincing a tribunal that the use of abandoned but copyrighted work is fair. Among the solutions suggested by Khong is the ‘grey market’, which would allow for distribution as long as the copyright owner does not object, or an open access solution when works are abandoned (*ibid.*, 75-77, 81-82). Khong (*ibid.*, 83-89) also notes that several scholars are calling for different legal reforms to solve these problems. At the time of publishing Khong’s article, the Orphan Works Directive (see below) was not yet in place, and thus some of Khong’s legal arguments may be outdated.

Writing on copyright in European libraries, law scholar Rán Tryggvadóttir (2018, 51) argues that preservation of digitally born material requires reproduction, and that digital preservation might require access which means it falls under the legal framework for making works available digitally. Furthermore, she points out that the reproduction right and communications to the public, specifically the making available right, are unclearly defined both in international treaties and national legislation, but that in the EU accessibility of a website in a country gives rise to jurisdiction by the country’s national court. The territoriality of copyright is found to be one of the obstacles to creating cross-border access to European cultural

heritage (*ibid.*, 68-69, 269). Tryggvadóttir (*ibid.*, 310) calls for substantive copyright legislation to clarify how and where in-copyright works can be used online. She also points out that for certain institutions and projects orphan work status can be applied if a rights holder cannot be found, which in some cases can make it permissible to make these works publicly available (*ibid.*, 109-116, 414).

Law lecturer Robin Schard has written about the Internet Archive's National Emergency Library, in which they made large amounts of digital material available without practical limits due to the COVID-19 pandemic, which caused publishers to file a lawsuit for copyright infringement against them (Schard 2019, 53-54). The case is not yet settled as of March 2022 (Free Law Project 2022). Schard (*ibid.*, 55-56) notes that there are several aspects where the outcome is unclear. For one, copyright was intended to protect creators, and not publishers, but the relatively flexible fair use law may not extend to the large-scale digitisation performed by the Internet Archive. However, it has earlier allowed projects like Google Books, that give a limited access to digital material. The option to opt-out was given to authors, and the Internet Archive may use laches as a defence; meaning publishers waited too long to enforce their right to the material. Schard (*ibid.*, 57) argues that the copyright law may need updating, both due to the long duration of copyright in the United States and the demand from the public for new formats and ways of access. Although, examining the same case law scholar Aaron Schwabach (2021, 215-216) points out that usually, rulings are in favour of content owners and that legal precedent does not seem to support emergency exception as a valid defence. Nevertheless, Schwabach also calls for an updated fair use law for the 21st century.

Several studies on software piracy (e.g., Gomes et al. 2015; Lahiri 2012) focus on a company or industry point of view. This literature is not relevant to possible copyright infringement or piracy as it pertains to Flash works created by amateurs. As is evident above, the application of copyright law is complicated and often outdated, which makes cases concerning the Internet especially complex.

2.3 Copyright, emulation, and the preservation of videogames

Much of Flash media is comprised of Flash games. Therefore, literature on videogame preservation relevant to Flash preservation is presented below.

James Newman, digital media scholar and co-founder of the UK's National Videogame Archive, is one of the most influential researchers in the field of videogame preservation. He has pointed out that the safeguards against copying -

which is unilaterally treated as software piracy by the game industry - actively hinders preservation attempts, and that some of the best organised and sophisticated preservation projects arise from illegal actions of code ripping and file sharing. Industry practices such as the retiring of servers also complicate preservation. He also argues that software pirates, contrary to the industry's wish to portray them as commercially motivated, often celebrate and lengthen the lifespan of games, and make them available to researchers and developers (Newman 2012a, 46-49). Newman (2012a, 50) also notes that the current legal situation surrounding copyright and game 'piracy' hinders preservation by institutions such as Berlin's Computerspielenmuseum, who are forced to watch their collection succumb to bit rot. Newman (2012a, 56-58) considers the knowledge and projects produced by illegal file sharing invaluable to institutions seeking to preserve digital games, and calls for collaboration between industry, community, and the ALM field.

English scholar James K. Harris has written on the failures of the videogame industry to preserve and make games accessible, and on narratives of identity and nostalgia in relation to videogames. Harris argues that in re-releasing only a selection of older games, such as those pre-programmed into Nintendo's 'classic' consoles, creates an idealised image of the past, profitable through consumed nostalgia; nostalgia that unites individuals around goods that give their identity meaning (Harris 2020, 1418 -1422). However, in rewriting their history the game companies also create an artificial shortage of the older games that they do not re-release or enable players to access through legal avenues, which in turn gives rise to community practices such as modifying the classic consoles to run other games than the pre-programmed ones (Harris 2020, 1429 - 1433).

As also noted by Yin Harn Lee (2018, 103, 105-106), lecturer in law at Sheffield University, business practices within the videogame industry hinder preservation, particularly in respect to digital games whose availability is entirely dependent on the publisher making them available on their platforms. A player may be unable to acquire a legal copy even if they wish to do so. Harn Lee (2018, 104-107) writes that migration of videogames is potentially copyright infringement under European copyright law. While the building of an emulator through reverse engineering and de-compilation of code may be allowed, the distribution of potentially illegal games along with the emulator is still considered infringement. Furthermore, even if certain videogames fall under the category of orphan works, it is not clear whether they fall under the Orphan Works Directive as entire works, and abandonware cannot necessarily be argued to be orphaned. He recommends that institutions use

the flexibilities existent in the European copyright framework, such as certain countries allowing exceptions for archives and libraries to make preservation copies under the Information Society Directive and the development of emulators under the Software Directive. Furthermore, he recommends collaboration with the video game industry for preservation, as well as lobbying for legal changes in the long term, as the current legal situation is causing a loss to our cultural heritage (Harn Lee 2018, 107-208). Despite Harn Lee arguing that the act of creation of emulators itself is legal, media scholar Giovanni Carta (2017 200) points out that the industry is still strongly opposed to them. Carta (2017, 196 - 201) also argues that metadata is essential to preserving digital games, and that emulators alone are not enough to provide proper accessibility and understanding of the preserved software.

Some research on archiving and preserving videogames has been done in the Swedish ALM field. Olle Sköld wrote the dissertation *Documenting Videogame Communities: A Study of Community Production of Information in Social-Media Environments and its Implications for Videogame Preservation* in 2018. Sköld (2018, 130-132) studies the ways online communities centred on videogames produce documentation and knowledge around videogames, and how this can both be valuable in itself, and aid videogame preservation. In her master's thesis, Maria Carlsson (2014, 47-49) argued that, given their lack of resources, there is an overconfidence in that ALM institutions will be able to preserve the cultural heritage of videogames, though the competence to do so may exist within the field. Also in 2014, Ludvig Hals (2014, 53-55) examined in his master's thesis how Swedish ALM institutions discuss their role in computer game preservation. He notes that the preservation is resource-intensive and calls for legal changes and collaboration between institutions, the game industry, and private individuals in order to ease the preservation process. In their 2021 thesis, Ida Frisell and Kajsa-Stina Ågren Jönsson (2021, 59-60) examined the question of digital game preservation both from an industry and an ALM perspective. They point out that the strained or non-existent relationship between the ALM field and the game industry contributes to the lack of digital games in ALM institutions, and that both lack of resources and perceptions of the ALM field as highbrow are also contributing factors.

As is evident above, most of the research on preserving videogames assumes that there are industry actors who may or may not be willing to collaborate with institutions for game preservation; the single-person and hobby developers who created a large portion of Flash media are largely missing from the literature.

3. Theoretical framework

In this chapter Terry Cook's archival paradigms, Pierre Bourdieu's concept of cultural capital, and the ethical framework deontology are described. The archival evaluation criteria used to examine the chosen Flash preservation projects, and the research and theories they are based on, are also presented.

3.1 Cook's paradigms

In this thesis, Canadian archival theorist Terry Cook's community paradigm is used in discussion of the community projects that preserve Flash media.

Cook (2013, 97, 105, 113) has proposed four overlapping and parallel archival paradigms, or frameworks, for thinking about archival processes: evidence, memory, identity, and community. The traditional focus of archives and archivists on evidence has been challenged by concepts such as collective identity and memory, while the digital era offers each person the possibility to be the steward of their own voice and own online archive, but it also presents us with the possibility of documenting humanity and society at a never-before-seen scale.

The first paradigm of *evidence* is articulated in the idea of the archivist as a neutral guardian of the records of the state or concerning elite or national and international activity. This paradigm also brought with it the importance of *respect-des-fonds* and the importance of the context of documents for their value as evidence and truth, while personal archives and private records fell outside the purview of the archive. The second paradigm, *memory*, came about when the amount of documentation became much larger during the 1900s, and archivists had to abandon the idea of neutrality in favour of attempting to choose which documents would have lasting historical value. Historians were taking an interest in history from the bottom up, which meant that new types of documents became interesting, such as private or personal archives. As archivists took a more active and shaping approach to their collections, this also meant a change in the context of archives themselves. The third paradigm, *identity*, emerged along with the professionalisation of the archivist. During the postmodern era, appraisal was not based on trying to predict future historical research interests, but rather to reflect the activities of a diverse society. Archives also moved from being a cultural and heritage resource for the academic elite to becoming a foundation for identity and justice (Cook 2013, 106-113).

The fourth paradigm, *community*, is considered by Cook (2013, 113) to not yet be fully formed. Considering the possibilities and realities of every group, community or person to document their own activities online, some archivists call for the need for the profession to give up total control over the archives and instead share archiving with communities and consider not removing records from their originating community context. Certain communities may feel uneasy about turning their records over, and the records hold identity provenance in their community context. Therefore, archivists should act as facilitators of participatory community processes of archiving rather than collectors and guardians of the archival product. They should also encourage communication between communities and archival institutions, whose collaboration may fulfil the aspirations of a ‘total’ archive of human activity. Moreover, the knowledge exchange on methods of preservation has the potential to be two-way and mutually beneficial. Thus, in a functional collaboration the archive will not be painting a picture of a single mythology or excluding the ‘other’ (*ibid.*, 113-118).

3.2 Bourdieu’s capital

In this thesis, the theories of French sociologist Pierre Bourdieu are used in discussing certain elements of the social and community aspects surrounding Flash preservation, particularly in terms of cultural capital.

Bourdieu (1986, 241-244) describes capital as accumulated labour, and a potentially immaterial asset; capital can take other forms than purely economic ones. Capital in its different forms is a way to explain that not every moment offers equal opportunity to every agent; social capital can for instance be described in terms of connections, which can in turn be translated into economic capital. Cultural capital can exist in an objectified state - that is to say in the form of cultural goods such as works of art. In the objectified state, capital is only capital when appropriated by an agent. In other words, it needs to be recognised as valuable and used in the field of cultural production to manifest as capital (Bourdieu 1986, 247).

The fact that cultural goods are a form of cultural capital implies that cultural goods themselves have different values, and that these values are only effective as capital if recognised as such. Although the concept of capital is normally applied and closely tied to human agents (Bourdieu 1986, 245) and although some critics of the concept find it more appropriate to speak of resources rather than capital (Siisinäinen 2003, 184), discussing the relative capital value of digital cultural

goods is useful when examining the decisions of legitimising institutions to collect or not collect certain objects. Just as institutions can give people legitimate capital in the form of academic credits (Bourdieu 1986, 247-248) institutions can legitimise objects and give them cultural value. Recognition of one's work is also a form of capital (Bourdieu 1993, 30). Bourdieu has theorised that aspects such as education and class affect the perception of culture and art (Bourdieu 1993 217-218; Bourdieu & Darbel 1970, 73-76). While it is not possible to deduce class or education level of those working to preserve Flash media as they are largely anonymous, the (dis)interest of institutions in such preservation projects and the perception by an academic and cultural elite as to what constitutes 'quality' culture can be discussed in these terms. It can also be discussed in terms of the field of cultural production, which is controlled both by internal recognition, but also by economic and political profit (Bourdieu 1993, 37 - 39). Should an artist's work neither be valued in their own field by their peers in the form of recognition, nor produce economic or political value, the artist will not occupy a prominent place in the hierarchy of their field. While production of Flash media is its own field within the larger field of cultural production with its own internal hierarchy, it is not always recognised as important, neither by cultural peers nor in the larger fields of economy or politics. Flash had a somewhat poor reputation, which affects the position of Flash media in society today. Furthermore, selection and appraisal of games for the projects can be discussed in terms of capital and value both within the communities that choose to preserve them and from an outside perspective.

3.3 Ethics and legalities

As the distribution of emulators and copying of Flash games can sometimes constitute copyright infringement (Fiadotau 2020, Everything, by everyone: Preserving the legacy of Flash games, para. 12, 22), the legal and ethical aspects of Flash preservation are discussed in this thesis. Because 'legal' does not equate 'moral'- such as in cases of legal but immoral data collection online (Kozinets et al. 2018, 232) - both aspects are considered. Furthermore, some archival scholars argue that breaking laws or disobeying orders to preserve or spread important information is the correct course of action in certain situations (e.g., Robinson 2014; Findlay 2013). While Flash content is not a direct question of human rights, the rapid decline of the state of the files is causing a digital heritage crisis. The discussion of legality follows the lines of reasoning on copyright and the Internet outlined in the literature review, and the ethical discussion examines the problem taking two aspects into account. These are as follows: firstly, the copyright holder's

own view of the matter if that opinion is available as perceived harm or benefit to them matters ethically, and secondly, a deontological framework.

3.3.1 Deontology

Deontology concerns itself with limits on how one may treat one's fellow humans; what one may do to them (Nagel 2003, 102). Deontology examines the intent of actions, such as in the case of the doctrine of double effect, in which a pursuit of good is less acceptable if the resulting harm is *intended* rather than only foreseen. Thus, a deontologist might argue that it is more acceptable to allow harm to befall someone than to actively bring the harm about (Quinn 2003, 194). Deontologists may also consider the relation of harm and good to the event. According to the principle of (im)permissible harm an event or action is permissible if its relation to the greater good has an equal or lesser intimate relation to the lesser evil it produces. In other words, if an event directly causes harm but indirectly causes good it is morally impermissible. This can be considered somewhat conflicting with the doctrine of double effect, as it is not the intention that is relevant but the relation of harm and good to the event (Kamm 2003, 176 - 178). There is also a difference made between harm by direct agency and harm by indirect agency, in which the latter is considered preferable, as the former is based on the presumption that the victimisation of the harmed person will serve the agent's goal. In any case, the doctrine of double effect rests on the idea that each person has some veto power over attempts to make the world better at their expense; although arguments can be made for cases of infringement, they do add a moral burden (Quinn 2003, 205 -207; Nagel 2003, 107- 111). From a deontological point of view, then, Flash preservation that infringes on the copyright of someone and cases where they have outright protested must be examined both in terms of intent, how great the infringement can be assumed to be on said person in relation to the good it has produced, and the relation of harm and good to the act of preserving the projects.

3.4 Archival evaluation criteria for Flash preservation

In this section the criteria for evaluating and discussing the examined projects from an archival standpoint are presented. The criteria are based on current research and theory within the field of archival science and were chosen based on emergent themes in said research.

Preservation method. There are several different ways to preserve digital material. Migration to a new platform or conversion to a new format may be two of the most well-known, true, and tested methods. However, they each have their own

downsides, such as requiring changes to the original file, or potential loss of information (Borghoff et al. 2006, 13-14). Emulation, which aspires to recreate the conditions of another software and/or hardware environment also allows for preservation of the original bitstream. This may make it the most authentic and viable option for certain kinds of born-digital content but may also require the continuous rewriting of the emulation software (Borghoff et al. 2006, 16f; Kristiansson 2002, 217; Newman 2012a, 48).

