

# Video Game Preservation and Emulation from Three Perspectives: Developers, Archivists and Gamers

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# Video Game Preservation and Emulation from Three Perspectives: Developers, Archivists and Gamers

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## ABSTRACT

This paper presents a comprehensive research study that investigates the perspectives of video game preservation from three distinct target groups consisting of game developers, game museums, and video game enthusiasts. Each target group expressed their thoughts and opinions regarding game preservation efforts and the use of emulation as a preservation method. Through a mixed-method approach, including questionnaires and semi-structured interviews, the study collected both quantitative and qualitative data from 148 respondents. By examining the responses, different challenges, obstacles, and possible improvements were identified for each target group. The findings of this study revealed several common themes among the participants. The importance of collaboration and communication between all three target groups can help improve current video game preservation efforts.

## KEYWORDS

Video Games, Digital Games, Video Game Preservation, Digital Preservation, Emulation, Archiving Games

## 1 Introduction

Video games play a significant role in the daily lives of many individuals around the world. Digital games provide entertainment, relaxation, and an opportunity to connect with friends and family, both in virtual and real-world settings. For many people, these digital games had a lasting impact on the childhood of those who grew up in the 1980s and beyond, and continue to be part of their present and future. However, despite their widespread popularity, video games are often undervalued in our society when compared to other cultural industries such as film and music. Video games are frequently overlooked when discussing significant aspects of our cultural and digital heritage [6].

Digital preservation is the process of protecting and safeguarding every type of digital material to ensure it is accessible for future generations. These digital materials can either be originally created in a digital format, such as emails, websites and video games, or they can be analog materials that were converted into a digital

format [29]. The question of how video games should be preserved and made accessible for users in the future have become more pertinent in recent years. Video game preservation is tied to the broader field of digital preservation as a whole [2]. However, video games are arguably more particularly affected by certain issues related to preservation compared to other forms of digital media [2]. The difference between preserving video games compared to other media like books, is that a book can sit on a shelf for over 50 years and still be accessible to read. Video games will not be accessible in the same way with the rapid technological changes and the resulting obsolescence of the technology necessary to play these old games [24].

The accessibility of older video game releases is threatened by the obsolescence of older hardware and software [23]. One example involves the game *Spacewar!*, developed in 1962. The game is originally stored on a punched paper tape which is intended to be read on a PDP-1 (Programmed Data Processor-1) computer. Only one functioning PDP-1 computer exists in the world, at the Computer History Museum in Mountain View, California. The fate of the original paper tape of *Spacewar!* is also possibly the fate of all games without the active intention of preservation [24].

To combat obsolescence, it is vital to save the games original source code for long-term preservation. The source code contains all the raw assets and data of the game. Without the source code, the only option for preserving these games in new hardware and software is to replicate the original system with emulation [38].

Currently, one of the most viable preservation strategies that have been identified for overcoming the problems of obsolescence involves the use of emulation [23, 8]. Emulation allows users to read ROM (Read-Only Memory) files taken from the original formats such as cartridges, CDs (Compact Discs) or tapes and run the games originally designed for arcade cabinets or older console hardware on a modern PC (Personal Computer) [5]. An emulator is a software that is intended to simulate the functions of older hardware [21]. The NES (Nintendo Entertainment System) is probably the most widely emulated video game console, with several emulators of varying quality available to download [13]. The goal with emulation is to safeguard access to a digital object in the face of the consequences of obsolete file formats and

unsupported operating systems [34]. The primary problem when it comes to using emulation for preservation is that it is in a legally grey area due to copyright laws [21]. Emulators themselves are not illegal, provided that all the information used when developing the emulator has been legally obtained and does not contain any proprietary code. However, it is illegal to run software which the user does not own a license for [13].

One of the unfortunate realities of video game preservation is how sometimes the game industry itself stands in direct opposition to preservation efforts [38]. There is a lack of support or sense of urgency from the industry about this subject [35]. Some video game companies in the industry do maintain archives of their own games, but mostly for the purpose of internal research [17]. The prevailing business model within the video game industry is structured mostly around the latest game releases and the next generation of video game platforms, this unfortunately at the expense of older titles and hardware [23]. Technological obsolescence is financially beneficial for the video game industry, since it profits on the sale of new hardware and software [17].

It is the gaming community and hobbyists that are the driving force behind maintaining and extending the lifespan of old video games, by emulation, when the original creators will do nothing about the preservation issue [35]. Game companies in the industry have claimed that emulation is piracy [9]. The emulation community claims that emulation does not infringe game companies' intellectual property (IP) rights, since it allows players to access older video games that are no longer available in stores for purchase. Emulation is developed in response to latent customer demands that have gone unmet by the video game industry [9].

Video games have evolved into a significant part of our cultural heritage, and the importance of video game preservation has gained recognition [19, 26]. However, understanding this subject requires encompassing multiple perspectives to help understand the problem and possible solutions on a deeper level. The goal of this study is to investigate the general thoughts and opinions on video game preservation and emulation from three different target groups related to video games. The target groups will consist of individuals that represent either the game industry, game museums and archiving institutions, or video game enthusiasts. These three target groups will all have a unique perspective related to video games, game preservation, and emulation. By inquiring data from these target groups, the study aims to answer the following question: *What are game developers, video game museums, and video game enthusiasts' attitudes towards current video game preservation efforts, with a focus on their perspective on using emulation as a preservation method?*

The goal of this study is to gain a deeper understanding of each target group's perspective and point of view regarding game preservation and emulation. Recognizing what each target group needs can help identify what changes should be made to improve current video game preservation efforts.

## 2 Background

The video game industry is one of the most profitable within the entertainment industry. Not only is it economically significant, but researchers from various academic fields, such as media studies, psychology, ethnography, and law, acknowledge that video games play a crucial role in shaping contemporary culture [10]. Archiving and preserving video games have been an important problem in the field of challenges related to the preservation of significant digital media for the future [34].

Compared to paper-based records, digital preservation poses significant challenges, primarily in terms of maintenance. Analog materials are relatively easy to maintain with proper storage and upkeep. However, digitized versions of analog materials will require continuous and ongoing maintenance for the duration of their retention. This leads to significant cost and time implications for the archiving institutions [29]. It is crucial that professional archivists adhere to best practices in digital preservation, such as authentically preserving digital objects, creating backups, generating standardized metadata, and diligently tracking surrogates [29]. However, these considerations can only be effective if archivists acknowledge the problems regarding digital preservation, especially when preserving video games. It is essential for librarians and archivists to raise public awareness about the significance and importance of digital preservation [29].

Video games have a unique set of problems for historical preservation. Like other software, video games are stored on media with a limited lifespan. Older games were not designed to last forever, and are at risk of disappearing. For example, ROM cartridges are subject to corrosion from moisture and battery acid, and game discs can be rendered unreadable by scratches [18]. Older video games availability is simply limited. A video game can easily become abandonware and commercially unavailable for the public [19]. Abandonware encompasses both hardware and software that is no longer supported by the company that manufactured the product [11]. Besides wear and tear, different storage mediums have different lifespans with an expiration date. The data stored on them will one day be lost or become unreadable, and the hardware used to play older games are degrading over time. The truth is that without intervention, video games will eventually become unplayable because of these technical issues [38].

