

Assembling Auras: Towards a Methodology for the Preservation and Study of Video Games as Cultural Heritage Artefacts

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Dany Guay-Bélanger¹ 

Abstract

Video games, while a digital art, live on physical media. Whether cartridge, magnetic tape or floppy disk, they degrade. Without care and study, they disappear and cannot be played again. While it might be possible to preserve play using emulation or video captures, scholars need to consider every option at their disposal to preserve video games for future study. This includes securing original versions of games and ephemera, recording play, interviewing game creators, and players, and much more. This article develops a new approach to conceptualise video games as material and cultural heritage, and proposes a methodology for their study, especially those for which there is no original version left.

Keywords

video games, preservation, assemblage theory, aura, paratextuality

¹Université de Montréal, Montreal, QC, Canada

Corresponding Author:

Dany Guay-Bélanger, Département d'histoire de l'art et d'études cinématographiques, Université de Montréal, 3150 rue Jean-Brillant, Montreal H3T 1N8, QC, Canada.

Email: dany.guay-belanger@umontreal.ca

Introduction

A 'video game' is not just software. It is consoles, living room couches, arcades, box art, supporting maps, magazines, and paraphernalia; it is everything that gives the act of 'playing' the game *meaning*. Because 'to play a game' depends on this wider assemblage of material culture in a particular social context, preserving the assemblage of material culture, digital culture, and cultural history of this medium is a pressing concern for museums – especially as the first generations of video game materials are rapidly decaying or are being forgotten. Many institutions, from the Laboratoire Universitaire de Documentation et d'Observation Vidéoludiques (LUDO), to the Residual Media Depot, and the Strong Museum of Play, and scholars such as Melanie Swalwell, Henry Lowood, James Newman, and John Haycock are now engaged in the effort to preserve and understand the various impacts and meanings of video games.

Academia and heritage institutions have been trying to devise appropriate methods for the preservation of this medium, but initial preservation efforts were ad hoc and done by members of the player community itself. It was fans who originally 'took the initiative and decided to start documenting and preserving games and games-related artefacts long before games were on the radar of most cultural institutions' (Swalwell, 2017, p. 213). Nevertheless, video game preservation is in its early stages, and there still is no established methodology for preserving this medium. This article suggests a framework for deciding what materials to conserve with regard to video game history, drawing on the experiences of the player community. The proposed methodology revolves around the concepts of intertextuality, paratextuality, aura, and assemblage theory.

Cultural Impact and Historical Significance of Video Games

Popular culture is a medium and vehicle for framing historical consciousness. Many historians, such as Davis (1983, 2000, 2003, 2006), who works on film, and Dean (2012, 2015, 2017; Meerzon, Prince, & Dean, 2015), who works on theatre and film, investigate it to uncover how the public perceives and interacts with the past, but few to date approach video games from the perspective of conservation. Video games emerged roughly 60 years ago,¹ and now influence movies, books, television shows, and popular culture more broadly. The Entertainment Software Association claims that, as of 2020, three quarters of all U.S. households have at least one person who plays video games, and 64 percent of U.S. adults and 70 percent of those under 18 regularly play video games (Entertainment Software Association, 2020, p. 5–6). Clearly, the material culture aspect of video games on its own is enormous.

Video games pose unique problems for historical preservation, and thus long-term research. Like all software, they are stored on media with a limited lifespan. Many older games' original versions are at risk of disappearing (Monnens, Vowell, Ruggill, McAllister, & Armstrong, 2009) or already have: diskettes and floppy disks, media

which store information magnetically on flexible disks (Rogowski, 1993, p. 557–558), last between ten and thirty years (Software Preservation Society, n.d.). The hardware that could read these media similarly degrades. Games released on this medium in 1980 will most likely be unreadable today. Every form of media storage decays, even more recent ones. Even online games, which are often stored on computers or servers other than the player's console or computer, decay. And once that storage medium becomes unreadable, those games will be lost. Sadly, we must come to terms with the notion that many original versions of games are irretrievable (see Swalwell, 2017).