Loss of information and loss of experience. These two criteria refer to potential problems with the varying methods of preservation. Loss of information could in this case refer to the disappearance of text or other graphical information when converting to a new file format. Loss of experience could be loss of playability in a game, which could happen if the game was preserved through gameplay recording such as machinima (Harwood 2019, 123) or if an emulator does not fully function. Machinima would still allow a viewer to perceive information like text and graphics but would not allow them to participate as a player. While there is discussion in the field of game preservation as to whether long-term playability or documentary approaches such as walkthroughs and machinima should be the ultimate goal of game preservation (see Newman 2012b, 160; Newman 2011, 111, 115-123), this thesis takes the stance that, in general, solely documentary approaches carry with them a loss of first-hand experience, even if they may contribute other information about the social and knowledge producing aspects of gaming culture. Furthermore, the stated goal of the examined Flash preservation projects is generally to preserve the playability and original experience of Flash media as much as it is possible to do so, which therefore makes loss of experience a relevant criterion. These two criteria also include changes in information and experience. Since the original files are in some cases no longer available, part of the analysis relies on a variety of sources including the accounts of other users or information found in metadata, journalistic articles, or information from the creators themselves.

Appraisal, selection, and culling. There is no way for archivists or anyone else creating a collection for posterity to know for sure what will be interesting for the researchers of the future; even so, the sheer amount of information makes culling and stripping necessary evils (Fredriksson 2003, 22). In the case of Flash media, rather than culling after the fact, the creators of preservation projects may have had to appraise and select which materials should be preserved. The selection made for any sort of collection is affected by those doing the selecting; this means that the act of selecting what to include in any given ALM collection can legitimise, signal

certain values, and create collective identity and memory as well as act as an exclusionary force (Cook 2013, 101-102; Eivergård & Lundström 2007, 130, 134-135). If any systematic appraisal and selection has been done by the project creators, the criteria on which the selection was based, and the possible repercussions should be discussed. This also includes a selection that includes ‘everything’ since this may have usability or economic repercussions (cf. Fredriksson 2003, 22-23).

Information architecture. The term information architecture describes the sum of the organisation, search functions, labelling, and navigation of websites (Taylor & Joudrey 2009, 20). Examination of the information architecture of each project is necessary, since aspects such as classification affect both how information is perceived and received. Classification systems also reflect the time and culture in which they were created (Adler 2016, 630). Thus, classification can both privilege certain information and act as a force of exclusion; examples include the lack of queer perspectives in classification systems, or the classification of homosexuality as a disease or as a solely adult topic (cf. Tortorici 2019, 89, 95; Taylor 1993, 23-24). Moreover, classification and organisation deal in trade-offs; comparability and visibility might make a system unmanageable, while too much freedom causes structurelessness (Bowker & Star 1999, 232-233). These aspects of information architecture must be examined, as well as its usability and UI/UX.

Metadata and provenance. The traditional concept of provenance may be difficult to apply to a website (Craven 2008, 22-23), but the metadata provided in the preservation projects could, and ideally should, still list the original creator and the original upload site and date of the preserved Flash media as a form of digital provenance. Metadata about the origins of digital files should be central to any form of digital archives (Eriksson 2014, 235). For digital games especially metadata is a key component of the preservation (Carta 2017, 196-201). In an ideal preservation project, the metadata would contain information such as file characteristics, acquisition information, categorisation, title, and creator (Taylor & Joudrey 2009, 97, 102-103). Because metadata is central to the organisation of digital files the state of each project’s metadata is examined.

Accessibility. For a physical archive, questions of accessibility may be centred around topics like disability accommodation, fees, location, opening hours, surveillance, and prejudice (Tegnhed 2018, 152; Primer 2009, 61-62; Brekke & Røsjø 2016, 134; Cartwright 2020 65-67). For the Flash preservation projects, accessibility may still be a question of disability accommodation and fees, but

otherwise accessibility must be evaluated based on different aspects than for those of a physical archive. As pointed out by Fiadotau (2020, Everything, by everyone: Preserving the legacy of Flash games, para. 18) the Newgrounds Player (see section 5.1.1) project is problematic in this aspect because it is only available on Windows systems. Aspects such as operating system and browser compatibility, the requirement to download a program or install a plugin or mobile compatibility all affect the accessibility of these projects. While potential (in-)compatibility with digital accessibility aids should also be examined for digital projects, this is a topic too vast for the scope of this thesis and thus this aspect of accessibility will unfortunately not be evaluated.

Long-term preservation plans. Ideally, a preservation project of any kind would have long-term plans for upkeep and accessibility. Certainly, long-term preservation is at the heart of much archival activity. Whether or not the projects can last in the long term, and whether their creators have considered it at all, is relevant if they are viewed as a form of online community archives. Since the fickle nature of the Internet as an archival repository is one of the key issues of Flash preservation, this is an important criterion to evaluate if possible.

3.4.1 The question of authenticity

As the reader will have noticed above, there is no criterion that particularly deals with authenticity, other than in terms of loss of information. This is because, in contrast to video games published on discs or cartridges, Flash media cannot be preserved in a hardware museum in its original form. With the end of life of the original software that enabled playback of Flash media in its original form, emulations, simulations, third-party .swf players, and conversions to new file formats or migration to new platforms are the remaining preservation options. Thus, the question of whether an emulation or a port is authentic or not (see Newman 2012c, 136-141; Carta 2017, 194-196) becomes irrelevant. What can be verified is whether the preservation projects include provenance and metadata information about who is the original creator, when and where the media was first uploaded etcetera, and whether they are forthcoming about potential culling or altering of information, be it purposeful or not. In other words, authenticity is not discussed in the same terms as it would be for a paper archive, or even for a digital game archive relying on specific hardware.

4. Methodology and material

In this chapter, the methodology and material selection are explained in detail. Furthermore, the research ethics, particularly in regard to collecting data from the Internet are reflected on.

4.1 Netnography and text analysis

The methodology used to collect data for this thesis is based in the netnographic tradition. Netnography is an appropriate method for collecting qualitative data from the Internet, since quantitative methods can only paint a limited picture of human activity online. Up to 80% of Internet traffic may be visual material, which requires a qualitative approach (Kozinets et al. 2018, 231 – 235; Reid & Duffy 2018, 272). As the main concern of this thesis is evaluating online projects against flexible criteria, a qualitative method is more appropriate than a quantitative one. Netnographic method also entails the adaptation of methodology and understanding of context, language, and communication in Internet communities (Reid & Duffy 2018, 266; Berg 2015, 145), which is a part of the research in this thesis. However, this is not a study focusing on social interaction online, which is usually a central aspect of netnography.

Netnography uses immersive, but not intrusive techniques (Reid & Duffy 2018, 265-266). It usually means that there are participatory aspects to the research (Reid & Duffy 2018, 266; Berg 2015, 149). In this thesis the participatory aspect is mainly articulated through the examination of criteria such as playability and readability, from the perspective of a casual Flash gamer and *Homestuck* reader, with a fair but not overly detailed knowledge of the game portals and of the webcomic examined. To broaden this perspective, the experiences of other users and developers are used when they are available. Netnographic method means the researcher treats the Internet as an archive; much of what has been said or uploaded remains for at least some time, and this material can be used to collect data and construct context. This material also contains one of the inherent flaws in netnography. Some users only read and never post, or only play Flash games without leaving comments; a netnographer will always work with incomplete material (Berg 2015, 151-153). It is also important to note that a qualitative method like netnography will not give a complete picture of a heterogenous community or website, but it is a method that captures aspects that quantitative methods do not, as pointed out above.

Netnography means the researcher may have to analyse text, symbols, images, and video. This means that it includes aspects of text and linguistic analysis to examine procedures such as exclusion, inclusion, and the construction of arguments. The researcher must also employ this type of analysis to attempt to ascertain whether a bot or a human is posting (Kozinets et al. 2018, 236, 239; Boréus 2015 162 - 166). However, the researcher cannot speculate freely about the truthfulness of what someone is posting, but should instead focus on what they are actually saying (Berg 2015, 149). This type of analysis is particularly valuable when considering the data collected from comments on the preservation projects, and when considering the role of cultural capital in Flash preservation. Further details on the exact methodology of examining each project is included in the dedicated section in 5. *Archival Evaluation*. Functionality in the Safari desktop browser or on MacOS are not tested due to a lack of access to Apple products. Functionality within the Linux OS is also not tested.

4.2 Material selection and limitations

Since there are several different projects focused on preserving Flash media, only a limited selection is examined in this thesis. Considering the diversity in the type of preservation projects and their creators, the following projects have been chosen:

- Newgrounds' Flash preservation project, consisting of a site-locked media player and use of the Ruffle emulation program (see 5.1.1 for details).
- Three different projects preserving the webcomic *Homestuck*; (i) VIZ Media's platform migration and conversion, (ii) VIZ Media's print version, and (iii) a fan-made unofficial collection of the webcomic (see 5.2.1 for details).

There is a wide range of actors, from a publishing house to private individuals to Internet communities, interested in preserving Flash media. Other than the two projects mentioned above, other preservation attempts will be outlined in less detail for the purposes of discussion and comparison. Since Flashimations are generally easier to convert to new formats than Flash games (Fiadotau 2020, Introduction, para. 8), the focus is largely on projects that aim to preserve browser games, with the exception of *Homestuck*. The preservation of *Homestuck* is included because although it is only one single webcomic, there are at least three separate preservation attempts which take on radically different forms. Therefore, they are interesting both in comparison to each other, but also in comparison to preservation

of other Flash media. Due to the sheer number of games uploaded to Newgrounds, only a selection of games originally created for Flash were tested for playability. These were selected both through Newgrounds' search and discover functions, and from lists of well-known Flash games. A full list of tested games, sources for, and details on the selection process can be found in the appendix (see appendix 2). For the same reason – scope – the evaluation of *Homestuck* is limited to Act 1 and 2 of the webcomic. These Acts are comprised of the first 758 pages.

To complement the data collected in the examination of the selected projects, other users' and developers' opinions and impressions are also used where they are available. These are found in forum comments, blogposts, and interviews.

4.3 Research ethics

One of the ethical issues netnography faces is the grey area between what is public and private on the web, because a user might post something with perceived privacy, and they may not consider that their post would ever be included in scientific research. Using the web as an archive means that the users do not have informed consent in the same way as an interviewee would. Furthermore, it is usually not possible to verify the age of someone posting online. These complications mean that the researcher must consider the ethics on a case-by-case basis (Reid & Duffy 2018, 281; Berg 2015 154-155). While using a hashtag, for instance, can be equated with actively wanting to participate in a community or a discussion, it may still be appropriate for a researcher to anonymise posters (Reid & Duffy 2018, 281). This reasoning can be extended to the forum or blog posts used in this thesis; while the posters want to and do participate in discourse and discussion through the action of posting, they may have written their post with the intent that only users of the forum or members of the blog community would read it. As also pointed out by Pace & Livingstone (2005, 35-36), the main issue is whether one is to consider what is written on a given forum private or public, as the latter means that there would be few, if any, ethical qualms about using the material without anonymising it. Opinions and expectations on whether an Internet user can be expected to understand that what they write online could potentially be read by anyone or used by researchers varies (Whiteman 2012, 55-63). All forums and blogs quoted in this thesis – that is to say, any data that could be considered as concerning a human subject – are possible to access through a regular search engine

and read without logging in to any of the websites which makes it possible to judge the data as publicly available (cf. Pace & Livingstone 2005, 38; Vepsäläinen 2022, 146). Furthermore, it may be possible to identify someone through the way that they write or by searching for verbatim quotes online, and it may therefore be necessary to partially alter text or anonymise usernames to ensure that it is not searchable through a search engine (Berg 2015, 155). Because the quotes used and threads discussed below mainly deal with technical discussion of, or opinions on, the different projects, they have been deemed not to contain sensitive information and therefore not warrant further anonymisation than what is offered by the use of usernames in forums, or the need to inform users that a researcher is reading their threads. No personal data beyond comments on the projects the thesis is concerned with is gathered (cf. AOIR 2019, 20 on data minimisation). Certain forms of data collection, such as data collection through automatic scrapes, are forbidden in many websites' user policies, but it is debatable whether following such terms and conditions is legally required of an academic researcher whose research may benefit society at large (AOIR, 2019, 14-15). In any case, all data collection for this thesis was performed manually and did not involve any of these types of processes forbidden by site policies. Therefore any concerns about such policies are irrelevant in this case.

The research in this thesis briefly touches on projects that in some cases are in a legal grey area regarding copyright. Links to some projects have been removed to protect the privacy of their creators, and for those projects no individual creators are named, even by username. This is also done to protect their privacy. When discourse on or user-reported issues with the projects is analysed, usernames are written out as these users are considered to have actively and willingly participated in the discussion. No actual, legal names are used for any quoted forum user or blogger, with the exception of Newgrounds founder Tom Fulp's, as his username on the account he uses to communicate to the Newgrounds community is 'TomFulp'. Since this is the case, what he posts using that account is assumed to be written not in his role as a private individual, but as a representative founder and administrator of Newgrounds.

5. Archival evaluation

In this chapter the projects are evaluated based on the archival criteria listed in section 3.4. The evaluation considers the projects from several aspects important to archiving and long-term preservation. Quotes in the sections below are written out as they appear on the forums, with spelling and grammatical syntax errors left in.

5.1 Newgrounds

Newgrounds is a website, launched in 1995 by Tom Fulp. In the early days of the Internet, it was an important hub for collecting and connecting content. This particularly consisted of Flash content, including animation and games, in the earlier days of the site. The site also hosts a forum, which was part of creating and producing knowledge on Flash and Flash programming. Newgrounds uses the tagline ‘Everything, By Everyone’, denoting the site’s willingness to accept works by amateur and hobby creators. Creators have their works judged and rated by other amateurs and the site employs a lax content regulation which allows for adult and violent content matter (Salter & Murray 2014, 39-40, 49, 69-70, 74-76, 83). As noted by Fiadotau (2020, Growing old on Newgrounds: Community discourses of technological change para. 3, 30-32) Newgrounds’ identity as a community is closely tied to Flash. The site discourse on the end of Flash initially oscillated between blame-seeking and nostalgia, before turning to an interest in preserving the content. This led to the development of the site-locked solution the Newgrounds Player (Fiadotau 2020, Everything, by everyone: Preserving the legacy of Flash games para. 14-19), which is examined closer below.

Use of the Newgrounds Player requires an account on Newgrounds. All data collection on the Newgrounds Player was undertaken while surfing the site from a logged in account. Games were tested for playability and functionality in the two different preservation solutions (see 5.1.1 below). Appropriate games to test were identified both by using the list and sources in the appendix (see appendix 2) and by sorting by number of views while using the site’s search and discover functions. To ensure each tested game was an .swf file its page was initially visited with the Ruffle toggle (see 5.1.1) turned off, to check whether the game prompted a launch in the Newgrounds Player – meaning that it is a .swf file – and then the page was refreshed to check whether Ruffle emulation was used. To find threads and

comments on the software, the forum search function with keywords such as ‘Ruffle’ or ‘Newgrounds Player’ were used.

5.1.1 Preservation method

As outlined in a post by user Sonucais (2021) on Newgrounds, there are several workarounds for Newgrounds users wishing to play Flash games after 2021. The solutions outlined in this section are the two solutions implemented by the site runners: launching games through the Newgrounds Player or using Ruffle.

The Newgrounds Player (hereafter NGP) is a downloadable plugin program which functions similarly to the original Adobe Flash Player (Newgrounds 2021). When a user browsing Newgrounds comes across an .swf file they are asked whether they would like to launch the game through the NGP (see figure 1 & 2). It is currently only available for Windows operating systems. Version 1.0.7, released in May 2021 is as of March 2022 the latest stable version (Newgrounds 2021).

The other solution implemented on Newgrounds is Ruffle, a Flash Player emulator written in the Rust programming language and, although sponsored by the site, not developed specifically for Newgrounds (Ruffle n.d). Ruffle offers both the possibility for website owners to implement it sitewide so that files previously played in Flash automatically play in Ruffle, and the possibility of a browser plugin for those only surfing the websites (*ibid.*). If a game uses Ruffle the user will not normally notice any difference from playing a game in HTML5, as it is an invisible solution. Newgrounds has an uneven implementation of Ruffle where some games use the emulator, and others prompt the player to launch the game in the NGP.

Ruffle does not yet have full compatibility with all versions of Flash’s ActionScript language (Ruffle n.d; TomFulp 2021a). As such it currently cannot be the sole solution for Newgrounds even though, when functional, it offers a more seamless solution than the NGP. A majority of the games tested for this thesis still used the NGP, and some ran more smoothly in the NGP than in Ruffle. Only one tested game (see appendix 2) ran exclusively in Ruffle. Newgrounds’ founder, Tom Fulp, is actively working on easing the implementation of Ruffle (TomFulp 2021a). Currently, Newgrounds users have the option of using a toggle on their account settings page, which enables/disables Ruffle where applicable. If the toggle is set to off, .swf files prompt a launch in the NGP. If it is set to on, games compatible with Ruffle emulation does not prompt a launch in the NGP.