### 2.1 The Consequence of Digital-Only Games

Video games that are only sold digitally to consumers have the risk of being unavailable for purchase later, since their future availability depends entirely on the game publisher. If the publisher decides to remove a video game from the online marketplace, then that game effectively disappears. Making it impossible for a future would-be consumer to acquire a lawful copy of the video game [23].

In 2023, Nintendo decided to discontinue the eShop for the Wii U and Nintendo 3DS. Meaning it will no longer be possible for users to purchase games from the online marketplace for these video

game consoles [25]. Nintendo stated that they did not have any plans to offer these classic video games for future consumers in other ways [27]. This decision resulted in up to 1000 digital-only games that will disappear forever [33]. Diskin [13] discusses how many believe that there should be exceptions to the law when emulating video games which are no longer in production and that Nintendo no longer makes any money from.

A similar situation was about to happen to PlayStation games, until the decision was stopped. In 2021, PlayStation announced their plans to shut down their digital store for the PS3 and PS Vita devices. This would have meant that consumers would no longer be able to purchase and get access to the catalog of games that are available on these two consoles. However, after receiving a huge amount of negative feedback from the gaming community, the company decided to reverse their decision [14]. Jim Ryan, the president and CEO of Sony Interactive Entertainment, said that they had made the wrong decision and would keep the PlayStation store operational for the PS3 and PS Vita [32].

The shift to digital distribution of many modern video games presents a host of new legal issues in game preservation. Many digital-only games that are never released on physical media are at a greater risk of being lost than many other older video games. Furthermore, video games that require a constant connection to a server to function, or gaining access to certain features, can quickly be rendered non-functional or incomplete once those servers are taken down [38].

### 2.1.1 Physical Games

Compared to digital-only games, physical copies of video games can continue to be sold and bought by consumers second-hand if the game publisher has ceased to offer them for sale. However, even games that are sold on physical discs may not contain all the necessary data needed to play the games, with the rest being downloaded during the installation process [23]. The installation requires an internet connection and a user account linked to a digital store to download the rest of the game [19]. Harkai [19] provides a hypothetical example of how users gain access to the game content upon installation, comparing video games as a service to only having access to certain chapters of a book they purchased. If the reader wants to read more, they must go to the library to access the other chapters of the book.

### 2.1.2 Online Multiplayer Games

Whether a user owns a video game in physical or digital form, that game can still become completely inaccessible if its primary functionality necessitates an online connection for gameplay. Online multiplayer games therefore present additional challenges in terms of video game preservation. These types of video games always require an internet connection to an external server, which is maintained by the developers or publishers, in order to play. Once the developer or publisher ceases to offer support for the video game and its servers, the game effectively becomes unplayable for players as their access to the server is terminated [23, 19].

## 2.2 Game Developers on Game Preservation

Sköld [34] discusses in his research previous studies that explored the attitudes towards video game preservation in American and British game development studios. The studies seemed to yield similar results, that preservation tactics and attitudes vary between different game development studios. One of the studies presented was made by Bachell and Barr [2], who said that the video game industry's approach to preservation was largely disorganized when it comes to record keeping practices. That developers are not using any overarching guidelines when preserving their own work. Preservation decisions are only made by individual developers, who mostly do not have any formal training in records management, when deemed necessary [2]. The most common types of materials that are being kept by game studios were the games source code and the assets of released video games [34].

It has been observed that game companies have a varied attitude towards game preservation. Some game studios observed a lack of interest in preservation from the game industry, while others observed an interest in preservation as a business strategy. By business strategy meaning the purpose of future commercial opportunities and as an educational resource for developers [34]. Bachell and Barr [2] found similar results in their research. The video game industry sees the preservation of video games as positive for historical purposes. However, this historical purpose was in the context of educating new developers or in providing commercial opportunities for the industry [2].

There is a risk of video game developers themselves losing access to important material that are needed for preservation. In 2021, the video game developer Bioware released the game *Mass Effect: Legendary Edition*. This game is a remastered version of the original trilogy of *Mass Effect* games that was released in 2007, 2010, and 2012. A video game remaster is a re-release of an older game for modern hardware with a fresh coat of paint. These remastered video games usually have improved visual effects and graphics with high resolution textures compared to the original version of the game. Video game remasters rarely change the core gameplay of the original game, but might include some improved user experience or accessibility features for modern audiences [1]. The *Mass Effect: Legendary Edition* remaster was supposed to include all the bonus content, DLC (Downloadable Content), that had ever been released for the original trilogy of games in one package. While the game did offer over 40 additional content, one DLC was unfortunately not included in this new version of the game. The DLC called *Pinnacle Station* was not included in the remaster, and it was beyond the developer's control. The original source code for this DLC had been lost. The development team tried to contact everyone that had previously worked on this DLC back in the day, to hopefully gain access to backups for the code. But unfortunately, the backups contained almost all corrupted data, and even vital links were missing. The only way to include this part of the original game would be to remake the *Pinnacle Station* DLC itself from the ground up, completely from scratch [31]. This is a

clear example of game developer's needing to be more conscious about the importance of game preservation.

## 2.3 Video Game Emulation

Video game emulation is a well-known practice among video gaming enthusiasts. Emulation programs have become widespread, enabling users to play games on their PCs and other platforms that were not originally intended for those games [10]. Emulation is not the only way to preserve video games, but it might be considered the best way [36]. The gaming community is the side that perceives emulation as a force for good, since it allows users to play older games that are no longer sold commercially. While the video game industry mainly is against emulation, claiming it to be theft and piracy. Intellectual property owners' argument is that emulation violates their rights and poses a risk to their business model [9, 10].

Video game piracy refers to the act of illegally copying and distributing games without the authorization of the intellectual property owner, and it is a type of copyright violation [28, 3]. One of the main obstacles when it comes to archiving video games are the copyright laws. A video game consists of multiple components, each of which possesses its own individual copyright protection. These elements encompass artistic designs (such as scenes, graphics, layout, and the game console design), musical compositions, the script, and the recorded sounds of both the script and music [10].

Video game historian Frank Cifaldi discussed emulation in a 2019 GDC (Game Developers Conference) talk titled "*It's Still Emulation: Saving Video Game History Before It's Too Late*" [16]. GDC is an annual conference that brings game developers together to exchange ideas, solve problems, and shape the future of the game industry across five days of education, inspiration, and networking [15]. In the GDC talk, Cifaldi discussed emulation from the perspective of a producer at Digital Eclipse, a studio mainly known for making re-releases of classic games. Cifaldi states that emulation is the best tool for keeping older video games in print, both in a cost-effective and accurate way. It's believed that the video game industry should embrace emulation, instead of demonizing it [16].

However, there are some bigger names within the video game industry that hopes for an industry-wide acceptance of emulation [36, 4]. Phil Spencer, CEO of Microsoft Gaming and head of Xbox, have expressed his belief that the video games industry should prioritize preservation of older games. Spencer hopes that the industry can accept and work on "legal emulation" that allows modern hardware to run older executables. This would allow someone to play any game and continue to play that game in the future [7].

## 3 Methodology

This section of the paper will describe the methods used for data collection and data analysis. A mixed method research approach

was used for this study to collect and analyze both qualitative and quantitative data from three target groups.