Some historians, such as Lowood (see Heineman, 2015 and Guins & Lowood, 2016) and Dyson (see Dyson, 2017), have contributed in the discussion surrounding the preservation of digital games and how this relates to future research. The first efforts for the preservation of video games typically focused on the material aspect of games (i.e. consoles, diskettes, and cartridges). The conversation has recently shifted towards the preservation of use (Smithsonian American Art Museum, 2012) and discussion of video games as audio-visual and cultural heritage (Glas, de Vos, Van Vught, & Zijlstra, 2017), which suggests that to truly understand a game, to study it, one must also understand and preserve the emergent experience of gameplay. Therefore, video games are not either material or audio-visual and cultural heritage; they are both. There is need for an approach that unifies the two.

Current Approaches and Theory on Preservation

One critical aspect of software preservation is the materiality of digital artefacts. Software is intangible; one cannot directly hold it. Yet, it is not immaterial either. Software is literally pits and grooves on a CD-ROM that disrupt a laser beam; it is charged particles that disrupt a magnet; it is pulses of electricity that flow through logic gates. Software resides in a liminal space between physical and digital. One can purchase a CD or DVD with a video game on it, but what one holds is but the housing medium of that software. This is also the case of software bought online. It is downloaded directly to a computer, but it is the hard drive of that computer that houses the software. Reinhard aptly and artfully depicts this liminal nature of video game code and software specifically when he compares them to objects traditionally studied by archeologists: 'The cartridge or disk is a vessel with the wine, the stone upon which the writing was carved containing the deeper meaning born of words and syntax. It is the physical manifestation of code wrapped in layers of instructions that created the portable package, a world in itself containing a world within' (Reinhard, 2018, p. 93).

This dual nature of software is what makes it so difficult to preserve. Software is of two objects: the code-object and the media-object.² Harman's definition of source code can be applied to the code-object. He defines it as 'any fully executable description of a software system' (Harman, 2010, p. 7). This includes 'machine code, very high level languages and executable graphical representations of systems' (Harman, 2010, p. 7). Therefore, Harman's definition also includes the user interface. For the media-object,

this includes every physical object surrounding software, including housing medium and complementary objects (i.e. paratextual material and information).

Several software and video game preservation scholars have devised lists of material necessary to the preservation of born-digital artefacts, notably Zabolitzky (2002) and Monnens et al. (2009). Both lists include important material, such as development material, legal documentation, user manuals, and source code. But focusing on such materials neglects that software *needs* a user; a video game emerges from the user's interactions with the software's rules and potentials for it to actually *be*, and so, the ancillary materials that enable or depend on and result from that running also need to be considered. The tendency to emphasise development rather than use has recently been challenged by scholars such as Lowood and Glas et al. In a presentation entitled '*Replay: Games, performance, preservation*' given at Concordia University, Lowood presented an interesting piece of software toolkit called the Game and Interactive Software Scholarship Toolkit (GISST). He argued that this toolkit with emulation – running of old games on newer hardware, a simulation of the old platform – would permit researchers to view, and format obsolescence (Lowood, 2017). Glas et al. (2017), for their part, proposed an interesting approach to recording play sessions by installing a Commodore 64, a video game console from the 1980s, at the Netherlands Institute for Sound and Vision's exhibition of Dutch audio-visual cultural heritage and recording volunteers playing different games. This approach seems promising since it can record the various types of experiences depending players' background or age group. Nevertheless, there are still some pressing issues concerning the physical aspects of video games and software which make this form of preservation problematic.

Digital material suffers from three important issues: bit rot, hardware failure, and format obsolescence. The first, bit rot or media decay, is 'the gradual and natural decay of digital information and storage media over time, causing information to become unreadable' (Monnens et al., 2009, p. 141). Every housing medium has a different lifespan and decays differently. Magnetic media, such as diskettes and cassette tapes, last between ten and thirty years before they start losing their magnetic properties (as cited in Monnens et al., 2009, p. 141). Optical disc media, like CDs and DVDs, lifespan is currently unknown. They suffer from CD rot, which is the physical and chemical destruction of their reflective layer, and CD bronzing, which is the discolouration of the disc (SPS, n.d.). Read-only memory (ROM) cartridges corrode from contact with moisture and battery acid. The ultimate lifespan of ROM cartridges with a plastic enclosure 'is unknown, but it is possible that some cartridges-based games will last longer than the copyrights associated with them' (SPS, n.d.). Erasable programmable read-only memory (EPROM) cartridges last upward of 25 years, but the electrons within them slowly leak through the cartridge's insulation, causing the 'irretrievable loss of information' (as cited in Monnens et al., 2009, p. 142).³ ROM and EPROM both use random access memory (RAM) chips to store information. These chips are powered by batteries, but when they die, the information saved on the cartridges is erased (Monnens et al., 2009, p. 142–143).