Both preservation projects are community efforts to a large extent, with users aiding each other in troubleshooting and indexing non-functional games, which is the point of the 2021 TomFulp thread referenced above. In a thread by user otonomic (2022), the community both aids them in activating the Ruffle toggle, and theorises that the site administration is currently working on perfecting Ruffle implementation rather than updating the NGP. This sentiment can also be found in other places. On the software recommendations site alternativeto.net user Douze (2022) commented that they think Ruffle is the future of Newgrounds Flash preservation in the eyes of the NGP development team, but that they could not confirm it for sure.

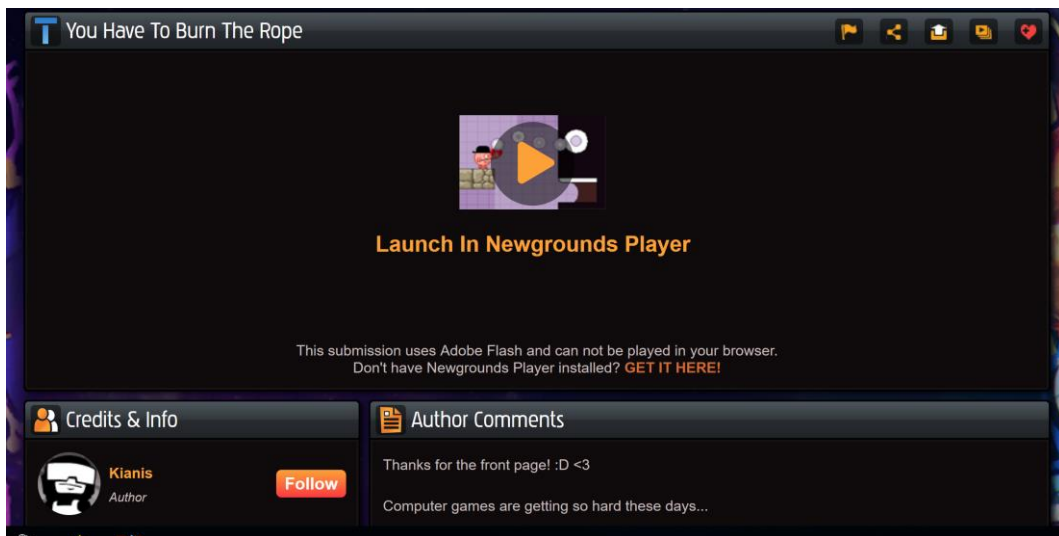


Figure 1. Screenshot of prompt to launch You Have To Burn The Rope in the Newgrounds Player. 2022-03-04.

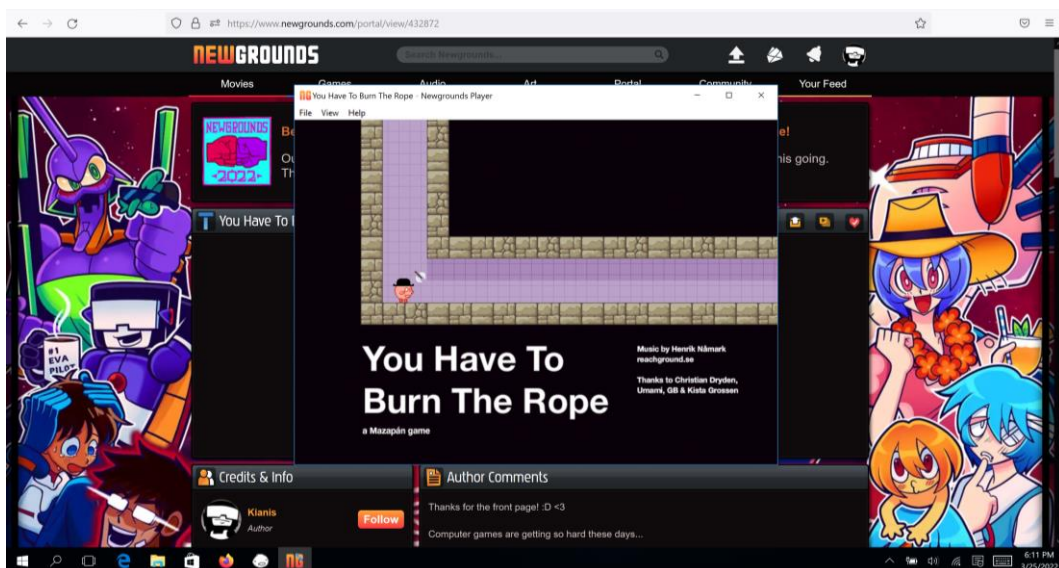


Figure 2. Screenshot of You Have To Burn The Rope launched in the Newgrounds player with Newgrounds open in the background. Note that the player is a different program in the taskbar than the browser. 2022-03-25.

5.1.2 Loss of information and loss of experience

Most games tested for this thesis ran as intended in either Ruffle, the NGP or both. Because Ruffle is an opt-in both for developers, site-runners and players, all games using Ruffle emulation should be possible to run in the NGP, but not *vice versa*. Some games run more smoothly in the NGP than in Ruffle (see appendix 2), but Ruffle is a solution that is equally convenient and invisible to the original Flash Player. If the player chooses to keep the Ruffle emulation toggle on and the emulation functions as intended, the player hardly notices that they are playing a Flash game since it is an identical experience to playing a Newgrounds game in another format. Its advantages over the NGP are that it is less intrusive to the browsing experience and does not require installation of a separate program. Some of the games tested ran slowly in both solutions, but this may be due to how they were programmed in the first place as Flash content did have varying quality and UX to begin with. However, certain users on Newgrounds have reported Ruffle implementation as a buggier or less functional experience than using the NGP, as well as active intervention being required by developers to ensure functionality with the emulator (e.g., TomFulp 2021a; Kwing in Abracadabra123 2020; Lambtaco 2021). These reports also match the data gathered while testing games for this thesis. Another observation made while comparing the upload dates of tested games is that while most of them herald from the mid to late 00s, there are examples of Flash media made even after 2020 (see appendix 2). This implies that the existence of Ruffle and the NGP is supporting further creation of Flash media, albeit on a smaller scale than before.

The biggest issue is with multiplayer games. While a majority of games tested were single player, four multiplayer games were also tested for the thesis (see appendix 2). Two of them used local multiplayer and functioned as intended. Of the other two, one linked to another website and was not playable at all, and the other only functioned when choosing to battle against the CPU. As stated by earlier game preservationists, gaming as an experience is created in part by its context in a community of gamers (Newman 2011, 115-116). While both the NGP and Ruffle preserve the original context of the games on Newgrounds – which might please the archivist concerned about digital provenance and *respect des fonds* – they are not appropriate or satisfactory ways to preserve multiplayer experiences. As Newman (2012b, 160) states, we may have to accept that retaining playability is not always possible. These are cases where other approaches to preservation than attempting to retain playability are appropriate.

Other than multiplayer games and certain games that become buggier when run through the Ruffle emulator, the loss of information and loss of experience for either solution can be considered negligible.

5.1.3 Appraisal, selection, and culling

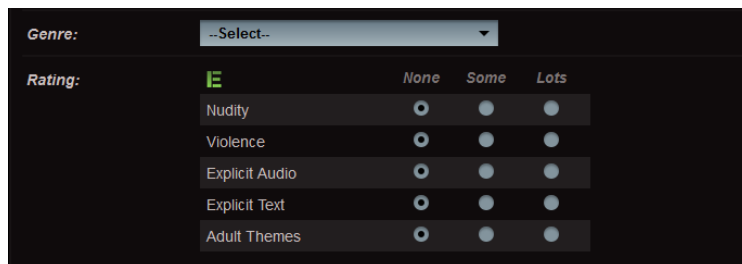
Since all Flash games on Newgrounds theoretically function either in Ruffle or the NGP, there is no appraisal, selection or culling that differ from the general submission rules of the site. Any submission on the site has already been subjected to the site's submission policy of 'blamming'. When a submission is uploaded to Newgrounds, it enters the state of being under judgement, and users can vote to blam – delete – or protect the project. If a project does not receive a sufficient score when the judgement process is over, the project is blammed from the site. The appraisal, selection and culling processes are therefore based on quality recognition by the site's community. Submissions are also subject to the general rules of Newgrounds, which means they will be deleted if, for example, they contain nude photos, illegal content, hate speech or copyrighted content. Parodies do and are allowed to appear on the site (Newgrounds n.d. a-c). The blamming process has been in place since 2000 (Salter & Murray 2014, 74).

This system means that everything on Newgrounds has gone through something that could be compared to a peer review process, and is valued by at least part of the community. This means the content has capital within the field of Flash creation (Bourdieu 1993, 30), and the Newgrounds community. The site administrators also have the ability to remove submissions that break the rules, which can be reported in various ways (e.g., BrokenDeck 2014; Newgrounds n.d.d). Furthermore, although the site's acceptance policies are broad and allow content not allowed in other places, content may be reviewed on a case-by-case basis. There are hard limits against certain kinds of content, such as sexual content depicting underage characters which is not allowed under any circumstances (Newgrounds n.d.e). Whether or not this is an ideal policy for selection and culling can be discussed but, as stated above, the content on Newgrounds does have value and holds recognition capital within the community. Even so, the system cannot be said to be fully egalitarian since active users have more blamming and protection points, which means their votes hold more power (Newgrounds n.d.b). The ability to directly report content as a logged in user is also tied to the user's 'whistle status'; if a user has reported a lot of content deemed not in violation after review by moderators, that user has a broken whistle. This means moderators will not be notified of their reports until they have built up sufficient points again, functioning as checks and

balances against abusing the reporting system (Newgrounds n.d.f). This system and the blam/protection points system risks rendering feedback loops where certain users are more powerful and taken more seriously, furthering increasing those users' power.

5.1.4 Information architecture

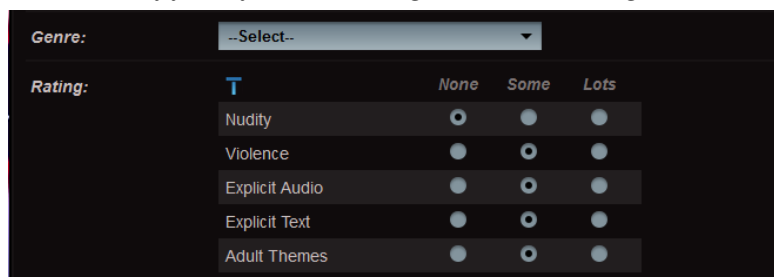
Since both the preservation solutions allow the player to browse Newgrounds as a regular user, the information architecture of both projects is identical to that of the site. Newgrounds employs several levels of classification for its submissions. The broadest category is that of age ratings, where all works fall into one of four categories: E- Everyone, T- Teen, M- Mature and A- Adult, which users can filter by. When submitting a work, creators are asked to mark on a scale how much nudity, violence, explicit content, and adult themes their submission contains, which then determines what rating it receives. The only way to receive an E rating is to mark 'none' for all. Nudity, not violence, is the determining factor for whether a game is marked T, M or A. In general, marking a submission as containing 'some' of the other factors will give it a T rating (see figures 3-8).



The screenshot shows a submission form with a 'Genre' dropdown menu set to '--Select--'. Below it, the 'Rating' section displays a large green 'E' and three radio button options: 'None', 'Some', and 'Lots'. The 'None' option is selected. Below these are five rows of content categories, each with three radio buttons corresponding to 'None', 'Some', and 'Lots':

Category	None	Some	Lots
Nudity	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Violence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explicit Audio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explicit Text	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adult Themes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

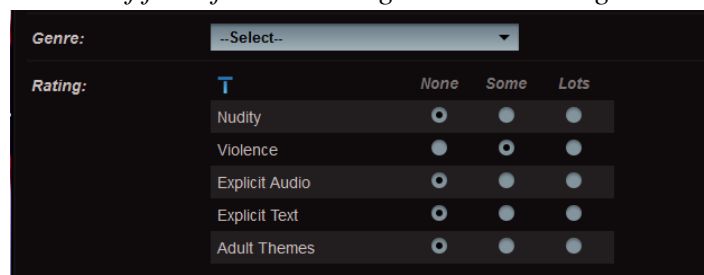
Figure 3. Screenshot of form for submitting content to Newgrounds. 2022-04-12.



The screenshot shows the same submission form, but the 'Rating' section now displays a large blue 'T'. The 'None' radio button is still selected for all categories, but the 'Some' radio button for 'Violence' is now selected.

Category	None	Some	Lots
Nudity	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Violence	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Explicit Audio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explicit Text	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adult Themes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 4. Screenshot of form for submitting content to Newgrounds. 2022-04-12.



The screenshot shows the same submission form, but the 'Rating' section now displays a large blue 'T'. The 'None' radio button is still selected for all categories, but the 'Some' radio button for 'Violence' is now selected.

Category	None	Some	Lots
Nudity	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Violence	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Explicit Audio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explicit Text	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adult Themes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 5. Screenshot of form for submitting content to Newgrounds. 2022-04-12.

Genre: --Select--

Rating: **M** None Some Lots

Category	None	Some	Lots
Nudity	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Violence	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Explicit Audio	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Explicit Text	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Adult Themes	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Figure 6. Screenshot of form for submitting content to Newgrounds. 2022-04-12.

Genre: --Select--

Rating: **M** None Some Lots

Category	None	Some	Lots
Nudity	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Violence	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explicit Audio	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Explicit Text	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adult Themes	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 7. Screenshot of form for submitting content to Newgrounds. 2022-04-12.

Genre: --Select--

Rating: **A** None Some Lots

Category	None	Some	Lots
Nudity	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Violence	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Explicit Audio	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Explicit Text	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Adult Themes	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

Figure 8. Screenshot of form for submitting content to Newgrounds. 2022-04-12.

The fact that nudity in and of itself means a submission receives an automatic M rating equates nudity with sexual content. Nudity is also the main thing users on the site watch out for when rating their submissions (ZedrinBot 2016). This may be erring on the side of caution to ensure those not wishing to see nudity or sexual content while browsing will be able to safely avoid it, as much of the content rated A is in fact sexual in nature. If that is the case, one might ask oneself why the same caution is not applied to content containing graphic violence which may also be upsetting but is consistently marked with the lower M rating. The input values are subjective, meaning site administrators may consider ‘adult themes’ or ‘some’ to mean something else than the uploader. Categorisation is affected by the culture and the society in which the categorisation system is created (Adler 2016, 630) and Newgrounds was founded by a US American. This may contribute to the categorisation of nudity in and of itself as adult; it has, for example, been found to be constitutional for the US government to prevent a woman from showing her nipples to protect morality (see Gutwein 2021, 349-351). In the US female nudity

in particular is sexualised by the laws that govern it. While this is not unique to the US (*ibid.*), it can be assumed that cultural perceptions of nudity affect the way it is categorised.

The rating system itself does not, for example, differ between heterosexuality or homosexuality. While this theoretically means gay as well as straight content could be marked E, a search in games using ‘gay’ as a keyword produces results containing several joke games – such as a ‘gay test’ – as well as adult games. This is probably not due to the information architecture of the site itself but rather due to its userbase. Fiadotau (2020, Growing old on Newgrounds: community discourses of technological change, para. 12) has written on the varied politics of Newgrounds users and how both left-wing and right-wing content coexists on the site. This is probably equally true for other types of divisive content, although outright hate speech is not allowed, as pointed out above. The game *Gay Kiss* (horriblepain 2013) is, despite not containing any nudity, categorised as T. A likely explanation is that the violent joke of the game – the couple is kissing behind a priest, trying not to get caught until the priest’s head explodes – is the reason for the rating, but the creator may have reasoned around gayness and kissing as adult themes as well. The process is not transparent. More inexplicable is the T rating of the game *The Gay Test* (vomic 2021), as this game contains nothing but a question asking whether the user is gay, and buttons marked with ‘yes’ and ‘no’ options. The game will always return the result ‘gay’ regardless of what button is pressed. The T rating on this game implies that the creator considers either joking about sexuality or the mention of sexualities other than heterosexual a somewhat adult topic, as the game contains no profanities, nudity, or violence. The high grade of subjectiveness of the rating system does risk creating marginalisation of subjects such as queerness or homosexuality through categorisation (cf. Tortorici 2019, 89, 95; Taylor 1993, 23-24).