## 3.1 Target Groups

This study decided to focus on the topic of game preservation and emulation from the perspective of three target groups. The first target group consisted of participants that would represent game companies' perspective on the topic of game preservation and emulation. These individuals all worked within the game industry as game developers, or a similar role, investing time and resources into bringing digital games to life. Recognizing their perspective is crucial because game preservation directly impacts game developers' creative legacy. This target group will in simple terms be referred to as the "game developers" target group throughout the paper.

The second target group consisted of individuals working with preserving video games at either a game museum or another archiving institution focused on video games. This target group will be referred to as the "game museums" target group throughout the paper. The perspective of game preservation from this target group is important because museums and archivists play a pivotal role in actively collecting and preserving older games and video game consoles.

The third target group consisted of video game enthusiasts who play video games in their spare time. This target group would represent the video game players and consumers perspective on game preservation and emulation. Understanding this target group's perspective is important because gamers are the driving force behind the game industry's success. Throughout this paper, this target group will be called the "video game enthusiasts" target group.

## 3.2 Data Collection Method

Questionnaires and semi-structured interviews were used as data collection methods in order to gather insight from the participants in each target group.

### 3.2.1 Questionnaires

In order to gain insight from the selected target groups, one of three online questionnaires were distributed to each group. With all three questionnaires, the goal was to reach as large of an international audience as possible. This in the hopes of receiving a diverse set of respondents with a worldwide perspective on game preservation and emulation. Some of the questions in all three questionnaires were the same, and some were more relevant for each specific target group. The questionnaires included open-ended questions where respondents could freely express their opinions, attitudes, and preferences [12] regarding game preservation. The three questionnaires included some close-ended questions that had predetermined answers for the respondents to choose from. The closed-ended questions were used to collect basic information about the respondents, and the open-ended questions were used to gather more subtle and complex information about the respondents' personal thoughts and feelings regarding the topic [20]. This section will describe how all three video game preservation

questionnaires were structured and distributed to their respective target group.

The first questionnaire was targeted at video game companies and game developers in order to get the game industry's perspective on the topic. The goal with this questionnaire was to learn what types of materials game developers themselves saved and archived from their previous video game projects. This in order to get a deeper understanding and insight on what game companies consider to be worthy of permanent archiving and what is only temporarily saved. This questionnaire was distributed to 45 different video game companies and developers worldwide. These companies were both larger AAA (triple-A) game studios and smaller indie studios and mobile game developers. AAA game studios have higher-budget and produce high-profile games distributed by a well-known game publisher. Indie game studios produce smaller games created by independent developers [37]. These 45 game companies were contacted about this research study by using the contact email displayed on the company's website for general inquiries and press. The game companies were asked to participate in the study by either answering the questionnaire linked in the email or scheduling an interview. In addition, Facebook and Reddit was later used to distribute the link to the online questionnaire to relevant Facebook groups and subreddits targeted at video game developers.

The questions in this questionnaire were partly inspired by the questionnaire and interview questions used in the research study by Bachell and Barr [2], with some added questions about emulation and who should be responsible for preserving video games for future generations.

This questionnaire consisted of 17 questions in total. The first couple of questions were related to gaining some relevant information about the respondents participating in the study. The criteria that needed to be met for participants to qualify for this study were that they stated in the questionnaire what role they had at a game company, and describe their responsibilities at that company. This was to ensure that the participants' responses could accurately represent someone working within the game industry. Naming the game company that the respondents worked for was completely optional and not necessary to qualify for this study.

The respondents were encouraged to share their own perspective and opinions on the current state of video game preservation efforts, and what they considered to be the biggest problems and obstacles when it comes to preserving video games for the future. The questions related to video game emulation were about whether the respondents' thought emulation was good or bad for the game industry, and if they considered it to be piracy.

The second questionnaire was targeted at video game museums and other archiving institutions whose job is to preserve video games for historical purposes. The goal of this questionnaire was to learn more about these museums and archiving institutions as an organization. To learn what types of games are in their collection and how visitors can interact with them. Furthermore, the questionnaire was meant to help determine if the organization had any communication or cooperated with the video game industry when archiving games for historical preservation.

18 different video game museums and archiving institutions around the world were contacted about the opportunity to partake in this research study, either by answering the online questionnaire or scheduling an interview. The game museums and archiving institutions were contacted about this study using the contact email displayed on the organization's website.

This questionnaire consisted of 16 questions in total. In the first few questions, the respondents stated which game museum or archiving institution they worked for. The criteria that needed to be met for participants to qualify for this study were that they stated in the questionnaire which organization they worked for. This was to ensure that the organization the participant represented was real and did indeed collect and archive video games.

The respondents were given the opportunity to express their own thoughts and opinions regarding the current state of video game preservation efforts, and what they considered to be the biggest problems and obstacles for their organization when it comes to preserving video games.

Another set of questions in the questionnaire were about the organization's relationship with the video game industry. The respondents answered whether their organization needed any permission from game companies and developers in order to archive certain materials from video games.

The third questionnaire was targeted at users with a gaming interest. The goal with this questionnaire was to learn how aware video game players are of video game preservation and the problems that exist within this topic. Social media platforms such as Facebook and Reddit were used to distribute the link to the questionnaire to relevant gaming community groups. The questionnaire consisted of 16 questions in total. The first few questions were related to gaining information on what types of games the respondents played. The criteria that needed to be met for participants to qualify for this study were that the respondents stated in the questionnaire that they did indeed play games and had a gaming interest.

The respondents could express their thoughts about game preservation efforts, and their feelings regarding using emulation to access older video games.

### 3.2.2 Interviews

Besides questionnaires were interviews used to collect data from the target groups. All interviews in this research study were semi-structured interviews. Meaning that a set of questions about game preservation and emulation were prepared, but these questions were discussed in a flexible order [20].

The interview questions were similar to the ones asked in the questionnaires. However, the respondents could answer the interview questions unrestricted and elaborate on their points [12], with potential follow-up questions being asked based on the respondent's answers. The follow-up questions helped explore unanticipated responses and obtain more nuanced answers from the respondents [30]. The interviews were then transcribed and coded for analysis.

### 3.3 Data Analysis Method

For this research, content analysis was used to analyze the qualitative data that was generated from the transcribed interviews and the open-ended questions in all three questionnaires. The idea of a content analysis is to classify elements of the text into categories and themes, and then quantify the content by calculating the frequencies of these elements [12, 20]. Content analysis can reveal relevant themes, ideas, and priorities [12] the respondents had regarding game preservation. The themes identified from each target group are presented in Figure 1, Figure 2, and Figure 3.