One option to remedy the issue of bit rot would be to image (i.e. clone) the information on these housing media on a newer format, such as hard drives or servers. Yet, these also suffer from degradation and indefinitely moving files from a dying medium to a new one is resource intensive and time consuming. Furthermore, to ensure the effective preservation of a digital artefact, there need to be three copies ([Computer History Museum, 2012](#), p. 7; also see [Owens, 2018](#)). This causes issues in terms of space, as while it might be possible to save one copy of a video game, saving three will take much more space and resources. Additionally, if the location where those copies are present is victim to fire or a natural disaster, this could result in the loss of the three copies. Ideally, each copy would be saved in different locations, maximising their chance of survival. One of the seemingly most promising options would be to use Trusted Digital Repositories (TDR), also known as Trustworthy Digital Repositories, whose mandate is ‘to provide reliable, long-term access to managed digital resources to its designated community, now and in the future’ ([Research Libraries Group and Online Computer Library Center, 2002](#), p. 7). Should their objective and rigorous policies be broadly adopted, the long-term preservation of software might more easily be assured.

The second, hardware failure, is as important. While there might still be functional diskettes, CDs, or cartridges available, their original hardware might not. Like any other technological object, video game consoles and computers age, and eventually stop functioning correctly, if not entirely. Parts malfunction, especially if platforms are not properly maintained. While there is a tendency not to use objects in museum collections, this is detrimental to hardware. The power supply of computers and consoles has capacitors which, if not periodically powered up, can explode and damage the platform ([Stachniak, 2014](#)).

Furthermore, the production of some screens, such as CRT TVs, and their parts has stopped. This means that repairing them becomes increasingly difficult, as parts become harder to find. Likewise, as less of these screens survive, there is less demand for those able to repair them, resulting in a disappearance of the knowledge necessary to their preservation ([SAAM, 2012](#)). This is also true for platforms themselves. There has been some recognition of these issues by scholars, such as Mansfield ([SAAM, 2012](#)) and Newman (2012, p. 140–141), who discuss the issues of attempting to play video games on modern displays. Doing so typically results in quite different visuals and, at times, game-breaking issues. The average user might experience this by opening software that was not designed for the high-capacity display on Retina-enabled i-devices: pixelated, fuzzy graphics, etc. Another issue comes with controllers. Games’ many platforms and games themselves were designed for particular controllers, and playing them without them changes the experience ([SAAM, 2012](#)). If hardware is lost or stops functioning, one cannot experience the game.

The third issue is format obsolescence. As computer operating systems and hardware improve, older software and games stop being supported. For example, a game that could be played on an Apple II computer cannot be played on the latest version of the Apple operating system (iOS). Consoles suffer from the same issue, as

they are but specialised computers dedicated to video games. Typically, most consoles do not permit older games to be played on them, even if they were made for the same console family. There is some level of retro-compatibility, but this is not always the case. Changes in housing medium, moving from cartridges to CDs, for instance, or manufacturers simply not offering this option will prevent playing older games on new consoles (Newman, 2012, p. 55–59).

One of the ways to circumvent these issues and preserve use is emulation. This method involves ‘replicating the exact operation of another hardware and software environment’ (Monnens et al., 2009, p. 144). Put simply, emulation tricks software into thinking it is being run on the correct operating system and hardware. This seems to be a promising avenue for the preservation of gameplay, and there is much support for this practice. Recent conferences on video game preservation, such as the Video Game Preservation Workshop organised by the Stanford University Libraries in February 2018, spent much time on the potential of emulation for preservation purposes and video game research (Stanford Libraries, 2018). Yet, emulating games is problematic.