Games, which are the type of submission this thesis examines closely on Newgrounds, are sorted into broader genres, called ‘categories’ on the site. These include Action, Adventure and Puzzles, which in turn contain varying numbers of subgenres such as ‘Action – Fighting – Brawler’ or ‘Puzzles – Quiz’. Various metrics are searchable and possible to filter. These include title, creator, tags, description, genre/category, age rating, date, number of views and score, among others. Users can also filter by APIs such as medals (see figure 9).

While the search function is thorough, the number of results returned and number of options for filtering may be daunting to a casual or first-time user. The search does work well when exact titles or creator names are known, and the tags (see 5.1.5 for further detail) do enable browsing of similar content. There are also advanced search options which offer the possibility of tuning, such as input of exact matches or specific dates. The number of options and the amount of detail available do result in a trade-off (cf. Bowker & Star 1999, 232-233) against user-friendliness until the user familiarises themselves with the site. Certain terminology such as the ‘Spam’ category may also be confusing for a user not familiar with the site-specific application of the term.

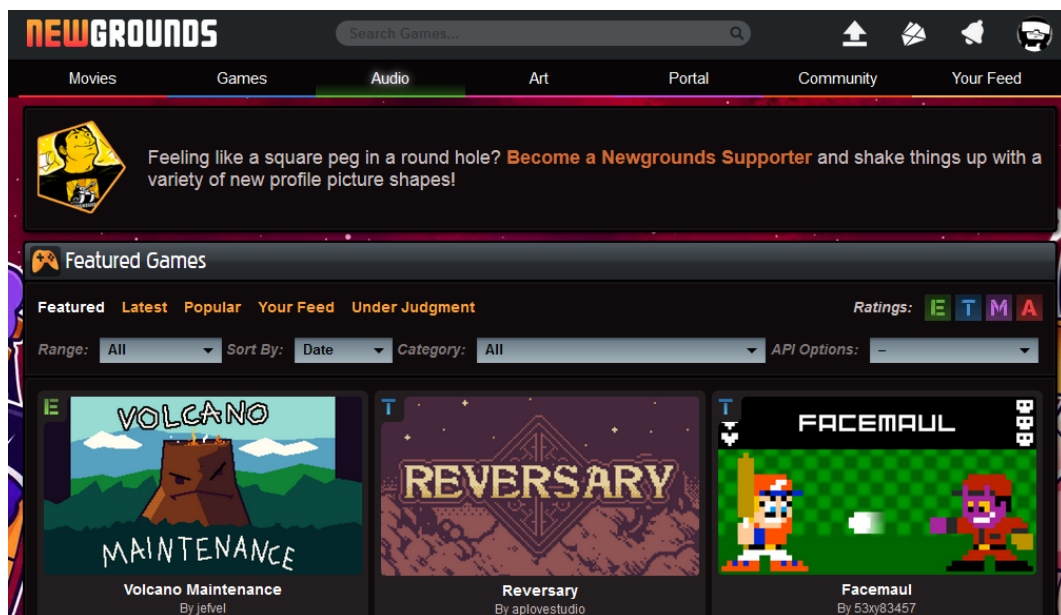


Figure 9. Screenshot of some of the search options for games on Newgrounds. Typing into the search bar at the top will result in a search through game titles, descriptions, and other metadata. Clicking a tag when on the page of a game will bring up other games with the same tag. 2022-04-15.

5.1.5 Metadata and provenance

Newgrounds shows metadata, comments, and credits about each submission next to or below the submission, with the exception of the submission rating, which is shown in the top left corner of the submission (see figure 1 & 10). The metadata includes age rating, creator, music credits, score, number of faves, views and likes, whether the game has been frontpaged, upload date and time, genre, and tags. Some of these aspects are automated, and some are controlled by the creator.

Tags are added by the creator when uploading, but Newgrounds offers a guide on how to tag submissions for maximum possibility of retrieval when searching the

site (Newgrounds n.d.g). While tags are useful to help users create their own ways of connecting, adding and categorising information, they also come with drawbacks such as spelling errors, users' personal taste and no control of synonyms or homographs (Taylor & Joudrey 2009, 366-367). The tags on Newgrounds are used in addition to several other ways of organising submissions, but these drawbacks could still make browsing more difficult. In some cases, tags on Newgrounds add information not available through the site's standardised information input; games can for instance be tagged as 'casual', which is a category that does not exist in the genre selection menu.

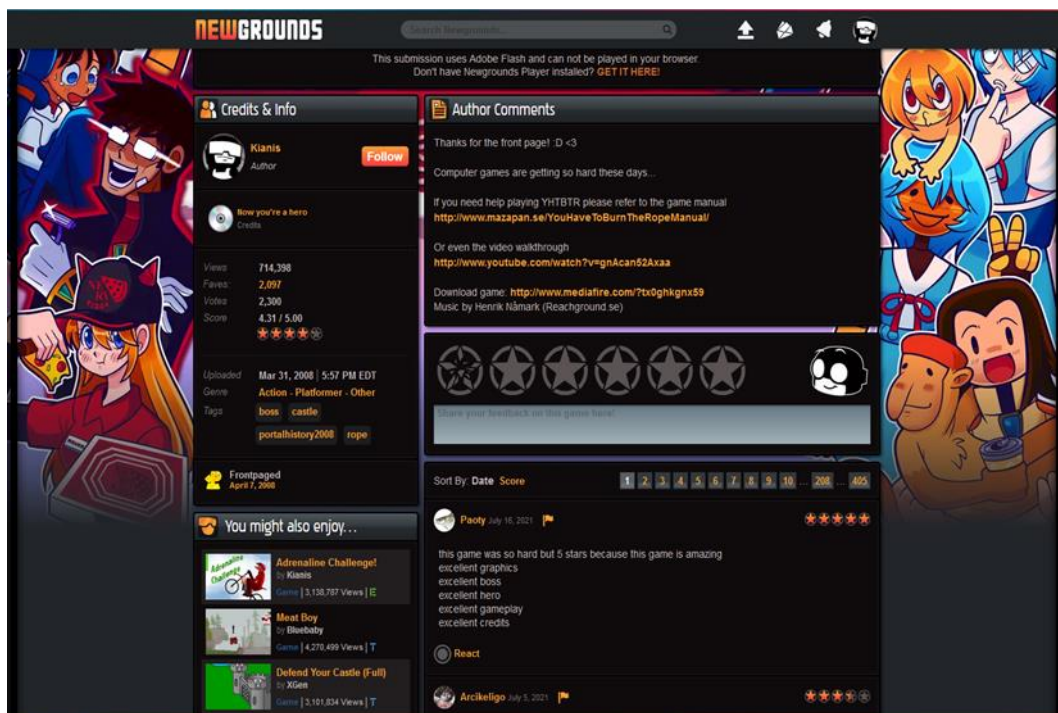


Figure 10. Screenshot showing the available metadata for You Have to Burn the Rope. 2022-03-17.

Assuming that the information provided by the creator is correct and they are following the rules of the site and only uploading their own work, the metadata gives a fairly clear picture of each work and its provenance on Newgrounds, and the tags and other options for data input mostly aid information retrieval when used correctly. There is always the risk that the files have been uploaded somewhere else initially and arrived at Newgrounds through a filesharing site. The Ruffle solution risks the same invisibility that plagued the original Flash plugin; it is not noticeable until it stops functioning, although it can be discovered by turning the toggle to off and refreshing the page. However, both the NGP and Ruffle allow the games to remain in their original context.

5.1.6 Accessibility

The NGP requires extra steps to use compared to Ruffle, which lowers its accessibility. Since Ruffle is an invisible solution on the UI/UX end of the spectrum as long as it is functional, its accessibility could be said to be equal to that of Newgrounds itself, affected by the site's information architecture as described above. Both types of preservation come with bugs and usability issues that may require some tech know-how to solve (see examples below). Therefore, neither of them has universal accessibility. Furthermore, the NGP's accessibility is also hampered by the fact that it only functions on Windows systems, while Ruffle runs in multiple browsers. Therefore, to improve its accessibility either the NGP would need to be developed for Mac and Linux OS, or Ruffle compatibility with all ActionScript versions would need to be improved.

Because there was awareness of Adobes decision to end Flash before it was executed, the NGP was made available before Adobe fully stopped support of the Flash Player. Initially, the NGP ran into some trouble. In a Newgrounds thread created by user stickyfigyguy (2019) requesting help using it, early adopters posted the problems they experienced:

For me it keep asking me to download adobe flash player

- Warbinger (09/08 2019)

and

doesnt work for me either - asks me for a url or someothershit to put in the field, and I can't find it on the webpage (via: view page info) because it didn't load it... vicious circle lol

-VicariousE (13/08 2019)

Later, players attempt to link to *Alien Hominid* as a quick way to try out the NGP since it is a known Flash game; however, sometime during this discussion *Alien Hominid* was switched over to the other Flash solution on Newgrounds: Ruffle. Therefore, a user suggests other games to try. Several of the games on this list have since also switched to Ruffle. Users point out that there is a toggle in the Newgrounds account settings which if switched to on should allow players to launch games through the NGP. Nevertheless, soon after another issue is revealed:

For me, NG Player has been working fine, but on some games I get a popup asking me if I "want to allow ____ to store information on your computer", and I can't get rid of it once it pops up, essentially making the game unplayable. It's very frustrating to have it work fine up to that point and then it won't even let me play the actual game after all. Anyone know how to fix this?

-eithmableura12 (13/08 2020)

The issue outlined in the quote above also appeared in one of the games tested for this thesis (see appendix 2). Although the user is offered help further down in the thread, it does speak to the NGP not functioning perfectly and the need for some tech know-how to solve problems caused by attempts to launch certain games. The discussion of various issues in the thread quoted above, such as the NGP conflicting with a still installed Flash Player, continues and the problems are solved with varying degrees of success up until December 2021. The NGP also requires a separate download and installation on the user's computer. This can pose a psychological barrier (cf. Brekke & Røsjø 2016, 134) to those unsure on how to handle unknown programs. On both Newgrounds and Reddit, users can be seen asking whether downloading the player is safe (e.g., NewgroundsNerd 2021; Crywank 2021). While the response given is that there is no reason for the Newgrounds administration to distribute malware, the question still speaks to there being an anxiety around being required to download something. User Skeltek (in Crywank 2021) argues that the NGP is in fact safer than the original Adobe Flash Player. The security issues of the original Flash player, covered for example by CVE Details (MITRE Corporation n.d) could be one reason that potential users are feeling anxious about the download.

To summarise, Ruffle has a lower accessibility threshold than the NGP, but its functionality is not as good with certain games or possible at all in some cases. While both solutions are free, the NGP may pose more of a psychological and technical barrier to users than Ruffle does.

5.1.7 Long-term preservation plans

Newgrounds' solutions will only last for as long as Newgrounds lasts. Since its founding in 1995, it has relied on ad revenue to offset the cost of running and hosting the site. The site is currently asking users to help cover their expenses, since the ad revenue brought does not provide sufficient funds (Newgrounds n.d.h). Therefore, a currently dedicated community and continuously updated solution through Ruffle or the NGP are not a guarantee that the site-locked project will have any longevity. This problem is not unique to Newgrounds – in fact, it is even something of a joke in communities concerned with digital infrastructure, and has been the subject of long-running webcomic *XKCD* which illustrates all modern infrastructure as a precarious tower reliant on one thanklessly maintained, single-person project (Munroe, n.d). The NGP is also threatened by Windows updates that make it harder to use, because Windows is blocking Flash, as pointed out by Newgrounds users (TomFulp 2021b). Currently it seems as though the community

is willing to improve and sustain the Flash preservation solutions they have developed, but the project faces several long-term issues. Most pressing are those of Newgrounds' funding and potential future loss of interest, either from the Newgrounds community itself, the site owners and runners, or the Ruffle team, all of which could bring about a more or less immediate shut-down of the projects (cf. O'Sullivan 2005, 70; Fournet 2021, 120-121). Site-locked projects all face the problem of only having the same lifespan as the site they are hosted on. Should Newgrounds' owners decide to shut down the site, it is not clear what would happen to the material currently hosted on it. At the moment the preservation projects seem to be intended to keep running for as long as the site does.

5.2 *Homestuck*

Homestuck is a webcomic created by Andrew Hussie, which originally relied on Flash technology for the playback and functionality of various interactive elements. These include GIF animations, music and pages set up as browser games or minigames, where the story is told through the reader controlling a character and interacting with various elements in a limited space (Hussie 2018a; Hussie 2018b, 4). The very first beta of *Homestuck* was created entirely in Flash, but this idea was later abandoned in favour of combining Flash with other programs (Hussie 2018b, 11). The webcomic, which ran from 2009 until 2016, also had a high degree of fan interaction with the story itself, originally including a suggestion box for the fans to suggest actions for the characters to take (Hussie 2018b, 3; Katz 2019). In 2018, Hussie wrote a news blog post on the platform migration of *Homestuck* from its old residence mspaintadventures.com to homestuck.com. The migration was performed by VIZ Media, who had become the publisher of the comic. It was also announced that *Homestuck* would be released in a print format with creator commentary, which happened later that year (Hussie 2018a; Glennon 2018). In the following section the first two Acts of the official publication on homestuck.com (hereafter referred to as *Homestuck*), the printed 2018 VIZ hardcovers (hereafter *print!Homestuck*),¹ and the fan-made downloadable program *The Unofficial Homestuck Collection* (hereafter *Unofficial Homestuck*) are compared to each other and evaluated. To a smaller degree the earlier 2012 print version of Act 2 published by Topatoco is also used in comparison with its later VIZ counterpart. The VIZ books reuse

¹ The format 'adjective!noun' or 'trait!character' to is used in fandom culture such as fanfiction, to denote a quality in a character or a fanfic. This may be an out of character trait, like 'evil!hero'. It is often used in the tags of a fanwork to inform a reader about the character dynamics in the fanfiction they are about to read (see '!?' as explained by fanfiction resource sites Fanlore 2019; Moonbeam's Predilections 2017).

commentary and layouts from their Topatoco equivalents to a degree, with some edits.

To collect data for this thesis, the three different versions were examined by running *Homestuck* and *Unofficial Homestuck* juxtaposed on two monitors, alongside *print!Homestuck* opened to the relevant page(s), to enable a close comparison of each page in each version. In addition, data on other user's experiences were collected from fandom dedicated blogs and forums by using search terms such as 'reading Homestuck 2021'. Below, each project is described in turn for each section. Some minor differences such as potential typos or layout mistakes have been left out of the sections below in the interest of readability and brevity.

5.2.1 Preservation method

The preservation of *Homestuck* is threefold, not including meta documentation such as content guides or wikis. The three different preservation methods are described below.

In 2018, VIZ Media performed a platform migration and conversion of the original *Homestuck* webcomic, as mentioned above. The migration also meant conversion of old Flash files into HTML and other video formats. This resulted in the current official *Homestuck* site. Most of the site, excluding links to the tie-in game *Hiveswap* and the web shop, remains functional and running in up-to-date desktop and mobile browsers as of March 2022. However, as pointed out by The Unofficial Homestuck Team (hereafter TUHT) in early 2022, *Homestuck* is made up of content hosted on places other than the core site, which is not necessarily being maintained and updated. Several pages of *Homestuck* (e.g., pages 422, 444 & 651) are embedded YouTube videos. This means that their hosting is out of both Hussie's and VIZ's control, and dependent on YouTube's continued existence and services. Hussie (2018a) has also described some of the VIZ solutions as temporary, but no more information on whether the concerned files have been updated is offered by the official news blog as of 2022. The 'More' section of homestuck.com also contains a link back to the original content on mspaintadventures.com, but it is explicitly described as un-maintained (VIZ Media 2018). The way the comic appears on the site is shown in figure 11.