Categories and Themes	Percentage of Respondents	Qualitative Comments
<b>Game Preservation Efforts</b>		
Improvements are needed	84,6%	"I think a lot more should be done to preserve games." "The current state of game preservation is bad and needs to improve, but the kind of improvements needed cost time and money, and it's not obvious who has both the resources and the motivation to supply that."
Indifference	15,4%	"Nothing needs to be done. The game creators and publishers who own the rights to these games are the sole entities with any legal right to decide how they will be preserved, and they can do so to their satisfaction." "I don't think everything humanity creates inherently needs preserving indefinitely, especially with the sheer volume of cultural artefacts being produced in the digital age."
<b>Problems and Obstacles</b>		
Copyright laws	46,2%	"Breach of copyright and theft are the greatest problems, as they cloud the issue of ownership, and remove the rights and agency of the proper lawful owners of the games." "There are many issues pertaining to copyright law, IP ownership, and DRM. We live in a world where everyone, rightfully, wants to be paid for their creations. But thanks to copyright law, they have a certain stranglehold on those creations for a long time."
Financial issues	30,8%	"Proper archiving costs time and money. And no one has the time or money for it." "Who would finance it?"
Technical issues	23,1%	"With mobile games, the changes in device - like if they used touch and tilt inputs, that's less easy to preserve the experience with an emulator."
Greedy game companies	23,1%	"Individual companies are unreliable and profit driven." "Some might argue that archiving games might be a waste of resources."
<b>Using Emulation as a Preservation Method</b>		
Positive attitude	61,5%	"I think emulation is great if done ethically and legally." "I think emulation is a good way to keep older games alive."
Nuanced opinion	30,8%	"Emulation is an important tool, but it only emulates some of the hardware, not the full experience or cultural context." "I think emulation is good for games and systems that are not currently being offered for sale, and have truly been abandoned. The problem with emulation is that some people do it to preserve games, while others do it to not pay for them."
Disapproving attitude	7,7%	"It's dishonest, illegal, and self-deceiving."

**Figure 1: Content analysis of qualitative data collected from the target group “game developers”, emphasizing key insights and comments from the respondents.**

Categories and Themes	Percentage of Respondents	Qualitative Comments
<b>Challenges Regarding Game Preservation</b>		
Funding	91,0%	"Game preservation needs a lot more funding and a lot more awareness, especially from politicians and publishers." "The biggest obstacles regarding preserving video games are time and money, something that most museums don't have much of either."
Lack of Collaboration	72,7%	"Cooperation between institutions and the video game industry." "A more unified approach to preserving games, instead of everyone doing their own thing." "One organization will not be able to do all preservation. It's through collaboration that we will be able to learn from each other and thus preserve more."
<b>Using emulation as a preservation method</b>		
A necessary tool	45,5%	"I think emulation is a fantastic tool to be used. Emulation can be a great thing for people who maybe want to try a game which are no longer available." "Emulation is just a tool. I think a lot of companies have kind of made it synonymous with piracy, but it's not, it's just a tool through which you can play games. And it will be essential in giving libraries and archives the ability to share that stuff too."
Can't give an authentic gaming experience	18,2%	"Arcade machines are really difficult to emulate. Not the actual software, but the look and feel and input devices are not the same."
<b>Game Preservation in the Distant Future</b>		
Digital distribution and server-based games	45,5%	"If the games have server-based content, and need the servers, web access and digital right management systems to run, then it can become a huge problem when trying to preserve these games in the future." "It's very concerning because we already know there are games disappearing now. Some quite large ones because the servers gets turned off."
You can't collect them all	18,2%	"In the future we might have to pick the top five digital games over a certain year and try to preserve them."

**Figure 2: Content analysis of the collected data from the target group “game museums”, emphasizing insights and comments.**

Categories and Themes	Percentage of Respondents	Qualitative Comments
<b>Purchasing a Digital or Physical Games</b>		
Gaming platform	39,8%	"Digital purchases only for PC games, and usually physical games on console."
Availability	32,5%	"Depends if the game is available digitally or physically." "Physical games when it's possible, digital if it's the only option."
Price	25,3%	"The price of the game is one deciding factor." "If the physical game is cheaper than the digital one, I'll pick that one up."
<b>Digital-only games disappearing</b>		
Forces people into emulation	34,7%	"I think it sucks that people will no longer be able to access these digital-only games without the use of emulation. Nintendo doesn't seem to be giving its consumer any alternative options on how to access these games." "I think it's trivial for these companies to keep these games available on modern systems, and if not, I see no reason enthusiasts should feel bad about emulation when they do not." "It's awful and it leads everyone in the direction of emulation if the games don't get ported to the next generation of consoles."
Terrible	21,8%	"Terrible to lose access to any video game."
It's a shame	16,9%	"It's truly a shame, and I think that the developers themselves should be the first to prevent this from happening. Until they take the responsibility to preserve their own creations, I believe that the piracy of the video games affected is morally acceptable." "It is a shame such media is lost and cannot be legally accessed anymore, except for buying used game consoles with said game already installed."
Sad	15,3%	"I think it's sad that it's not possible to buy games for this platform anymore."
Understandable from a business perspective	3,2%	"It's understandable due to financial or licensing issues." "From a company perspective I can understand it. It's also why we can't rely on companies alone for preservation. Community efforts are required to handle it. It would be helpful if companies would be more willing to work with institutions as well, and legal issues would be resolved so these institutions can do the work."
Indifferent	1,6%	"Most good games got a physical release in that era. Most digital only games were bad so not worth re-releasing. If they were preserved, great; if not, nothing of value was lost."

**Figure 3: Content analysis of the collected data from the target group “video game enthusiasts”, emphasizing key insights and comments from the respondents.**

### 3.4 Research Ethics

This study adhered to the ethical guidelines and principles for research ethics. These principles emphasized the significance of safeguarding participants' identities and interests, ensuring voluntary and informed consent, avoiding deception, operating with scientific integrity, and complying with the legal requirements of the land [20, 12, 22]. The respondents were informed before answering the questionnaires and interviews that all of their responses to the questions would be kept anonymous throughout the study. All interviews in this study were conducted remotely through Zoom video meetings. The participants were informed that the interview would be recorded for note taking purposes with their explicit consent. And participants were informed that the recorded material was not to be shared or viewed by others, and would be deleted once the research study was completed. This study operated openly and honestly throughout the entire research process to ensure the quality and validity of the study [20].

## 4 Results and Data Analysis

This section will present all the results that have been gathered from the collected data through the three online questionnaires and interviews.

### 4.1 Participants

In this research study, a total of 148 respondents participated. 13 of them were part of the "game developers" target group, 11 were part of the "game museums" target group, and the other 124 respondents were part of the "video game enthusiasts" target group.

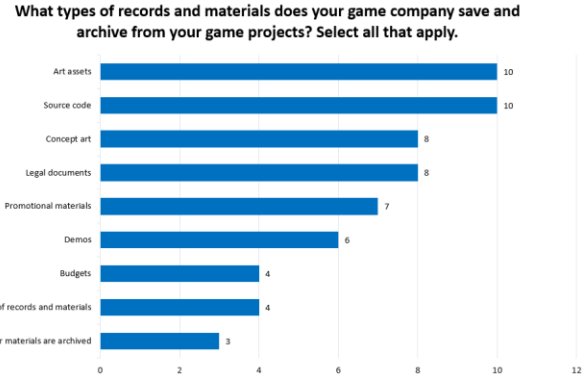
#### 4.1.1 Respondents in Target Group "Game Developers"

In this study, 13 participants were part of the target group representing the video game industry. Out of these 13 participants, 12 of them responded to the online questionnaire aimed at game companies and video game developers, whereas one of the respondents participated in a semi-structured interview.