Apart from the technical challenges of emulation and the inevitable discrepancies between an original game and its emulated version (see Newman, 2012, p. 137–154), Murphy and Charbonneau have described at length the legal implication related to emulating games. In order to emulate a game, one must first circumvent copy protection, a practice which is illegal under both in Canadian and American copyright law. The Canadian Copyright Act does not ‘clearly stipulate whether a new interoperability provision (30.06) makes the use of emulation legal for scholarly research’ (Murphy, 2013, p. 48; Bill C-11, 2012).⁴ And, in the United States, the Digital Millennium Copyright Act (DMCA) only puts in exemptions for museum, archives, and other heritage institutions for three-year periods (University of British Columbia, n.d.). The unstable nature of these exemptions to the DMCA hinders American heritage institutions’ preservation efforts. In addition, copyright law varies from country to country, meaning that while emulation might be legal in Canada, it could be illegal in France (Charbonneau et al., 2019). Internationally, copyright law is a barrier to the preservation of software and, more to the point, video games. Given all of these issues, what then are we to do?

Proposed Approach: Intertextuality, Paratext, Aura, Assemblages and Articulations

There is a lack of established vocabulary and practices for video game preservation, but we might appropriate, with due caution and translation into our own domain, theories and practices from other disciplines. In particular, the literary theories of intertextuality and paratextuality, the notion of aura, and the ontological framework of assemblages and articulations are useful to understand video games and their preservation.

The literary notion of intertextuality provides an interesting take on the origin and influences of video games. This theory suggests ‘that meaning in a text can only ever be understood in relation to other texts; no work stands alone but is interlinked with the tradition that came before it and the context in which it is produced’ (Allen, 2000, p. i). Put simply, and if we adapt the theory to video games, games can only be understood in relation to other video games. Dominic Arsenault applies this theory when discussing *Shovel Knight* (2014). He argues that it draws strong inspiration from other games, such as ‘*Mega Man, Castlevania, DuckTales, Zelda II, and occasionally Faxanadu*’, as well as many others (Arsenault, 2015). This argument could be pushed further. One could add that derivatives from games – such as ports, rereleases, emulation and fan fictions – use their direct ancestor, the original version, as intertext.

The concept of intertextuality also accounts for the influences of other sources. ‘The systems, codes and traditions of other art forms and of culture in general are also crucial to the meaning of a work of literature’ (Allen, 2000, p. 1). In other words, to truly understand literature, or in this case video games, one must also look to other media that influence the design and creation of the games. Like text, video games are not only influenced by other games but also by culture and other art forms. This is the argument of Donovan in his book *Replay: The history of video games*, in which he identifies literature, comic books, film, and *Dungeons & Dragons* as some of the most prominent influences and inspirations to video games (2010).

Paratextuality is another significant literary theory applicable to the medium. Koenig-Woodyard (1999) clearly summarised this notion by arguing that Genette, the literary scholar who developed paratextuality,

formulates a simple algorithm that governs the whole of *Paratexts*: Paratext = peritext + epitext. The peritext includes elements ‘inside’ the confines of a bound volume—everything between and on the covers, as it were. The epitext, then, denotes elements ‘outside’ the bound volume—public or private elements such as interviews, reviews, correspondence, diaries etc.—although Genette does comment that ‘in principle, every context serves as a paratext.’

In essence, if this is applied to video games, the peritext could be interpreted as the box of the game and everything inside it (the housing medium and everything on it, the manual, etc.) and the epitext would be everything outside of the box (development and marketing material, interviews, reviews, and so on). But video games’ paratext has the potential to be much more complex than the paratext of books.

As the number of people who can potentially work on the creation of a video game is greater and more diverse – from programmers, to music composers, and even military advisors – so is the potential for peritextual and epitextual material. Video games cannot be treated simply as literature. The diverse origins and inspirations of this medium require that they be analysed and thought of differently. For instance, when applying paratextuality to video games, one must account ‘for flexibility in when a game text (or any other media text) might become a paratext

and vice versa' (Consalvo, 2017, p. 177). This flexibility is what both makes analysing and even defining video games so difficult, and so rich in potential. Paratextuality is a useful tool to understand them, but it should be adapted to video games.

Hodges and Consalvo both apply this theory to video games but emphasise different aspects of a game's paratext. Hodges remains within the game itself. He uses paratext and epitext to discuss text files and drivers coming alongside original versions, emulations, or copies of games (Hodges, 2016). This is an important addition to the parts of a video game as these files accompany every piece of software. Even if a player might not interact with them directly, these 'hidden' parts of the game are instrumental to the video game's functioning.