Figure 11. Screenshot of page 750 as it appears on homestuck.com. The image is actually a looping GIF animation of the firefly blinking. 2022-04-20.

In the same year, 2018, VIZ Media also printed the webcomic as hardcover books, resulting in *print!Homestuck*. This meant migration to a whole different medium and conversion not to another digital format, but conversion from digital to print media. As a result, interactive aspects of the comics and animations or other moving images had to be altered. The books also include added commentary by the creator (Hussie 2018a; Glennon 2018). As of March 2022, the books remain possible to purchase both new and second hand. *print!Homestuck* sometimes collects several one panel pages on the same printed page, or conversely spread out the keyframes from animations over several pages. The way the comic appears in the books is shown in figure 12.

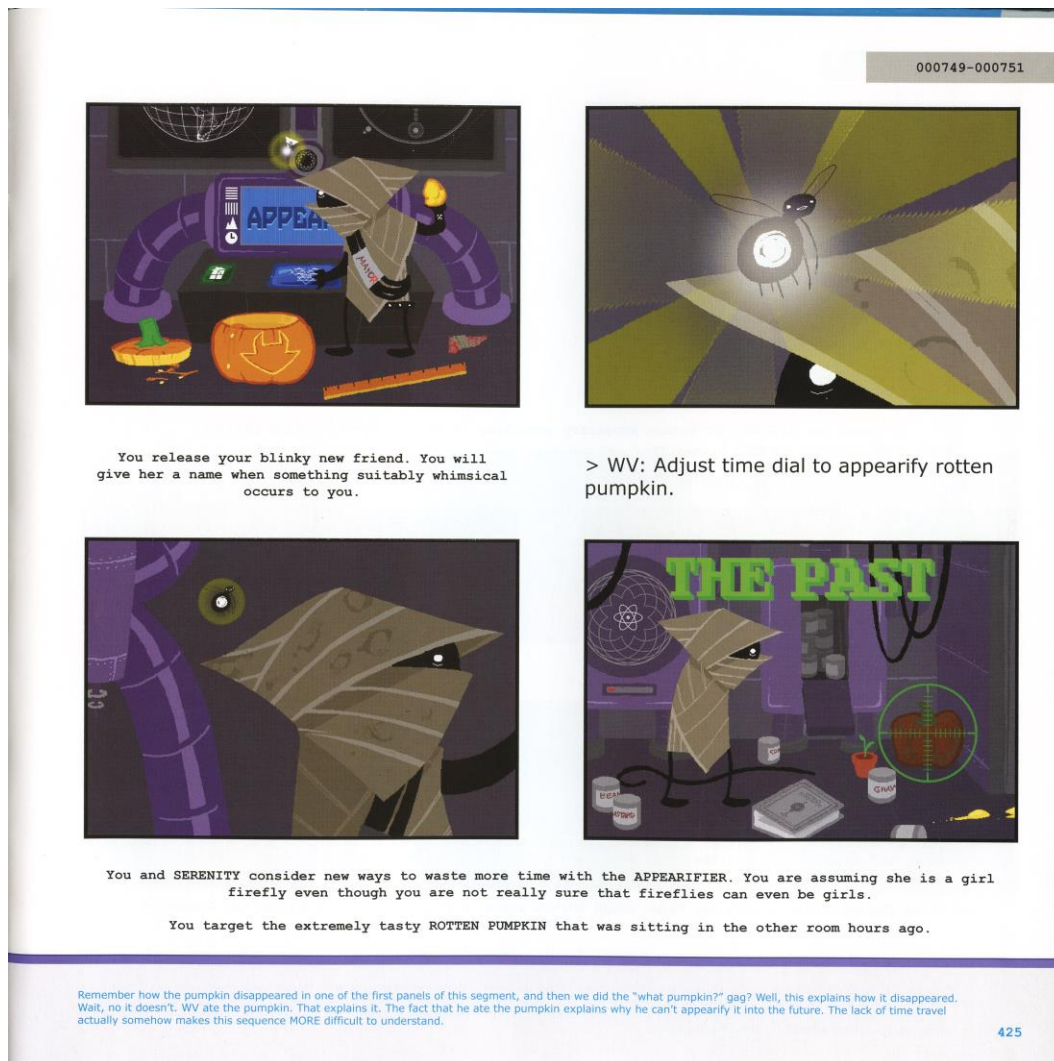


Figure 12. Page 425 of the printed Homestuck book collecting act 1 & 2. Note the numbers in the top right corner indicating what pages of the original webcomic are shown on this page, and the grey bar highlighting them, indicating that the Wayward Vagabond is currently the main character.

There is also a fan-made project: *Unofficial Homestuck*. *Unofficial Homestuck* is an offline browser and requires the user to download a program to run it. The inner functions of *Unofficial Homestuck* are not described in detail on its homepage, although links to the release history on GitHub and the following text are available:

The Unofficial Homestuck Collection is a heavily customised browser, built from the ground up to support Homestuck and its related works. Flashes? We got 'em. The collection runs Flash content natively, providing the most authentic Homestuck experience possible.

Don't get it twisted though, because "browser" in this context doesn't mean "online". The Unofficial Homestuck Collection is completely self contained, and never has to connect to the internet once you have it downloaded.

- TUHT (2022)

The program, containing a built-in Flash player, and the asset pack that contains the data are two separate downloads, both required to run the full *Unofficial Homestuck* (TUHT n.d). The collection allows the user to experience minigames and animations as they played back before the VIZ migration and conversion, but may also require rewriting for different operating systems and continuous updates to be able to run it on future machines. It is currently being continuously updated. As of March 2022, its last listed update was on February 21st, 2022: V.2.0.5. The application used for this thesis is V.1.1.0, since data collection was already well underway by the time the new application was released, and time-constraints would not allow for new data collection. *Unofficial Homestuck* may have minor changes in the newer releases. It is currently available for Windows, Mac and Linux operating systems (TUHT 2022). The way the comic appears in the application is shown in figure 13 below. The application also offers a settings menu unavailable in the other two projects. This is further explored below. Furthermore, *Unofficial Homestuck* is compatible with several optional third-party mods that readers may use for the application (TUHT 2022). These have not been examined for this thesis.

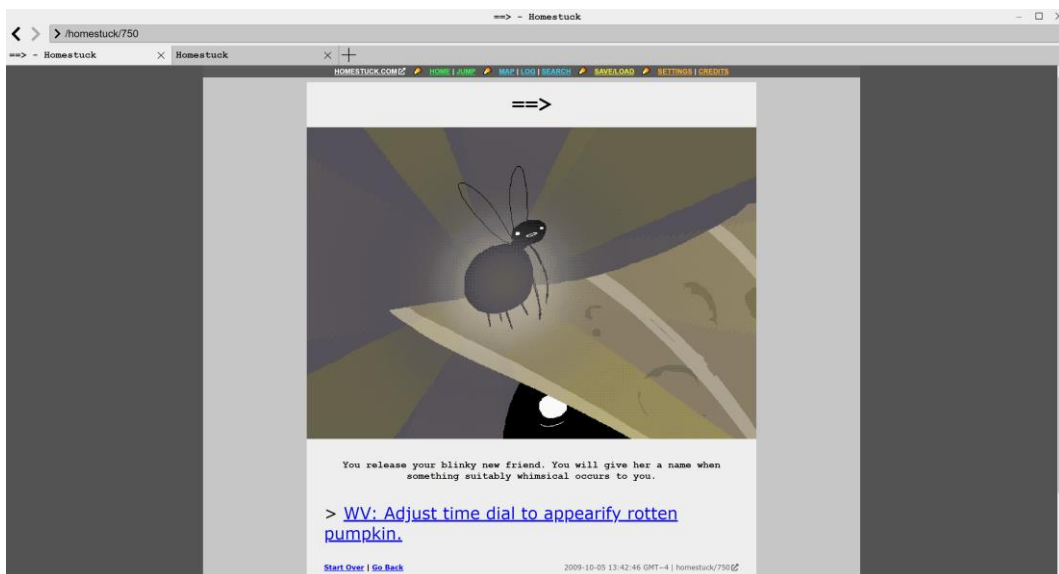


Figure 13. Screenshot of page 750 as it appears in *Unofficial Homestuck*. The image is actually a looping GIF animation of the firefly blinking. 2022-04-20.

5.2.2 Loss of information and loss of experience

There are several instances where the projects differ from each other in terms of loss of information and loss of experience. In the interest of brevity all of them will not be covered in the section below, but some notable examples will be mentioned.

Certain pages originally had a high level of interactivity, to the point of requiring programming when created and thus basically being minigames woven into the

story. The projects have treated these pages in different ways; some interactive pages are practically indistinguishable from each other in *Homestuck* and *Unofficial Homestuck*, while others are very different from each other – usually because they are replaced by a series of still images in *Homestuck*. On page 253 (corresponding to pages 173-191 in *print!Homestuck*) the reader originally had the option to walk around a character’s house and interact with different things, which moved the story forward, as commented on by Hussie (2018b, 173). In both *print!Homestuck* and *Homestuck* this page is replaced by still images, while *Unofficial Homestuck* retains the interactivity and allows the reader to walk around the house. However, while gathering data for this thesis this page was initially accessed with Flash enhancement enabled in the *Unofficial Homestuck* settings, which caused the character sprite to disappear. Switching off the JavaScript Flash enhancement solved this problem. While the still images are a necessary choice for *print!Homestuck*, it seems to be a choice of convenience to avoid manual conversion of .swf files when it comes to *Homestuck*. Another example of an animation being replaced with still images in *Homestuck* is page 476, which is still interactive in *Unofficial Homestuck*. Similarly, on page 338 (corresponding to page 237 in *print!Homestuck*) a beat sequencer is shown. As commented in by Hussie (2018b, 237), this was originally an interactive page which also contained musical easter eggs if the correct buttons were pressed – these are still present in *Unofficial Homestuck*, but not in the other two versions which both only show a silent still image.

Additionally, images in *print!Homestuck* have occasionally been altered to indicate movement in panels that were originally animated (e.g., page 14, corresponding to page 15 in the webcomic, or page 61, corresponding to page 93). This is an alteration of information rather than a loss of it, but still worthy of note. Another minor alteration of information is that the word ‘Flash’ in Hussie’s Topatoco commentary has been replaced by the word ‘interactive’ in the VIZ version (e.g., Hussie 2012, 9; Hussie 2018b, 173).

Further details on loss of information and loss of experience are given in section 5.2.3 below since there has been an active selection of what content to include in which project, which has affected both the experience and available information.

5.2.3 Appraisal, selection, and culling

Currently, the official *Homestuck* migration and conversion does seem to cover the webcomic in at least close to its entirety, even though fans point out that parts of

the content may still be hosted on mspaintadventures.com and that further ongoing updates other than the ones VIZ have implemented are required to make it fully readable and interactive (e.g., Makin- 2020). The site runners do seem to attempt to preserve and update the lion's share of *Homestuck* content. Hussie (2018a) has stated that their intention was never to continue maintaining *Homestuck* themselves and that it was necessary to hand responsibility over to someone else to keep the webcomic available. However, in the same post Hussie also states that the scope of the webcomic is very large, and describes the new site by VIZ as a work-in-progress. No news updates have been posted since then, so it is unclear what the future policy on selection and culling may be from VIZ. Some video clips of scenes from the film *Con Air* have been removed, but are present in *Unofficial Homestuck* (page 20, respectively).

As of April 2022, the last published *print!Homestuck* is number 6, covering Act 5: Act 2 part 2 (VIZ Media 2020). This means *print!Homestuck* is only about halfway through the approximately 8000 pages of *Homestuck*, as Act 5: Act 2 ends on page 4108 (Saltman, n.d). In a reddit thread (harryhinderson 2021) on the announcement that Hussie is not planning to continue working on projects related to *Homestuck* (What Pumpkin Games 2021), fans speculate that this means the books will not continue to be published since they use commentary by Hussie. Redditor maxdefolsch (2021) created a thread in which they posted an email exchange between them and VIZ Media that implies VIZ are currently not planning to continue publication. In another reddit thread, a user writes that several people have emailed VIZ asking about continued publication without receiving any satisfactory replies (DemonDogstar in Malleus94 2021). This implies that the *print!Homestuck* project may only ever cover the first half of the webcomic, a selection that makes this project less than ideal for preserving the comic for posterity.

The books do contain some of the bonus content accessible through links in the original webcomic as still images next to the panels that would have linked to them originally, meaning the option not to partake in the bonus content has been removed (e.g., pages 229-232, corresponding to page 326 in the webcomic). Furthermore, some linked content is missing altogether (e.g., on page 31, corresponding to page 45 of the webcomic). Music, GIFs, animations and minigames have not been included due to the restrictions of the printed page as a medium. Some panels have also been excluded (e.g., on page 50, corresponding to page 85 of the webcomic). Changes referred to as 'retcon' – amendments done retrospectively when much later in the narrative a character gains the ability to transport himself through the story –

are sometimes included in *print!Homestuck*, sometimes not, while present in *Homestuck* and available as an optional setting in *Unofficial Homestuck* (e.g., pages 148 & 226 and their webcomic equivalents 234 & 318). These exclusions, as well as other minor differences, have also been commented on by fans (e.g., millsbuddy 2018).

Whether or not the *Unofficial Homestuck* collection is complete is not entirely clear as the list of contents in the program is non-exhaustive. It is, however, intended to contain all *Homestuck* and bonus content. The selection has also been expanded to include other content from mspaintadventures.com (TUHT n.d). Furthermore, when opening the settings option in the downloaded program, the reader is offered the opportunity to turn on what is labelled as ‘controversial’ content. This is content that for various reasons was removed from *Homestuck*. Examples include offensive jokes and body horror. TUHT states in the application settings that inclusion of this content is not to be taken as endorsement of it. This content is presently not accessible through either of the other projects. *Unofficial Homestuck* can therefore be said to have a broad appraisal and selection policy, including not only the original comic but also related content by Hussie.

As is evident from Hussie’s own commentary and the examples explored in the two sections above, *Unofficial Homestuck* seems to have the lowest rate of loss of information and loss of experience in comparison to the other projects.

5.2.4 Information architecture

The information architecture of *Homestuck* is fairly straightforward. The navigation between pages is performed by clicking the link, usually accompanied by text, at the bottom of each page. The site offers a menu at the top, with links to options such as the shop and news, and the search bar is located to the right of this menu (see figure 11). Performing a search will return results both with the search terms in the title, which will appear as the first results, and in the text itself, which appear further down in the list of results.

The search function in *Unofficial Homestuck* will similarly search through the title of a page and the text itself, but in difference to *Homestuck* searching only for a page number will not return any results. The search results are ordered by the date the page with the text in question was originally uploaded to mspaintadventures.com. Very similar in look to *Homestuck*, a menu is also offered at the top, with the addition of logs of all the available comic pages, map navigation

to different moments within the Acts and a save/load option. There is also a settings menu, discussed further in 5.2.5 and 5.2.6. The search function is less usable than the *Homestuck* one, but the accessibility of the maps and the page logs – appearing under the tab ‘Read’ on homestuck.com – still offer aid to the reader. The ‘Credits’ tab in the *Unofficial Homestuck* application offers transparency into the project. Some of the settings that affect how the content is displayed, such as the spoiler-free ‘New Reader’-mode, are enabled initially, while settings such as the option to show controversial content are disabled initially. The fact that these settings need to be looked over for the desired reading experience is not immediately obvious upon opening the application itself, although the fact that there are customisation settings and optional content is explained by TUHT (2022) on the download page.

print!Homestuck has the linear structure of a traditional comic book. Its information architecture, such as it is, will therefore not be covered further here.

5.2.5 Metadata and provenance

The bottom of each *Homestuck* page offers links to contacts, the privacy policy, and 2018 copyright information naming VIZ Media and Homestuck, indicating the year the migration was performed. As pointed out in section 5.2.1 above, there is also a link back to the original home of the webcomic. Other than this, not much metadata or provenance information is available for *Homestuck*. The ‘Info’ tab on the page offers information on the *Homestuck* universe rather than on the files themselves, and the ‘News’ tab offers some information on the migration and conversion process as described above, but it is not exhaustive.