The game developers that participated in this study were asked what types of records and materials their game company saved and archived from game projects. This question was a select all that applied question, where the respondents could choose one or more predetermined options. The options were:

- Legal documents.
- Budgets.
- Source code.
- Art assets.
- Promotional materials.
- Demos.
- Concept art.
- Other types of records and materials.
- The game company does not archive any records or materials from our game projects.

The results from this question did show that the majority of the game developers and companies did save and archive the source code and art assets from previous game projects (see Figure 4). The respondents stated that the source code was one of the materials that was considered worthy of permanent archiving.



**Figure 4: Overview of what records and materials the game companies within the target group "game developers" saved and archived from previous game projects.**

The respondents in this study that said that their company did not archive any materials from previous game projects explained that the main reason for this was either because the company did not have the resources to do that, or it was something that was never discussed within the company.

#### 4.1.2 Respondents in Target Group "Game Museums"

11 participants belonged to the target group "game museums", representing an organization that worked with preserving video games for the future. The video game museums and archiving institutions that participated in this research study were: The Video Game History Foundation, The Strong National Museum of Play, The Finnish Museum of Games, The Museum of Art and Digital Entertainment, Retro Computer Museum, The Centre for Computing History, The Nostalgia Box, Embracer Game Archive, The National Library of Sweden, and The Computerspielemuseum.

The responses from the questionnaire showed that the majority of the video game museums and archiving institutions archived physical games at their organizations. 81,8% (n=9) of them had physical games in their collection, and 54,5% (n=6) of them also archived digital games. The reason for this is that physical games are easier to collect and store at the organization.

81,8% (n=9) of the respondents answered that their organization had different video game hardware and consoles as part of their collection. Most of the organization's collections were partly based on donations, and physical objects are easier to donate than digital.

72,7% (n=8) of the game museums and archiving institutions had playable video games that visitors could interact with. Because many of the organizations wanted to give their visitors the opportunity and the experience of playing these classic older video



games on the original hardware, and not only look at them behind plexiglass.

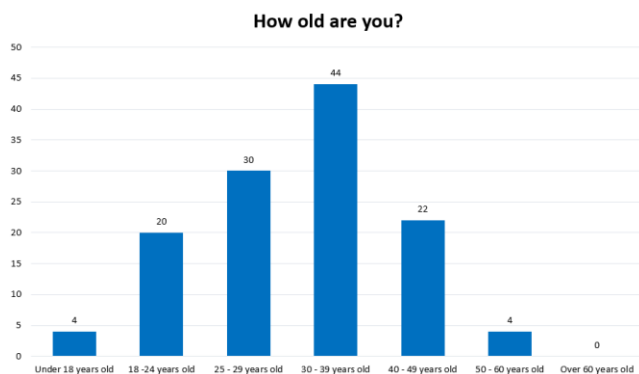
Among the 11 respondents, five of them agreed to participate in a semi-structured follow-up interview after initially responding to the online questionnaire. These follow-up interviews helped get a clearer picture into how these museums and archiving institutions are organized, and discuss the topic of preservation in more detail based on their questionnaire responses.

#### 4.1.3 Respondents in Target Group “Video Game Enthusiasts”

The majority of the participants in this research study, specifically 124 individuals, were part of the target group “video game enthusiasts”. All of these participants took part in the online questionnaire aimed at video game players.

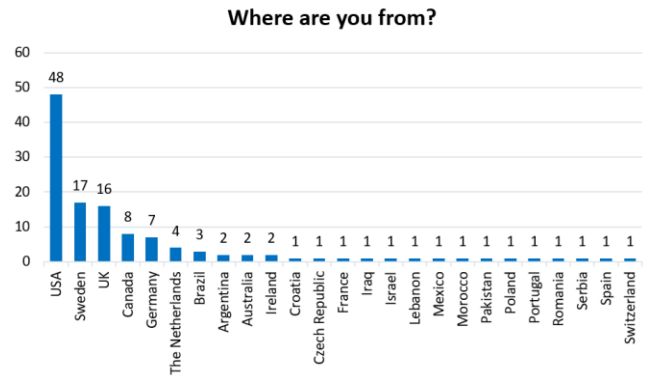
70,2% (n=87) of the 124 respondents were male, 21,8% (n=27) were female, 3,2% (n=4) identified as “other”, and 4,8% (n=6) of the respondents preferred not to state their gender.

3,2% (n=4) of the respondents were under the age of 18 years old, 16,1% (n=20) were between 18-24 years old, 24,2% (n=30) were between 25-29 years old, 35,5% (n=44) were between 30-39 years old, 17,7% (n=22) were between 40-49 years old, and 3,2% (n=4) were between 50-60 years old. None of the respondents in this target group were over the age of 60 years old.



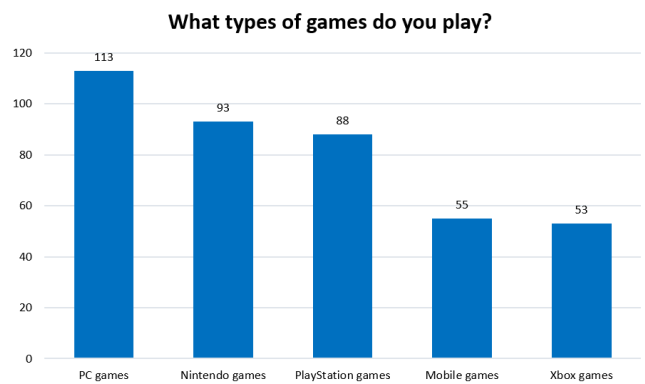
**Figure 5: Age range distribution among the respondents in the target group “video game enthusiasts”.**

The participants that responded to this questionnaire were from different countries all around the world (see Figure 6). The majority of the respondents were from the United States. The other two countries with the most respondents were Sweden and the United Kingdom.



**Figure 6: Geographic distribution of the respondents within the target group “video game enthusiasts” by country.**

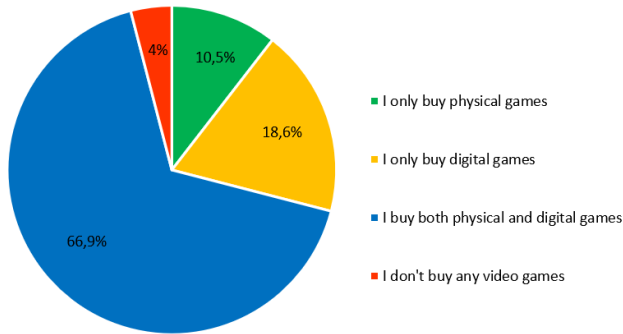
91,1% (n=113) of the respondents stated that they play PC games, 75% (n=93) played Nintendo games, 71% (n=88) played PlayStation games, 44,4% (n=55) played mobile games, and 42,7% (n=53) played Xbox games.



**Figure 7: Types of video games played by the respondents in the target group “video game enthusiasts”.**

When asked if the respondents purchased their video games physically or digitally, 18,6% (n=23) of the respondents said they only purchase digital games, 10,5% (n=13) only purchase physical copies of games, and 4% (n=5) of the respondents answered that they do not buy any video games. The majority of them, 66,9% (n=83), answered that they buy both physical and digital games (see Figure 8). When asked what was the deciding factor that made them choose to buy a game physically or digitally, the vast majority answered that it depended on price, convenience, availability, and the gaming platform. Many answered that they only purchase digital games on PC, and physical games on their game console.