For her part, Consalvo goes outside of the game, focusing on peripheral material. She uses Lunenfeld's adaptation of Genette's formulation of paratext to digital media. Lunenfeld argued that the boundaries of paratext are even more fluid when applied to that form of media (Consalvo, 2007, p. 9, see Lunenfeld, 1999). Building on this, she argued 'the peripheral industries surrounding games function as just such a paratext. Gaming magazines, strategy guides, mod chip makers, the International Game Exchange, Even Balance and other companies, and industry segments work to shape the gameplay experience in particular ways' (Consalvo, 2007, p. 9). This approach is closely related to Allen's claim that 'there is never a single or correct way to read a text, since every reader brings with him or her different expectations, interests, viewpoints, and prior reading experiences' (Allen, 2000, p. 6–7). As with literature, every video game player brings with them different expectations, interests, viewpoints, and prior gaming experiences. Additionally, many games come with cheat codes and map editors or can be modded, something Consalvo addresses in her book *Cheating: Gaining advantage in video games* (2007). The different experiences resulting from these game alterations were not necessarily intended during the development of a video game. Nevertheless, only preserving the 'intended' experience of a game would be to overlook and discredit an entire experience.

How can we incorporate these diverse understandings for preservation? What do these approaches imply for us? Both Consalvo and Hodges' use of paratextuality expands what is understood as paratext for video games, exposing the complexity of studying the medium, but still is not complete enough. Based on the interpretation of paratextuality as a fluid concept, I propose including all forms of fan-labour, such as fan fictions; oral histories of game creators and players; video recordings of the game, professional, academic, or otherwise; official and unofficial events; and much more.

Paratextuality is not without its problems. Consalvo herself warns of the dangers 'in "fixing" any text as central and others as peripheral' (2017, p. 178). The strong relationship between game creators and players exemplifies this well. The concept of game creation can be the result of a conversation between these two groups. This is especially true of games which rely on software updates, typically done automatically to modify or improve the game, such as massive multiplayer online games. Players can voice their grievances and opinions on official forums and social media pages ran

by the company who created a game or when testing early versions of a game. That is not to say that players play an equitable role in game creation – video game developers ultimately have the power to choose to listen to players or ignore them. Rather, I argue that players should be considered as a potential force capable of shaping game creation and therefore must be considered when attempting to preserve artefacts of that process. Sometimes, their influence will be much more pronounced, other times it will be minimal. Positioning material from developers, for instance, as central to game development runs the risk of devaluing the potential contributions of players to game creation. However small their contribution may be, players need to be considered as an integral part of a game's development. The boundaries of what is peripheral and what is part of a video game are fluid. Dividing between what is in and around the game stops being useful when all of the potential influences on a game are taken into account. By being flexible in what we consider to be central and peripheral to a game, the framework proposed here opens the door to new and varied positions. Limiting the number of items considered to be part of the game does not allow for the expression of the complexity of video games and their derivative material.

My position is that everything and anything directly or indirectly related to a video game is worthy of preservation, as it can tell something about the game to researchers. Realistically, no heritage institution could even attempt to preserve everything. Therefore, institutions and researchers will have to choose on which aspect of video games they want to focus. As mentioned earlier, there used to be much emphasis on the developmental aspects of video games and software. While these merit preservation, there are but one of the various aspects of video games. Games are much more than entertainment; they are art, they are software, but they are also inherently social. They are represented in movies and books and are the source for a plethora of derivative material, such as clothing and toys. All of which hold on to the game's aura.

Swalwell has already explored the concept of the aura and how it relates to video games preservation (Swalwell, 2017, p. 218). Nevertheless, Latour and Lowe's understanding of aura also helps make sense of video games' fluid identities, as well as their materials and materialities. Unlike Benjamin who argued that copies depreciate the aura of an original piece of art (1968), they argue that the aura of an original is, in fact, both created and reinforced by the availability of facsimiles. For them, 'the real phenomenon to be accounted for is not the punctual delineation of one version divorced from the rest of its copies, but the whole assemblage made up of one —or several— original(s) together with the retinue of its continually re-written biography' (Latour & Lowe, 2011, p. 4). In other words, the original cannot be separated from its copies. It is the very existence and prolific nature of reproductions that produce an aura of authenticity combined with the original that gives weight to a piece of art. This is profoundly important, especially given that one of the fundamental functions of a computer is to make copies and then perform manipulations on those. Games are copied, ported to other platforms, adapted, reinvented, and reimagined, be it as games, other media or memorabilia. All of these different iterations have the potential to hold the 'original's' aura. The development and