As is visible in figure 12, *print!Homestuck* contains extra information in the form of creator commentary at the bottom of the page, and a highlight colour that indicates the current main character, as well as the original page number. On occasion, the creator commentary (e.g., Hussie 2018b, 54) asks the reader to look at the page online, referencing the original page number at the top of the page. *print!Homestuck* also sometimes contains credits such as programming credits in the commentary by Hussie (2018b, 190).

In the bottom right corner of each page of *Unofficial Homestuck*, its original upload date is shown (see figure 14). This data is not available in either in any of the other projects, or on the pages found on the un-maintained mspaintadventures.com (see 5.2.1 above). This link back to the original website does hint at the provenance of the comic for the new reader. The settings in *Unofficial Homestuck* also offer the

option to display page numbers the way they appeared on mspaintadventures.com, where each comic's page numbers began where the last one left off even if it was not a direct sequel, which alludes to the original context of the webcomic. Furthermore, *Unofficial Homestuck* also contains credits for the developers within the application, as well as a link to the release history and other additional information on the program on GitHub (TUHT 2022). In addition, the reader has the option to show the name of each music file and its creator when music plays, information which is not immediately evident in *Homestuck*. This is an addition of metadata and information to what appears in the original context of the webcomic, which may be considered an alteration of the files, but it can also be considered an addition that offers greater transparency than *Homestuck* does.

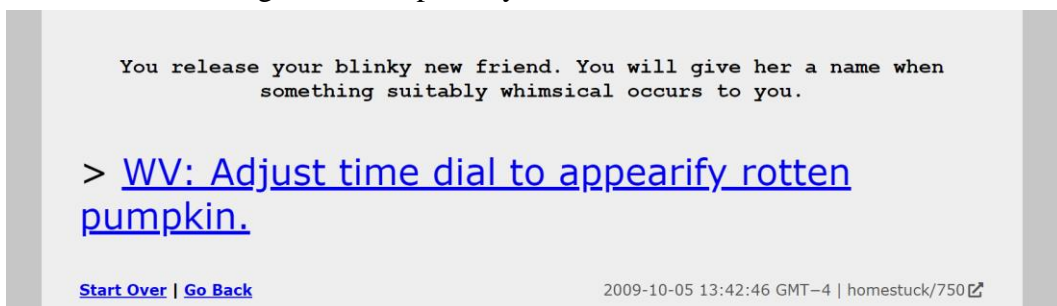


Figure 14. A zoomed-in version of figure 13. Note the timestamp in the bottom right, and next to it a link that offers the reader the option of opening the page on homestuck.com. 2022-04-20.

While none of the preservation projects keep the webcomic in its original context on its original site mspaintadventures.com, both *print!Homestuck* and *Unofficial Homestuck* remove the webcomic further from its original context than *Homestuck* does. The latter keeps the webcomic on a webpage in a regular browser, with a look and feel similar to mspaintadventures.com, while the former two do not.

5.2.6 Accessibility

In the migration of *Homestuck* VIZ has, in addition to being functional in several browsers, added mobile compatibility. This increases its accessibility, but the comic was not intended to be displayed on mobile devices; all the text does not display at once, and ad banners hamper the reading unless the reader has an ad blocker installed (see figure 15). Advertisements on the site making reading more difficult is also a fan complaint (e.g., Skyplayer 2021).² Fans have also described the site as ‘buggy’ and ‘poorly maintained’ post-Flash (e.g., Terrodis in Regular_Initial 2022). Additionally, on their Linktree Hussie (n.d) links both to the VIZ Media

² Ironically, during the writing of this thesis Skyplayer's blog on how to access *Homestuck* after 2021 was deleted. Therefore, no link to the blog appears in the reference list.

version and to *Unofficial Homestuck*, describing the former as ‘somewhat broken’, and the latter as ‘not broken’. Neither its functions nor its preservation efforts are perfect, and the site is probably in need of more active maintenance than it receives, as mentioned above. However, with multiple browser and device compatibility, and free access, *Homestuck* is not necessarily creating higher thresholds than an average 2022 website.

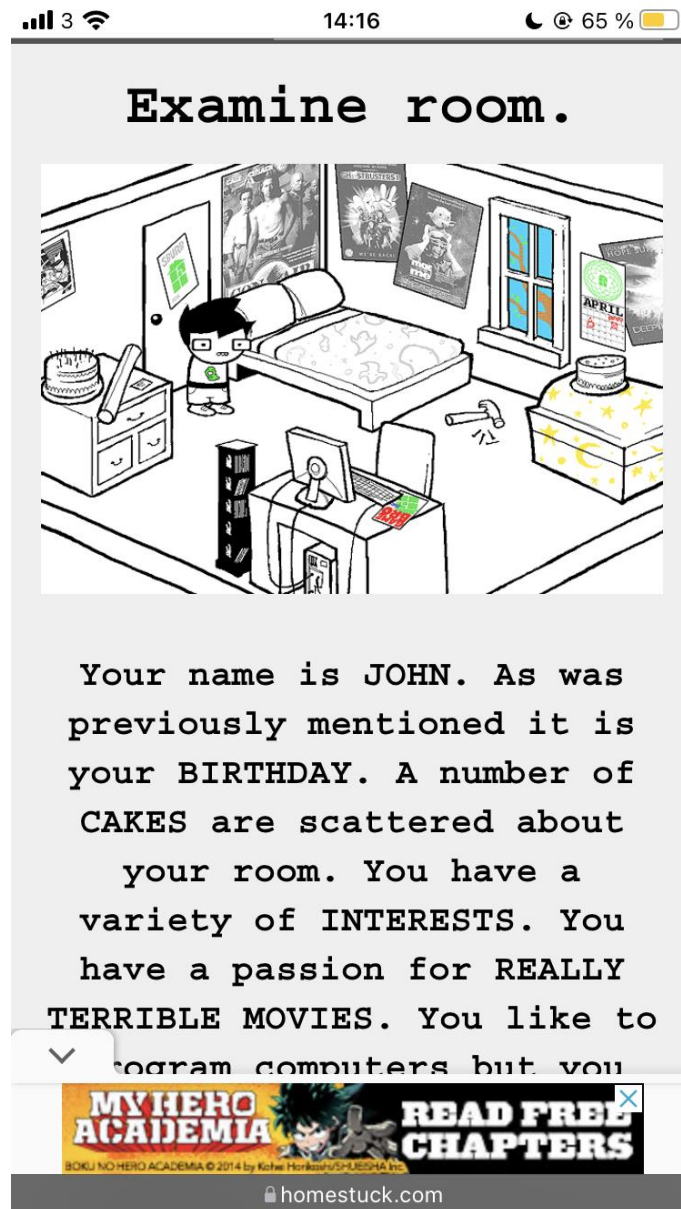


Figure 15. Screenshot of page 4 of Homestuck as it displays in a mobile browser. Note the ad banner blocking the text at the bottom. 2022-02-15.

print!Homestuck is the only one of the projects covered in this thesis that poses a direct monetary accessibility barrier (cf. Brekke & Røsjø 2016, 134). All other mentioned Flash preservation projects are available for free online. On the other hand, *print!Homestuck* requires no tech know-how or even an Internet connection

to read, meaning it poses lower technological barriers than the other examined projects. The small text in some panels is sometimes hard to read without the ability to zoom in, something also commented on in a fan reddit post (millsbuddy 2018).

Unofficial Homestuck is often the way to read the webcomic fans recommend (e.g., Skyplayer 2021; Regular_Initial 2022; hmsnofun 2021; Makin- 2021). Just like the NGP, this is a program that requires download and installation, and may pose similar psychological and tech know-how barriers to the NGP. In a reddit thread by a since deleted user, users ask for help installing it, with one user asking for more detail as they according to themself are not too proficient in using computers (ratboysupremacy in [deleted] 2021). Difficulties installing it since it requires a separate asset pack download is also discussed in other threads (e.g., Lightwren 2021). It is available for the three most popular operating systems (TUHT 2022), which makes it more accessible than the NGP. However, just like the NGP and other projects such as Flashpoint (see 5.3), a desktop or laptop computer is required to use it. Furthermore, the project is currently not being considered for expansion to smartphones or Chromebooks, because of compatibility issues with the browser engine (TUHT n.d). It is therefore less accessible than *Homestuck* when considering access to technology. On the other hand, *Unofficial Homestuck* offers several customisable settings like changing the font size and line height, automatic opening of tabs and chat logs, and navigation using the arrow keys. This is the only one of the options offering this type of experience customisation.

To summarise, the projects each pose various barriers to the potential readers, with *Unofficial Homestuck* being the one that poses highest technical barriers and *print!Homestuck* the highest monetary one. Because accessibility needs are different for each user it is not necessarily possible to deem one of these barriers more or less detrimental to accessibility than the other.

5.2.7 Long-term preservation plans

Both *Homestuck* and *Unofficial Homestuck* require active upkeep by their respective publishers to continue functioning. Someone who has downloaded *Unofficial Homestuck* may still be able to use it and even file share it even if TUHT pulled the plug on the project. On the other hand, if it is not rewritten for newer operating systems and platforms, it may become hard to use in the future. Hussie (2018a) has stated that the plan was never to continue or preserve *Homestuck* indefinitely. Even with the VIZ takeover, the site has not seen many updates over the last 4 years, and Hussie is currently working on other projects (What Pumpkin

Games 2021). Thus, both *Homestuck* and *Unofficial Homestuck* face the same longevity problems as the Newgrounds projects described in section 5.1.7 above.

While attempting to preserve a webcomic with a large degree of moving, auditory, and interactive content as a printed book is an unorthodox and perhaps not recommended way to preserve born-digital material (cf. Klareld & Gidlund 2017, 100-101), it is a solution that easily ensures a long lifespan. Paper, if handled correctly, can last hundreds of years, and the quality of most paper produced today is high enough that it can last for a long time in archive (Simonsson & Sirtoft Breitholtz 2018, 116-117). On the other hand, Hussie (2018b, 4) has stated that they do not consider *print!Homestuck* to be tantamount to the webcomic, but rather a companion piece or supplemental work. While this solution offers the highest loss of experience for the future reader and researcher, and means the removal of the material from its original context, *print!Homestuck* may be ensuring a long-term preservation of at least parts of the webcomic that neither *Homestuck* nor *Unofficial Homestuck* is necessarily capable of without active upkeep.

5.3 Other preservation projects and other Flash game hubs

Other game hubs and developers have settled on various solutions, depending on factors such as whether the content was submitted by users or proprietary, and available resources. Some of these solutions are briefly outlined in this section.

Flashpoint is a preservation project mentioned by several of the news outlets that have reported on Flash preservation (e.g., P3 Spel 2020; D’Anastasio 2020; Debré 2021; Hoon Chan 2021; Bailey 2020). Flashpoint is a community maintained downloadable program that collects games from several sources and then uses a built-in proxy server to process the player’s launch request, making it appear as though the game is being run on the original file server when in fact it is using the local filesystem on the player’s computer. This allows it to bypass many site-locks (Flashpoint 2022a; Fiadotau 2020, Everything, by everyone: Preserving the legacy of Flash games para. 19). Its creator hopes to have put off the death of the games by “at least twenty years” (P3 Spel 2020, 34:50). Like Newgrounds, Flashpoint has a broad acceptance policy, as the creator has stated “it’s not up to us to decide what the future finds interesting” (P3 Spel 2020, 29:53). Despite this policy, games have been removed from the project when requested by their creators (Flashpoint 2022b). Writing on this project, Fiadotau (2020, Everything, by everyone: Preserving the legacy of Flash games, para. 22) pointed out that its game metadata is sometimes flawed, due to having been sourced from third-party websites.

Kongregate is a video game publisher and portal for web games. In 2020, a partnership with The Strong Museum to create an on-site preservation of Kongregate games and metadata was announced. It was intended to be available to researchers by appointment (The Strong 2020). Unfortunately, this project was put on hold due to the COVID-19 pandemic. The museum hopes to revisit the plans in the future.³ Currently, Kongregate recommends using the Supernova player to play their Flash games (Kongregate 2019).

Girls Go Games, a site collecting games with girls as their intended audience, have stated that while users may request their favourite Flash game to be converted into HTML5 they cannot guarantee that they be able to fulfil the request and they will leave most games as they are. This is due to legal considerations, the number of games, and the resources that would be required (Spil Games 2021).

Nitrome, a game developer that previously made Flash games, have stated on their blog that they are attempting to convert their Flash games into HTML5. In the interim, they recommend using the third-party Supernova player (Nitrome, 2021).

Gamevial, another game developer that used Flash as well as other now defunct technology, announced in 2018 on their Facebook page that they were donating their code as open source to developer team Raven-Woods. Gamevial as a company had been dissolved the year prior, and Raven-Woods are currently offering some older converted Gamevial games for free (Gamevial 2018; Gamevial 2017; Raven-Woods 2022). Getting permission like this to make abandonware – or orphan work, since Gamevial does not exist anymore – available is one of the recommended solutions to the issues surrounding software distribution when the original owners cannot or will not continue to distribute it (Khong 2007, 82).

The Internet Archive has a collection of Flash content, including games and animations. It is available to anyone browsing their site using the emulators Ruffle and Emularity. The Internet Archive recognises both the aid of media outlets in bringing attention to the project, and the nostalgia Flash media holds for a lot of people (Scott 2020). The software library does not only contain games and animations, but also Flash website interfaces and other types of media (Internet Archive 2022). The metadata does not always include the original source site, but it does include information on who uploaded it to the Internet Archive.

³ Rhinewald, S. The Strong Museum (2022). E-mail. March 9th.

6. Analysis and discussion

In this chapter Flash preservation is discussed using the theoretical framework outlined in chapter 3 and the evaluation of the projects in chapter 5.

6.1 Internet communities and the community paradigm

As demonstrated by examples such as threads on Newgrounds offering troubleshooting and pooling competence, Flashpoint's reliance on volunteer coders and *Unofficial Homestuck*'s user submitted fix requests and third-party mods, dedicated and helpful communities have grown around various types of Flash media. Preservation efforts are not only made by singular individuals, but by communities - and in the case of Homestuck, by a publisher. Regardless of institutional interest, the communities affected by Flash's end of life are interested in preserving what in some cases may be a foundational part of the community's identity, or at the very least evidence of an important milestone in theirs and the Internet's history.

As already argued by Fiadotau (2020, Growing old on Newgrounds: Community discourses of technological change para. 3-32), for a community like the one on Newgrounds, the Flash technology is tangled up with nostalgia and the identity of the site and by extension its community. Cook (2013, 105) writes that the paradigms do not completely replace each other, but rather co-exist; this appears to ring true for both Internet communities and archival institutions. Clearly identity matters as an aspect of virtual community archiving and history preservation. This, as well as the death of Flash giving rise to preservationist community practices that enable continued access to the material is similar to patterns observed by other researchers (e.g., Harris 2020, 1429-1433). As is evident by the recent upload date on some games using Flash, on a small scale the community preservation efforts may also be resulting in keeping the culture of Flash creation active and alive, although the lion's share of Flash content is dated much earlier.

Evident above is also that there could be a beneficial exchange of knowledge, strategies and resources between archival institutions and Internet communities, as suggested by Cook (2013, 115) when writing on the community paradigm. The community members who create and maintain the projects have a high degree of technical know-how and knowledge of and *fingerspitzengefühl* for the digital

heritage they are attempting to preserve. As such, they could, just like the software pirates at the forefront of videogame preservation (Newman 2012a, 46-49) offer valuable knowledge and insights into both the material itself and its context to any researcher or institution approaching them. However, the projects do not have the guarantees of longevity that an archival institution could offer, and they have varying quality of metadata and information on provenance. This is where an archivist or archival institution may offer aid, advice, and another perspective on preserving the material in question (cf. Cook 2013, 115-116). Furthermore, the examined preservation projects also pose different accessibility barriers, some which may be mitigated through the backing of an archival institution that may previously have worked towards increased accessibility of their material. Users feeling nervous when downloading programs from an unknown source (as discussed in 5.1.6 and 5.2.6) may also feel safer downloading something backed by an institution, since institutions of different kinds act as legitimising forces in society (Bourdieu 1986, 247-248).