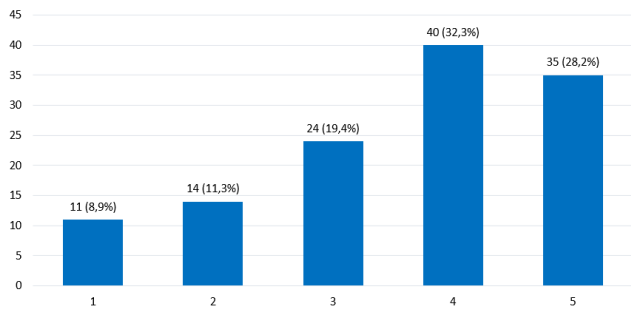
**Do you buy physical games or digital games?**



**Figure 8: Questionnaire results from the target group “video game enthusiasts”, illustrating respondents’ preferences when it comes to purchasing physical or digital games.**

The majority of the respondents, 86,3% (n=107), believed that all video games are worthy of long-term preservation. The respondents ranked their own knowledge of video game preservation on a scale of 1 to 5 on a Likert scale. A 1 on this scale meant that the respondent had no knowledge about this topic. A 5 on this scale meant that the respondent was very knowledgeable about the topic, and was fully aware of the challenges and problems that exist when trying to preserve video games for the future. The majority of the respondents ranked their own knowledge as a 4 or 5 (see Figure 9).

**On a scale of 1 to 5, how much do you know about video game preservation?**



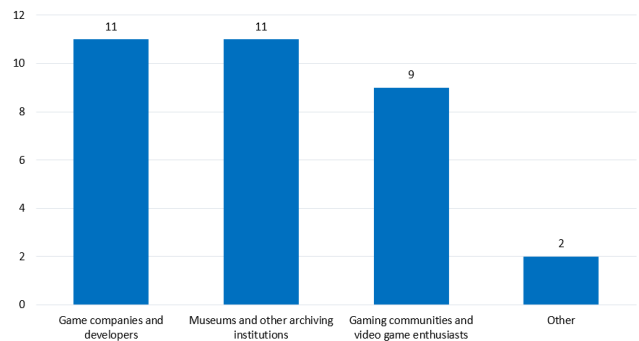
**Figure 9: Self-assessment of video game preservation knowledge among the respondents from the target group “video game enthusiasts” rated on a scale of 1 to 5.**

## 4.2 Responsibility of Preserving Video Games

The respondents in all three target groups were asked who they thought should be responsible for preserving video games. This question was a select all that applied question, where the respondents could choose more than one option for who they thought the responsibility of game preservation applied to. The options given to them were: “game companies and developers”, “museums and other archiving institutions”, “game communities and video game enthusiasts”, and “other”.

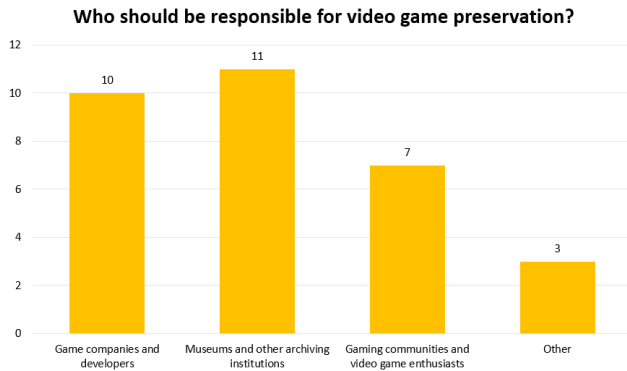
11 of the 13 respondents in the “game developers” target group answered that game companies and developers are responsible for video game preservation. 11 of the 13 respondents thought that museums and other archiving institutions are responsible for preserving games as well. 9 of the 13 respondents had picked game communities and video game enthusiasts as responsible. In addition, 2 of the 13 respondents wanted to add another option on potential people that should be responsible for video game preservation. One of the respondents thought that video game publishers like EA (Electronic Arts) need to be responsible and make sure their games are being preserved for the future. Because they stand to profit from having their classic games be available for purchase. The other respondents said that: *“Anyone is responsible, if you enjoy a game, you should keep it around.”*

**Who should be responsible for video game preservation?**



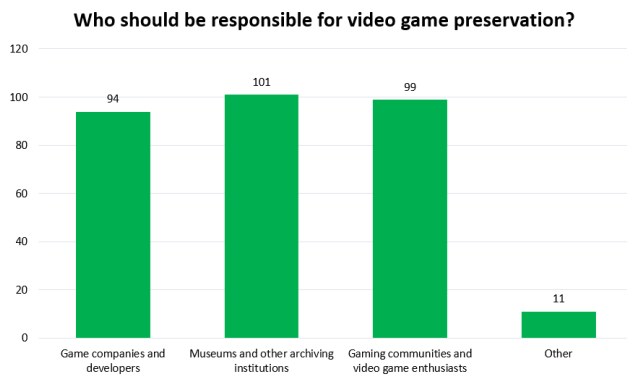
**Figure 10: Questionnaire results from the target group “game developers”, displaying their views on who should be responsible for the preservation of video games.**

All of the 11 respondents in the “game museums” target group agreed that museums and other archiving institutions are responsible for video game preservation. 10 of the 11 respondents said that game companies and developers should be responsible for preserving their own video game projects. 7 of the 11 respondents answered that game communities and video game enthusiasts have a responsibility to preserve video games. In addition, 3 of the 11 respondents also added other organizations that should take responsibility. These respondents expressed that governments, universities, and other industry organizations and international cooperatives should help preserve video games.



**Figure 11: Questionnaire results from the target group “game museums”, displaying their views on who should be responsible for the preservation of video games.**

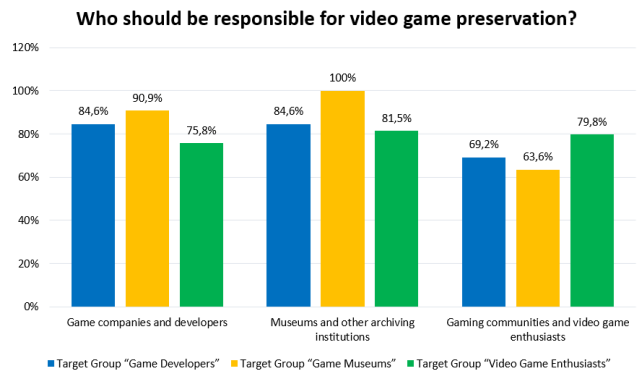
101 of the 124 respondents in the “video game enthusiasts” target group said that museums and other archiving institutions have a responsibility to preserve video games for the future. 99 of the 124 respondents answered that communities and video game enthusiasts should be responsible. 94 of the 124 respondents thought that game companies and developers needed to be responsible for game preservation. In addition to this, 11 of the 124 respondents also added other options to this question. These 11 respondents expressed that governments and libraries should take more responsibilities and play a larger role when it comes to preserving video games as our cultural heritage. The respondents stated that anyone who cares about this topic should be involved and help preserve games for future generations.