6.2 Flash media and its capital

From the point of view of the insiders, although there is not one set narrative or viewpoint, Flash preservation is tinged with nostalgia, as pointed out by Fiadotau (2020, *Growing old on Newgrounds: Community discourses of technological change* para. 3, 30-32). Nostalgia is also a driving force from a consumer or hobbyist point of view when considering game preservation in general (Harris 2020, 1418 -1422). In posts ruminating on the death of Flash, people who consumed Flash products can be observed on sites other than Newgrounds mourning and reflecting the loss of media important to them (e.g., Izzzyzzz 2022; caprisun-and-novacaine 2022; lobotomizedskull 2021; bagelandcreamcheese1 2020). In the specific field of game or Internet media production that encompasses those who created and consumed Flash media - such as Newgrounds - Flash media holds, if nothing else, peer recognition capital (Bourdieu 1993, 30). This does not necessarily mean that it is considered valuable in a larger cultural context. Flash media would need to be recognised in the broader field of cultural production for its cultural value to translate out of the limited field of Flash media production (cf. Bourdieu 1986, 247).

In their reporting on Flashpoint, Swedish public radio channel P3 claimed that few people seemed to care about the death of Flash, even though they should – because, they argue, Flash media ought to receive cultural recognition. They also reported on Flash games’ poor reputation and the stigma surrounding the games, and

community opinions that the context of being playable online is important to Flash preservation (P3 Spel 2020, 00:10, 04:00, 35:20). From an outside point of view, opinions on Flash are split. Critiques of Flash during its lifetime are well documented (e.g., Salter & Murray 2014, 8, 78, 80; Fiadotau 2020 A Flash History of Flash, para. 11-12). For example, its end of life brought with it journalistic commentary celebrating the discontinuation of an obsolete technology (e.g., Gibbs 2015; Barrett 2017), but also journalistic commentary mourning or reflecting on Flash media (e.g., Bedingfield 2020; Pinheiro 2020). Even pieces pointing out the inability of HTML5 to fully recreate a Flash-driven web appeared (Lawhead 2020). Its death was also chronicled by web developer Scott Schiller on isflashdeadyet.com (Schiller, 2020). In other words, it was known the technology would be phased out at some point and reactions ranged from joy, to indifference, to feelings of loss and nostalgia.

While both Flashpoint and the NGP have received some mainstream media coverage, there is little outside support available for the preservation projects. Some of the journalists who wrote positively on the preservation attempts, praising the efforts to preserve this cultural heritage, still made evident through how they reported on the projects that the reputation of Flash has been severely damaged during its lifetime, as argued by Fiadotau (2020 No flash in the pan: What next for Flash game preservation?, para. 5). The preservationists are referred to as a “ragtag squad” (D’Anastasio 2020) and in an article reflecting positively on the projects they are described as mostly being comprised of “small, talented team[s] of enthusiasts” (Hoon Chan 2021), who come together to create the whole of Flash preservation. The fact that media using this seminal technology is being preserved mostly by the communities built around it and not by larger institutions speaks to the fact that Flash is not being recognised for its impact on Internet culture.

While institutions can be a legitimising force and ‘give’ objects cultural value (Bourdieu 1986, 247-248; Cook 2013, 101-102; Eivergård & Lundström 2007, 130, 134-135), many of the preservation projects are run by either those who created the Flash media themselves or by communities built around consuming the media. There has been some interest from at least one ALM institution, The Strong Museum, mentioned in 5.3, but that project has yet to be realised. As pointed out by Salter & Murray (2014, 74), creators often struggled to monetise their Flash creations, meaning the economical aspect of cultural value (Bourdieu 1993, 37 - 39) was often non-existent. The cultural value and recognition of Flash media continues to be low outside its own specific field, which may be one reason that its

preservation is largely carried out by people who have some sort of personal stake or interest in it. In all likelihood, its reputation for varying quality (Salter & Murray 2014, 78) also contributes to this. Another tangible potential reason is the ethics and the legalities of the examined preservation projects.

6.3 Copyright law and preservation ethics

As this is not a law thesis, legal considerations will be discussed only briefly, building on previous research. They will also be discussed in conjunction with purely ethical aspects. As laws regarding software differ in each country, European and US laws are used as examples due to the accessibility of the research on them. Discussing the ethical aspects surrounding Flash preservation projects, preservation of Flash is considered a direct good, while perceived or potential harm is based on the opinion of the creator or copyright holder, which is available in some cases. If the creator feels harm has been done - whether this is based in not wanting to lose agency over one's own creation or simply out of principle, or for another reason will not be speculated on - whatever information is available will be accepted as the standpoint of the people in question (cf. Berg 2015, 149 on speculation).

The main legal concern when creating a software imitating the functionality or entirely replacing another piece of software is copyright. Since use of neither the NGP nor Ruffle require that the .swf files be copied and distributed through other channels than their original context, it is a potential copyright concern regarding the media player/emulator software itself. Under EU law, de-compilation and reverse engineering of code in computer programs for the purposes of creating interoperability or gaining knowledge may be legal as it falls within conditions specified in the Software Directive. Furthermore, because functionality of a program does not constitute a form of its expression, this means that the creation of an emulator is not necessarily illegal (Harn Lee 2018, 105). Therefore, from an EU perspective, the Ruffle emulator itself could be considered legally unproblematic. This should logically apply to the NGP as well, since it differs in code but not in function from the original Adobe Flash Player, as pointed out by users discussing its security in section 5.1.6. As noted by both Harn Lee (2018, 105) and Tryggvadóttir (2018, 310) there is not yet proper harmonisation of European copyright law, so depending on the country, a software copyright issue could play out differently. Depending on applications under national law, certain copyright exceptions for ALM institutions may be allowed in some European countries (Harn Lee 2018, 107). These exceptions could be the key to preserving the type of material described in this thesis, and other web-based media in the countries where they are

applicable. Nevertheless, as demonstrated by academic articles (Schard 2019, Schwabach 2021) considering the yet unsettled case concerning Internet Archive's National Emergency Library, copyright rulings do not have a clear outcome even within the singular country that is the US. Considering the Software Directive, though, Ruffle and the NGP are not necessarily legally problematic.

At this point, the original Adobe Flash Player could arguably be considered abandonware, and as such there is also the legal argument that use or supply of in-copyright abandonware does not actually harm the copyright holder as after abandonment they would only suffer a windfall loss (Khong 2007, 65). As the Adobe Flash Player was distributed for free, and in fact browsers were even paid to include it (Salter & Murray 2014, 118-122), while the paid product was the development environment now known as Adobe Animate, it does not seem like an argument that Adobe experiences any losses at all from any creation of other programs functioning similarly to Flash Player could be made.

The preservation efforts dedicated to converting certain appraised and chosen Flash games (cf. Cocciolo 2016, 78-80) to HTML5 undertaken by the original creators of the games, such as Nitrome or Girls Go Games, are of course both legally and ethically unproblematic. The same goes for Raven-Woods maintaining and distributing Gamevial games, as Gamevial donated their source code to them upon dissolving the company. What may be worth considering in some of these cases though, is that it could be considered irresponsible to choose not to convert a majority of the games one is a copyright holder of, as their loss is detrimental to our collective digital heritage. Therefore, in cases where preservation requires more resources than available, seeking a partnership with an ALM institution that is willing to aid in a preservation project may be a recommended way forward. In a case where a company or creator chooses not to preserve their Flash media, the doctrine of double effect may be applicable. The harm – loss of cultural heritage – is almost definitely not an intended consequence of failure to preserve the media, but rather a foreseen one (cf. Quinn 2003, 194). On the other hand, this harm does not come about in a pursuit of good, as is assumed when the aforementioned doctrine is discussed, but rather as a consequence of an inability or an unwillingness to act. However, as has also been discussed in relation to the doctrine of double effect, harm by indirect agency is also more permissible than harm by direct agency (Quinn 2003, 205 -207), so the people making the choice not to preserve their Flash media may still be ethically within their right to do so, regardless of the potential loss of collective digital heritage. They are also, after all, the owners of their

creations and it could be argued that they have the right to do with them as they please.

Since VIZ Media is the current publisher of *Homestuck*, they are also within their full legal right to distribute both the webcomic and the printed version. On the other hand, projects such as Flashpoint and *Unofficial Homestuck* exist in a legal grey area as they, within the applications, are distributing work that may still be in-copyright. Flashpoint is self-described as existing in an unclear legal area, but copyrighted games have been removed from the program upon request from the copyright holders (Flashpoint 2022b). Some of the works included in Flashpoint could potentially be orphan works if the original creator cannot be found, or if the site the files were originally uploaded to has been shut down (cf. Tryggvadóttir 2018, 109-116, 414). As outlined in 5.2.6 *Unofficial Homestuck* is included on Hussie's Linktree (Hussie n.d.). As the creator of *Homestuck* this implies that they approve of the project. Furthermore, several texts (e.g., Khong 2007, 83-89; Tryggvadóttir 2018, 310; Harn Lee 2018, 107-208) on laws surrounding digital copyright, and on software and videogame preservation call for legal changes. In particular, they call for changes to allow institutional exceptions that would make currently illegal or legally grey preservation legal for ALM institutions. Should such legal changes be made, ALM institutions in the countries where the laws would apply would benefit through gaining knowledge both of the material itself and of technical solutions to preserve it by collaborating with the communities currently dedicated to preserving these types of digital material (cf. Newman 2012a, 56-58). Clearly, without legal changes the hands of ALM institutions are tied even if they want to rescue our collective digital heritage from bit rot and link decay (cf. Newman 2012a, 50), and the community preservationists will continue to operate in grey areas without the security offered by institutional approval.

The NGP and Ruffle both only deal with making what was once available on Newgrounds available anew. The act of uploading something to Newgrounds means a creator wants their work to be available through the site, meaning these projects neither seem to be breaking any laws, as pointed out above, nor making any major ethical faux pas. In fact, the community support around both the projects and creators' willingness to make their games compatible with Ruffle are signs that, on the whole, these are appreciated and beneficial projects.

As stated above, the creator of *Homestuck* seemingly approves of the *Unofficial Homestuck* project. As one of the tenets of the doctrine of double effect is that each

person has some veto power over attempts to do good at their expense (Quinn 2003, 207; Nagel 2003, 109), Hussie's approval of the project matters. If Hussie does not experience any harm from their creation being distributed and preserved in this manner, this absolves the project of ethical concerns. This applies as well if one considers the principle of (im)permissible harm (Kamm 2003, 176 – 178) since Hussie does not seem to consider the project harmful to begin with. *Homestuck* and *print!Homestuck* were created with active involvement from Hussie, and as stated in 5.2.3 above they had not intended to maintain the project indefinitely themselves and it is therefore assumed that these projects cannot be said to cause any harm.

Flashpoint's creator has stated that the project has largely been appreciated by game developers whose creations appear in the program. However, they have also been asked to remove games from certain developers and have done so. On their website they also expressly state that they do not condone harassment of the developer over the decision (D'Anastasio 2020; Flashpoint 2022b). This is a case where the intentions are noble, which is even stated by the CEO of the developer that asked for their games removed (D'Anastasio 2020), but the CEO also said their consent to the redistribution was not given and thus, although no harm was intended, the developers could be argued to hold ethical veto power over what is done with their creations (cf. Quinn 2003, 194). Considering the principle of (im)permissible harm, the developers felt direct monetary harm was caused to them (Kamm 2003, 176 – 178) which means the harm had a direct relationship to the action of putting the games in Flashpoint. Whether the good of the preservation is equally direct is perhaps more unclear, as a case could be made that the benefits of the preservation may not yet be fully realised, but the preservation itself could also be seen as an equal or greater direct good. Though, in this case, the developers in question are themselves aiming to preserve and distribute their Flash games (D'Anastasio 2020), so perhaps that case could not ethically be made, and Flashpoint made the ethically correct decision to remove the games.

None of the projects save for *print!Homestuck* cost any money to use; ads appear on both Newgrounds and on homestuck.com, but the main intention of several of the projects mentioned, like Flashpoint, *Unofficial Homestuck*, Ruffle and the NGP simply seems to be making media available to people and not to make money (cf. Newman 2012a, 51-52). Largely, the intention of each project is to do good and any theoretical or factual harm to the parties involved appears to be unintended, which makes the pursuits of Flash preservation overall acceptable ethically (cf. Quinn 2003, 194).

7. Conclusion

In this chapter the conclusions of this thesis are presented, the chosen theories and method are evaluated and suggestions for further research are made.

7.1 Conclusions

This thesis has the following research purpose and research questions:

The purpose of this thesis is to analyse and evaluate several Flash preservation projects from an archival point of view. Furthermore, the thesis also aims to contribute to the research on Internet communities' initiatives to preserve Internet-based media.

And:

- What methods, such as emulation or conversion, are used in Flash preservation projects?
- How successful are the projects if evaluated from an archival standpoint, considering aspects such as metadata and long-term preservation?
- What are the potential pitfalls and benefits when communities rather than institutions preserve digital media?
- What are the legal and ethical implications of initiatives by Internet communities to preserve ephemeral media?

As explored in chapter 5, there is a multitude of ways to preserve Flash media. These include digital migration and conversion to more modern formats, emulation, alternative media players, applications consisting of modified browsers and finally, and perhaps most surprisingly, a printed book. Depending on the type of media being preserved, and whether the end goal is to preserve for instance information, context, or interactivity they display varying degrees of success and varying benefits and pitfalls.

When evaluated against the archival criteria established in section 3.4, the projects also displayed varying degrees of success depending on the specific criterion. Particularly the possibilities for long-term preservation, accurate metadata and accessibility were found to be lacking, while projects like the NGP, Ruffle and *Unofficial Homestuck* showed a very low degree of loss of information and loss of

experience, as well as reasonable appraisal and selection policies in relation to the media being preserved and the environments the projects operate in.

The archival criteria also illustrate the potential pitfalls of community preservation without any involvement from an ALM institution; one of the guarantees of a traditional archival institution is, ideally, longevity. An ALM institution may also have more experience in determining which metadata is important for future information retrieval and in creating accessible spaces. On the other hand, communities such as the ones described in this thesis are both willing and able to steward the preservation of their own history, even in the face of low interest from outsiders and a low cultural capital. This means they are preserving history which may otherwise very well have been lost, and doing so with an intimate knowledge both of the material itself and of ways to preserve it. Another benefit of community preservation, in particular seen in the example of the NGP and Ruffle on Newgrounds, is the potential to perform preservation while also keeping cultural expression alive, rather than static, as it risks becoming if preserved in a traditional archive. Communities also have the ability to act quicker and in different ways than an ALM institution is able to, including acting in legal grey areas. In any preservation project dealing with cultural heritage, involvement of the community that originated said heritage should be mandatory, as it clearly has benefits in terms of knowledge exchange and appraisal of material, among other aspects. This includes digital heritage, and the Internet communities producing it.

The legal and ethical implications vary with each project. However, it is clear that current copyright law might tie the hands both of ALM institutions and of communities and individuals interested in preservation of digital material. Ethically, the greater good of preserving our history must be weighed against the potential harm that unauthorised copying or spreading of someone else's content may cause. Overall, the pursuits of digital preservation explored in this thesis are found to be well-intentioned, and the responsible agents are in general found to have acted ethically.

Similar to other research (e.g., Newman 2012a 56-58) this thesis concludes that community preservation is of the utmost importance for digital media and enables both further consumption of and research on Flash media. Furthermore, the thesis illustrates that Internet communities are willing to preserve their own history, and that they place importance on the cultural expressions and digital heritage they have created. It is also possible to conclude that while this is the case, in line with the

community paradigm and as is stated in earlier research on similar cases (e.g., Halsband & Grimm 2018, 138-139; Fournet 2021, 126-127; Hals 2014, 53-55), the most beneficial way forward may be a collaboration between communities and ALM institutions. It may also be necessary for ALM institutions to re-evaluate their collection policies and actively look for and reach out to communities preserving media with a low cultural capital, to ensure that this material is indeed preserved for posterity. Material with low cultural capital has the potential to represent the human experience, provide research material, and be a cultural expression – like Flash media was – in the same way as material with high cultural capital can. Regardless of its cultural capital, both digital and non-digital heritage objects are of lasting value. The community hubs described above do collect at least a fraction of the single-person and hobbyist Flash developers in one place and would be a reasonable starting point for interested institutions to begin reaching out to, even if they are not able to reach every single creator.

7.2 Evaluation of the applied theories and methods

Bourdieu's cultural capital and Cook's paradigms provided insight into different aspects of Internet communities' preservation of Flash media. Using only one of the theories would have meant the loss of either the discussion of what cultural value Flash media has within smaller community fields and larger cultural fields, or of the community aspects of preservation and archival practices. In the analysis done in this thesis, it is found that these two aspects affect each other, and it is therefore reasonable to discuss both of them.

Going in-depth into other projects based around a downloadable or otherwise accessible archive that does not retain Flash media in its original environment, like Ruffle and the NGP do, or that do not have the approval of the original creator, like *Unofficial Homestuck* does, may have resulted in a more nuanced and deeper ethical discussion. Nevertheless, ethics and law are different things, and when considering potentially breaking rules to save archival material or any kind of information or heritage, problems should be considered both from a legal and an ethical point of view.

With the preservation projects themselves in focus, the netnographic methods chosen yielded raw data possible to compile and analyse, particularly for the purpose of this thesis. However, interviews with their creators or users, or focusing on technical aspects by analysing their actual code – with the exception of

print!Homestuck – may have resulted in different types of data, and highlighting other aspects of the projects than those discussed in this thesis.

7.3 Suggestions for further research

The projects studied in this thesis are only temporarily refreezing the tip of a massive melting iceberg of web-based media reliant on defunct technology. Further research and a general deepening of archivists' knowledge in this field is urgently required, as we are currently watching much of our early digital heritage and other digital archivalia rot away.

General research on preserving the Internet for coming generations and strategies that ALM institutions and communities may use to do so is needed. Furthermore, this thesis only examines Flash on the English-language web. Due to the language barrier, there may well be projects not explored here that are worthy of examination. Additionally, Flash was used to create other types of media than solely games and animation, which are the focus of this thesis, and this could also be a future area of study. There are also several other defunct technologies once used on the web, such as Microsoft Silverlight, Play3D/DeepV, and Visual WebMap. Further studies on technologies intended for use on the Internet and how and if they are preserved would aid archivists in their pursuit of sustainable digital preservation. Moreover, the legal and technical discussions in this thesis are relatively shallow and could be developed much further by other researchers. Another aspect that this thesis only briefly touches on is the ability of community preservation projects to keep a cultural practice alive while also preserving it. What this looks like, and whether it is an existent phenomenon at all, in other virtual communities could be a subject for further study.

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Appendix

Appendix 1. Definitions

The definitions in the table below are based on definitions and information from Borghoff et al. (2006), Bourdieu (1993), Carta (2017), Fiadotau (2020), Harn Lee (2018), Harwood (2019), Khong (2007), Newman (2012a), Newman (2012c), Reddy (2011), Salter & Murray (2014), Smith (2019), Sterne (n.d), Webopedia (2021), and WHATWG (2022).

.swf	ShockWave Flash/Small Web Format. The file format used for Flash content.
Abandonware	Proprietary software abandoned by its owner or manufacturer
ActionScript	Programming language used for development in the Flash desktop application, targeting the Adobe Flash Player platform.
ALM	Archives, libraries, museums.
API	Application programming interface. Type of software interface, offering services to other pieces of software – like medals for the games on Newgrounds.
Bit rot	Catch-all term for decay of different types of software and decay of physical storage for digital media.
Browser game/browser-based/web-based game	Game played in a web browser. Usually free-to-play and does not require a physical disc or software application consisting of the game files to play. May require a media player plugin such as the Adobe Flash Player installed in the browser to interpret the files.
Capital	The thesis uses Bourdieu’s concept of capital, explained in detail in section 3.2
Community	Used here to refer to online communities; a group of users on a site or a forum, connected by their mutual use of the site.
Compilation/de-compilation	Compilation is the transformation from source code to object code, one of the steps in making code into an executable program. De-compilation is reversing this process, extracting source code from already compiled code.

Conversion	Conversion is the transformation of data from one format to another. This may cause loss of data since not all formats have the same power of representation. Because of this, each conversion may have to be performed manually, depending on the data being converted.
CPU	Central processing unit. The unit that executes programs in a computer.
Emulator/emulation	An emulator is a piece of software that performs emulation: allowing one platform to execute program code from another platform, replicating it in a new software and/or hardware environment. Emulation is an attempt to ‘clone’ the original environment, preserving the data as is.
Field	Field is used in Bourdieu’s sense of the term: the setting in which agents act – arenas of production and circulation of capital. Fields are hierarchical and smaller fields can be encompassed by larger fields.
Flash/Adobe Flash/Macromedia Flash	Desktop application used to create content for the web, as well as a platform for distributing the content.
Flashimation	Flash animation.
Flash media	Catch-all term for different types of media created in and for Flash, including animations, banners, games, etcetera.
Flash player	Browser plugin used to interpret .swf files
HTML/HTML5	HyperText Markup Language. The standard markup language used for documents and even applications on the World Wide Web. HTML5 is commonly used to refer to its current latest standard.
<i>Homestuck</i>	<i>Homestuck</i> is a webcomic known for its animations, soundtracks, and interactive pages, explained in detail in section 5.2.
Linktree	A bio link tool that allows people to post one link, for example in their social media bio, to their Linktree which would then show multiple links. An artist, for instance, may link to their store, other places they post art, or projects they are interested in.
Machinima	A type of gameplay recording and art production using game graphics engines.

Migration	Refreshing and/or moving digital data to a new storage medium and/or platform. Migration may also entail conversion between formats. Migration often causes some loss of information or adjustment of the data.
Newgrounds	Newgrounds is a website that allows creators to upload their own games and other works, explained in detail in section 5.1.
Newgrounds Player/NGP	The Newgrounds Player (referred to as the NGP) throughout the text is a Flash player created specifically for use on Newgrounds. It is explained in detail in section 5.1.1.
Orphan work	Copyrighted work whose rightsholders cannot be determined or cannot be contacted.
Platform	The digital environment where a piece of software is executed; .swf files in the Flash Player, for example.
Plugin	Software component that adds a feature to an another, already existing program, such as ad-blocking in a browser.
Port	Porting is the act of transferring and translating a game to a new operating system or new hardware; the resulting game is a port. In other words, it's the migration of videogames.
Reddit	Popular website consisting of news and discussion forums.
Redditor	Reddit user.
Ruffle	Ruffle is a Flash emulator, which allows websites to appear and function closely to how they would if Adobe Flash Player was still functional. It is explained in detail in section 5.1.1.
Tween	Tweens are animation frames between keyframes, created automatically by a mathematical formula in the Flash program. The creator did have control over different types of tweens and their speed, but the automation caused a distinctive look in much Flashimation.
UI	User interface.
UX	User experience.

Appendix 2. Tested games

Appendix 2.1 Sources for game selection

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Appendix 2.2 Games tested on Newgrounds

To ensure that each game used a .swf file, the Ruffle toggle was always initially turned off. This prompts a launch through the NGP if the game is an .swf file. The toggle was then turned on and the page refreshed to check whether the game uses Ruffle emulation, which would remove the prompt. Some games were when possible tested both in the NGP and Ruffle, to compare the two versions with each other. This was done particularly when a game seemed to run poorly in Ruffle.

Games were tested in every age rating category: E- Everyone, T – Teen, M – Mature, A – Adult. Games were tested in every overarching genre, such as adventure or puzzles, but not in every subgenre due to the number of subgenres. Due to time constraints, not every game was played to completion. Local multiplayer was tested with the aid of other people to ensure it was possible for multiple people to play the games.

Information about the games is given in the following format:

Creator. (Year uploaded). *Title*. Genre. Rating. Usage of Ruffle/NGP. Link to game. [Date tested].

Comments, if any.

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Agamecom. (2006). *Bomb-it*. Puzzles - Other. E. NGP. <https://www.newgrounds.com/portal/view/349488> [2022-03-26]

Comment: Local 2-player mode functional.

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Comment: Caused the local storage error message mentioned by eithmableura12.

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Evil-Dog, DruoxtheShredder, jaxxy, Rina-chan, Sapphire, SoS, TomaMoto. (2010). *Punk-o-matic 2*. Rhythm. T. NGP. <https://www.newgrounds.com/portal/view/525045> [2022-03-26]

FreeAsANerd, luka, thedavidcarney. (2009). *The Company of Myself*. Action - Platformer - Puzzle. E. NGP. <https://www.newgrounds.com/portal/view/518729> [2022-03-26]

Gamebrew. (2007). *Artillery Live*. Strategy - Artillery. E. NGP. <https://www.newgrounds.com/portal/view/367326> [2022-03-26]
Comment: Local play functional, not server-based multiplayer.

GAMECUBICLE. (2005). *_ULTIMATE TUTORIAL 2_*. Tutorial. E. Ruffle and NGP. <https://www.newgrounds.com/portal/view/218367> [2022-03-26]

Hamburger-Clock. (2002). *KITTY SAEVS TEH DAY!!!*. Spam. E. Ruffle. <https://www.newgrounds.com/portal/view/57569> [2022-03-26]

heliopod. (2015). *game, game and again game*. Genre information missing. E. NGP. <https://www.newgrounds.com/portal/view/651224> [2022-03-26]

horriblepain. (2013). *Gay kiss*. Simulation - Dating. T. NGP. <https://www.newgrounds.com/portal/view/617295> [2022-03-26]

humbaged. (2008). *Metal Gear Solid X*. Genre information missing. A. NGP. <https://www.newgrounds.com/portal/view/421475> [2022-03-26]

jacobbgames. (2010). *The Idiot Test*. No genre information available. E. NGP. <https://www.newgrounds.com/portal/view/524916> [2022-03-26]

jmtb02, Armorgames. (2008). *Achievement Unlocked*. Action - Platformer - Puzzle. E. Ruffle. <https://www.newgrounds.com/portal/view/474371> [2022-03-26]

josh-tamugaia. (2005). *Sabermania*. Action - Fighting - Versus. M. Ruffle and NGP. <https://www.newgrounds.com/portal/view/241017> [2022-04-04]
Comment: Slow loading time in Ruffle.

karoshi. (2008). *Karoshi:Suicide Salaryman*. Action - Platformer - Puzzle. T. Ruffle. <https://www.newgrounds.com/portal/view/462774> [2022-04-04]

kevansevans. (2012). *Line Rider V3.3*. Gadgets - Other. E. NGP. <https://www.newgrounds.com/portal/view/603375> [2022-03-26]

Kianis. (2008). *You Have to Burn the Rope*. Action - Platformer - Other. T. NGP. <https://www.newgrounds.com/portal/view/432872> [2022-03-26]

korded. (2002). *the skullkid*. Action - Other. T. Ruffle. <https://www.newgrounds.com/portal/view/63747> [2022-04-04]

kpaekn. (2012). *Symphony*. Puzzles - Other. E. NGP. <https://www.newgrounds.com/portal/view/587537> [2022-03-26]

Lambtaco. (2014). *A Koopa's Revenge 2*. Action - Platformer - Hop and Bop. T. NGP and Ruffle. <https://www.newgrounds.com/portal/view/646067> [2022-03-26]
Comment: Runs more smoothly in NGP.

milanbassa. (2010) ...: *Tangram*:... Puzzles - Other. E. NGP. <https://www.newgrounds.com/portal/view/531919> [2022-03-26]

molkman, exotworking, studioSeufz. (2014). *MURDER*. Action - Other. T. Ruffle and NGP. <https://www.newgrounds.com/portal/view/648589> [2022-04-04]
Comment: Slow loading time in Ruffle but would not launch at all in NGP.

MonkeyWantBanana. (2009). *Shopping Cart Hero*. Sports - Other. T. NGP. <https://www.newgrounds.com/portal/view/481867> [2022-03-26]

ninjamuffin99. (2018). *cityhoppin*. Action - Platformer - Hop and Bop. E. NGP. <https://www.newgrounds.com/portal/view/716556> [2022-03-26]

Nutcasenightmare. (2008). *:the game:*. Action - Platformer - Puzzle. M. Ruffle and NGP. <https://www.newgrounds.com/portal/view/467574> [2022-04-04]
Comment: Slow loading time in Ruffle.

pixeljamgames. (2008). *Dino Run*. Genre information missing. E. NGP. <https://www.newgrounds.com/portal/view/443828> [2022-03-26]

playsaurus. (2014). *Clicker Heroes*. Idle/Incremental. E. NGP. <https://www.newgrounds.com/portal/view/643398> [2022-03-26]

Proxicide. (2006). *Dress Up Sim 2*. Gadgets - Dress Up. A. NGP and Ruffle.
<https://www.newgrounds.com/portal/view/287241> [2022-03-26]

PuffballsUnited. (2010). *Escaping the Prison*. Adventure - Other. E. Ruffle and NGP.
<https://www.newgrounds.com/portal/view/533001> [2022-04-04]
Comment: Slower loading screen in Ruffle.

raitendo, bentosmile. (2010). *Air Pressure*. Visual Novel. T. Ruffle.
<https://www.newgrounds.com/portal/view/529708> [2022-03-26]

shock-value. (2005). *Interactive Buddy v.1.01*. Simulation - Pet/Buddy. T. Ruffle.
<https://www.newgrounds.com/portal/view/218014> [2022-04-04]

SilverStitch. (2009). *Colour My Heart*. Action - Platformer - Other. E. NGP.
<https://www.newgrounds.com/portal/view/483057> [2022-03-26]
Comment: Runs a little slow, hard to tell whether it is due to the player.

sim-man. (2012). *Simgirls (Full Version)*. Simulation - Dating. M. NGP.
<https://www.newgrounds.com/portal/view/594476> [2022-03-26]

simonhanson. (2005). *Tactical Assassin*. Action - Shooter - First Person. M. Ruffle.
<https://www.newgrounds.com/portal/view/283047> [2022-04-04]

Snubby. (2008). *The World's Hardest Game*. Skill - Avoid. E. Ruffle.
<https://www.newgrounds.com/portal/view/431039> [2022-03-26]

StripArcade. (2005). *StripBowl!*. Sports - Other. A. Ruffle.
<https://www.newgrounds.com/portal/view/260279> [2022-03-26]

Taniquille. (2004). *Manga Boy DressUp*. Gadgets - Dress Up. E. Ruffle and NGP.
<https://www.newgrounds.com/portal/view/146570> [2022-03-26]
Comment: Runs slightly more smoothly in NGP.

The-Flash-Bros. (2005). *Zelda: Lampshade*. Genre information missing. T. Ruffle.
<https://www.newgrounds.com/portal/view/253819> [2022-03-26]

The-WalrusZ. (2005). *Boobs, Butt or Shoulder?* Puzzles - Quiz. A. Ruffle.
<https://www.newgrounds.com/portal/view/215427> [2022-04-04]

TomFulp, ThatJohnnyGuy. (2006). *Pico's School*. Adventure - Point 'n Click. M. Ruffle and NGP.
<https://www.newgrounds.com/portal/view/310349> [2022-03-26]
Comment: Slow loading screen in both Ruffle and NGP.

Totaljerkface. (2010). *Happy Wheels*. Sports - Racing. M. NGP.
<https://www.newgrounds.com/portal/view/547504> [2022-04-04]

VascoF. (2010). *G-Switch*. Action - Platformer - Other. E. NGP.
<https://www.newgrounds.com/portal/view/526596> [2022-04-04]
Comment: Local multiplayer functional.

vomic. (2021). *The Gay Test*. Spam. T. NGP.

<https://www.newgrounds.com/portal/view/788417> [2022-03-31]

Warnockworld. (2007). *Bloons Tower Defense*. Strategy - Tower defense. E.

Ruffle. <https://www.newgrounds.com/portal/view/395153> [2022-03-26]

Warnockworld. (2007). *Bloons*. Puzzles - Other. E. Ruffle.

<https://www.newgrounds.com/portal/view/370620> [2022-03-26]

xGen. (2006). *Stick Arena (NG)*. Action - Shooter - Multidirectional. T. NGP.

<https://www.newgrounds.com/portal/view/330120> [2022-03-26]

Comment: Does not function through the NGP, reroutes player to a separate site.