**Figure 12: Questionnaire results from the target group “video game enthusiasts”, displaying their views on who should be responsible for the preservation of video games.**

After comparing the responses from the three target groups (see Figure 10, Figure 11, and Figure 12), it becomes apparent that they share similar views regarding the entities responsible for preserving video games (see Figure 13). Specifically, 84,6% of the “game developers”, 90,9% of the “game museums”, and 75,8% of the “video game enthusiasts” acknowledge that game companies and developers are responsible for game preservation. 84,6% of the

“game developers”, 100% of the “game museums”, and 81,5% of the “video game enthusiasts” agree that museums and archiving institutions play a crucial role in preserving video games. Among the respondents in this study, 69,2% of the “game developers”, 63,6% of the “game museums”, and 79,8% of the “video game enthusiasts” believe that gaming communities and individual video game enthusiasts bear a responsibility to help preserve video games for the future.



**Figure 13: Comparison of the questionnaire results on video game preservation responsibility among the target groups “game developers”, “game museums”, and “video game enthusiasts”.**

### 4.3 Emulation as a Preservation Method

The respondents in all three target groups were asked to express their thoughts regarding using emulation as a preservation method for video games.

#### 4.3.1 Respondents in Target Group “Game Developers”

61,5% (n=8) of the respondents said that they did not consider video game emulation to be piracy. 38,5% (n=5) of the respondents said that they thought emulation to be the same as piracy. One respondent expressed this thought regarding emulation and piracy: “Emulation is a form of piracy, but as long as people aren’t trying to make money off other people’s IP, I see no problem with it. Emulation is good for coders and helps with software innovations that wouldn’t be possible without it.”

The majority of the game developers that participated in this study expressed a positive attitude towards the use of emulation as a preservation method for video games. One respondent said: “I think emulation is a good way to keep older games alive.” Another respondent noted that they thought emulation is great, if done ethically and legally.

Some of the respondents in this target group had a more nuanced opinion regarding emulation, they saw both positive and negative aspects of using emulation. One respondent said: “Emulation is an important tool, but it only emulates some of the hardware, not the full experience or cultural context.” Meaning that emulation is unable to recreate an accurate gaming experience for certain games.

Another respondent said this about emulation: *“I think emulation is good for games and systems that are not currently being offered for sale, and have truly been abandoned. The problem with emulation is that some people do it to preserve games, while others do it to not pay for them.”*

The minority of the respondents that participated in this study expressed disapproval of the use of emulation for preserving games. One respondent objected to the use of emulation, saying that: *“It’s dishonest, illegal, and self-deceiving.”* This respondent expressed that: *“Players and collectors use preservation as a moral dodge for engaging in breaching copyright and theft, and this argument holds no water.”*

#### **4.3.2 Respondents in Target Group “Game Museums”**

The majority of the respondents in the target group “game museums” did not consider emulation to be the same as pirating a game. One respondent said that for them emulation is not piracy if you legally already own the original software. The emulated game then becomes a backup copy. Another respondent said this about emulation and piracy: *“A lot of companies have made it synonymous with piracy, but it’s not, it’s just a tool through which you can play games. And it will be essential in giving libraries and archives the ability to share games.”*

Some of the respondents said that their game museums or archiving institutions did use emulation. However, emulation was only used with games that the organization already had another copy of in their collection or exhibition. The game museums that did not use emulation said that this was because they wanted their visitors to experience playing the games on the original hardware.

The majority of the respondents in this target group express that emulation was a completely necessary tool for video game preservation efforts. One respondent expressed: *“Hardware can’t be maintained forever. So, making sure that there is some way of being able to access these games without having the original hardware, that isn’t being produced anymore, is completely essential to preservation.”*

#### **4.3.3 Respondents in Target Group “Video Game Enthusiasts”**

The majority of the respondents, 87,1% (n=108), said that they had at some point used an emulator to play a video game. When asked if the respondents considered video game emulation to be piracy, 65,3% (n=81) said no, 15,3% (n=19) said yes, and 19,4% (n=24) said that they did not know if emulation is a form of piracy.

The majority of the respondents, 71% (n=88), thought that it is acceptable to play a video game, using emulation, that they did not already own a copy of. 10,5% (n=13) of the respondents said that it is not okay to play a game through emulation if you do not already own the game. 18,5% (n=23) of the respondents were unsure if it is okay to use an emulator to play a video game you do not already own. However, when asked if the respondents thought it is acceptable to emulate a video game that is no longer legally available for purchase anymore, then the vast majority of the

respondents, 91,9% (n=114), agreed that emulating that game is completely justifiable. 3,2% (n=4) of the respondents said that it was not okay to emulate a video game, even if the game was unavailable for purchase. 4,8% (n=6) of the respondents answered that they did not know the answer to this question.

#### **4.4 Games Disappearing from the Marketplace**

As previously mentioned in this paper, Nintendo decided this year to shut down their eShop for the Wii U and 3DS [25, 27, 33]. The respondents in all target groups were asked what their feelings were regarding this decision, and what they thought about more digital-only games disappearing in the future once an online marketplace shuts down.

The respondents from the target groups “game developers” and “game museums”, expressed that they understood Nintendo’s decision. The decision makes sense from a financial or business perspective. The intellectual property owner does have the rights to do whatever they want with their video games. However, respondents express that this was a bad decision from a preservation perspective, especially since Nintendo has not currently given any alternatives on how to access these older digital-only games.

The respondents in the target group “video game enthusiasts” had more negative feelings regarding Nintendo’s choice to shut down the eShop. One respondent expressed their disappointment that such a large library of digital-only games will be lost: *“It’s a shame such media is lost and can’t be legally accessed anymore, except for buying used game consoles with said games already installed.”* Many respondents expressed that decisions like this are what forces people into emulation. One of the respondents said: *“I think it sucks that people will no longer be able to access these digital-only games without the use of emulation. Nintendo doesn’t seem to be giving its consumers any alternative options on how to access these games.”* Another respondent mentioned that: *“It’s awful and it leads everyone in the direction of emulation if the games don’t get ported to the next generation of consoles.”*

The respondents in the target group “game developers” were asked if they believed the video games they helped develop and produce would still be available for consumers in the distant future? 46% (n=6) said no and 39% (n=5) answered yes. 15% (n=2) were uncertain and said that some of their games might still be available for players, while other less popular games would probably not be playable in the distant future.

#### **4.5 Challenges and Obstacles**

Financial issues were deemed to be one of the more common challenges and obstacles for both the “game developers” and “game museums” target groups. The majority of the game museums answered that their organization lacked any kind of financial support or funding from their respective governments. Their organizations were mostly financed by ticket sales and donations. One respondent said that: *“The biggest obstacles regarding*

*preserving video games are time and money, something that most museums don't have much of either."*

The game developers in this study said that the question lies in who would finance game preservation? *"Proper archiving costs time and money. And no one has the time and money for it"*, said one respondent in the "game developers" target group. More financial support would help improve game preservation efforts, *"Game preservation needs a lot more funding and a lot more awareness, especially from politicians and publishers."*

The respondents in the "game museums" target group expressed that a major challenge for them is a lack of collaboration and support from the video game industry.

Another thing is that there does not exist any standardized guidelines on how to best preserve all the different game materials. Meaning that every organization does mostly their own thing, without a unified approach.

One of the major challenges with more video games being distributed digital-only, and having server-based content is that they are more difficult to preserve compared to physical copies of games with no online features. Online multiplayer games and server-based games require a connection to a server in order to be playable, meaning if the server gets shut down then that game becomes unavailable. One respondent said: *"It's very concerning because we already know there are games disappearing now. Some quite large ones because the server got turned off."*

As an increasing number of digital-only video games are being released, it essentially becomes impossible to preserve every single game. One respondent acknowledges the issue of being unable to collect every game released, and they have initiated discussions at their game museum regarding potential solutions. They are considering the possibility of only collecting the best digital-only games of each year: *"In the future we might have to pick the top five digital games over a certain year and try to preserve them."*

## 5 Discussion and Conclusion

### 5.1 Discussion

This study investigated the attitudes towards game preservation and emulation from three relevant perspectives; game developers, video game museums, and video game enthusiasts. The results from this study showed that the vast majority of the participants in all three target groups thought that game preservation was an important topic that needs to continue to improve.

Previous studies have expressed that the game industry is standing in opposition to preservation efforts, and does not see game preservation as an urgent problem that needs to be addressed [38, 35, 34, 2]. The results from this study showed that the majority of game developers do see the importance of game preservation, and wished that the industry took more responsibility in helping preserve their games. The problem is that companies do not have the time and money to support game preservation efforts as much as developers might want to.

The results showed that all target groups agreed that game preservation needs to be an equal collaboration between all relevant parties. Each target group themselves agreed that they have a responsibility in preserving video games for future generations of video game players. However, the problems seem to be that communication is lacking between all target groups. Many of the museums and archiving institutions that participated in this study expressed that cooperation and support from the game industry have been challenging. A possible solution for this could be an outside third-party organization that would be responsible for communication between the video game museums and the game industry, with the common goal of improving preservation efforts. This third-party organization would be able to send forward requests that the museums might want or need from the game industry. In this scenario, video game museums could then contact this third-party organization instead of contacting several different game companies, developers, and publishers around the world when looking for support or game materials to donate.

The target groups "game developers" and "game museums" pointed out that there does not seem to exist any universal guidelines on how to best preserve all the different types of games and hardware materials. Every organization basically does their own thing regarding how to best preserve their collection. One of the respondents in the study stated that academics and researchers need to identify and create official guidelines that the game industry and archiving institutions could follow. To increase cooperation between each target group, a unified solution should first be established.

Emulation has been determined from both previous research and the results from this study to be a necessary tool for game preservation. However, copyright laws complicate the use of emulation, and the game industry do see it as a form of piracy. It seems like either some exceptions need to be made with copyright laws when it comes to older games that are unavailable, and have been abandoned by the game industry. Changes to the laws would make it easier for game preservationists to legally preserve these old video games. The solution for this would be to increase politicians' awareness of the importance of digital preservation, and video games as a significant part of our cultural heritage. Changes to copyright laws will probably not happen without the support from governments. Another possible solution would be for the game industry to embrace emulation and offer players their own official and "legal emulator" for players to access.

One respondent in the target group "game museums" brought up an interesting point regarding people's feelings towards game preservation, and older video games becoming unplayable. That nostalgia is an incredible motivator to make people aware of the importance of game preservation. If you asked a kid playing a video game in the 1990s if they thought game preservation was important, that kid would probably either not have cared or not thought much about it. But if you asked that same kid today, as an adult, then they might have a completely different answer. Then they would probably say that of course game preservation is important, otherwise they would not be able to replay the games from their

childhood. From a player's perspective, preserving video games ensures that beloved game titles and game consoles can always be revisited in the future. Preserving access to classic games is not solely about sentimentality; it also guarantees that future gamers can appreciate the game titles and consoles that shaped the medium. Many people may not realize the importance of starting conversations about preserving the video games of the current generation. Nevertheless, it is crucial to commence preparations for this. After all, in approximately two decades, the newest cutting-edge video games launched on the PlayStation 5 will one day transform into a cherished classic, at the risk of vanishing and becoming unplayable because of obsolescence.

## 5.2 Limitations

This study was mainly limited by the sample size of the target group "game developers". Meaning the results from the "game developers" target group was smaller than expected, and might not constitute an accurate representation of game developers' and the game industry's thoughts regarding current game preservation efforts and the use of emulation. Finding willing participants from this target group was the most challenging aspect during the data collection process for this research study. Approximately two months of the data collection process were spent trying to contact potential participants. As mentioned previously in this paper, 45 different game companies that consisted of both AAA game studios and smaller indie studios worldwide were contacted through official emails from companies' websites. During these two months, only two respondents from these 45 companies participated in this study. The other 11 participants in this target group responded to the questionnaire first after the link was distributed on social media platforms, such as Facebook and Reddit, that was targeted at video game developers. Meaning that it is a very strenuous task contacting game companies about game preservation questions through the company's official contact channels.

The study later identified that official game museums and archiving institutions had similar problems when trying to contact the game industry about support or collaboration. These challenges of coming in contact with game companies about the subject of game preservation should be something the game industry works on improving. An increased and transparent communication can only help improve the relationship between every relevant party when it comes to game preservation.

## 5.3 Contributions and Further Research

The main objective of this paper is to contribute to the growing body of work of research about strategies needed for video game preservation. This study has tried to gather insights from three important target groups related to the creation, preservation, and enjoyment of video games as a significant digital artifact. Video games are an important part of our cultural heritage, and should be preserved and accessible for future generations to experience.

Additional empirical research and studies are essential to explore emulation and determine the most effective methods for preserving

digital games. It is crucial to establish distinct guidelines that all organizations, both within the game industry and archiving institutions, can adhere to. In the current climate every organization does their own thing, and prioritizes game preservation differently. Future researchers and academics should investigate how the video game industry and video game museums can best, in a practical way, preserve and expand their video game archives.

The cooperation and endorsement from video game developers and publishers are imperative to ensure legal accessibility to older classic games for users. Without intervention and support from the industry, the risk of losing more video games increases.

## 5.4 Conclusion

The aim of this study was to investigate and explore the topic of game preservation and emulation from three perspectives. This in order to answer the following research question: *What are game developers, video game museums, and video game enthusiasts' attitudes towards current video game preservation efforts, with a focus on their perspective on using emulation as a preservation method?* The game developers in this study have a positive attitude towards game preservation, and not only for the purpose of commercial opportunities. Video game museums would look favorable towards more funding and support from the video game industry. Collaboration between different institutions can help establish a unified approach to game preservation. Video game enthusiasts are passionate about games and want preservation efforts to improve, mostly in the form of the acceptance of emulation.

Understanding the significance of various viewpoints in the preservation of video games is vital for the comprehensive growth and safeguarding of this cultural artifact. Game developers, archivists, and gamers all contribute critical insight into the multifaceted aspects of video game preservation. Whether it is safeguarding creative legacies, enriching cultural institutions, or fostering gaming communities. By embracing the shared appreciation for game preservation, we can guarantee that past, present, and future generations will continue to benefit from this interactive medium for many years to come.

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