derivative material, copies, and even references in other media – such as film, magazines, or online forums – contribute maintaining a video game’s aura. There is no single and unique object that holds that aura; everything has the potential to hold on to it. Video games are therefore assemblages (see [Colin, 2015](#); [Joseph, 2013](#); [Taylor, 2009](#)).

Returning to Latour and Lowe, they also use the word assemblage in their description of the aura. But what of ‘assemblage’? While Latour and Lowe may not have been thinking of the word other than as a descriptor for a grouping of relationships, the idea has been explored by DeLanda, drawing on Deleuze and Guattari. In *A new philosophy of society: Assemblage theory and social complexity*, DeLanda defines assemblages as ‘wholes whose properties emerge from the interactions between parts’ (2006, p. 9). Understanding video games as assemblages relates back to intertextuality. A text that inspired a game would be considered as one of the parts of the assemblage that is a game. For instance, the novel *The hitchhiker’s guide to the galaxy* (1979) would be part of *The hitchhiker’s guide to the galaxy* (1984) computer game assemblage, as would the film, the radio and TV series, and stage shows. The properties of those assemblages would therefore be a result of the book and the other parts of *The hitchhiker’s guide to the galaxy* computer game assemblage.

DeLanda goes further and argues that the theory must ‘account for the *synthesis* of the properties of a whole not reducible to its parts’ and that ‘parts of an assemblage do not form a seamless whole’ (2006, p. 4). As a result, the parts making up an assemblage might appear unrelated to one another, but still, these parts constitute the whole. Parts are not simply defined by the whole. DeLanda’s example of marketplaces illustrates this notion well. He argues that ‘scaled economic units must be regarded as an individual singularity bearing a relation of part-to-whole to the immediately larger one, much as organisms are related to species’ (2006, p. 4). Parts might constitute a whole, but they should not be interpreted as only having meaning in terms of the whole they make. DeLanda argued that ‘unlike wholes in which parts are linked by relations of interiority (that is, relations which constitute the very identity of the parts) assemblages are made up of parts which are self-subsistent and articulated by relations of exteriority, so that a part may be detached and made a component of another assemblage’ (2006, p. 18). Put differently, no part of an assemblage is restricted to one assemblage. This understanding of assemblage theory allows for much flexibility and permits an understanding of assemblages as inherently dynamic. DeLanda calls this flexibility and fluidity ‘a space of possibilities’ (2006, p. 33). Assemblages should therefore not be seen as closed systems, but rather as interrelated systems capable of influencing and being influenced.

Parts of assemblages are better understood as articulations. They are defined by Slack and Wise as ‘dynamic interminglings that can move in many and various directions, propelled by various and changing circumstances (of other articulations). The “web” of these particular articulations is what [they] call an assemblage’ (2015, p. 133). They stress the fact that though articulation forms identities or unities, ‘these articulations are neither necessary nor permanent’ (Slack & Wise, 2015, p. 152). In

fact, Slack and Wise describe assemblages as being ‘made up of multiple (corresponding, noncorresponding, and contradictory) articulations’ in which ‘change takes place in the dynamic tensions among the articulations that constitute an assemblage’ (2015, p. 133). This understanding of assemblages and articulations gives much space for the same type of flexibility Consalvo advocates for when a text can shift to and from paratext (2017, p. 177–178). Considering the potential for constant fluctuations and tension between articulations of a game-assemblage permits to acknowledge its constantly shifting nature as new versions or sequels are released, players continuously give it new meaning with mods or play practices, and as scholars analyse them. While it could be argued that this interpretation could cause confusion in the understanding of an assemblage, making a whole too stable risks oversimplifying and denying the dynamic aspects of assemblages and their articulations.

Slack and Wise also state that, in articulations, ‘no single force or relationship takes the center stage, and that the context is more heterogeneous’ (2015, p. 127). For the scholar of video games interested in a preservation strategy that does justice to the idea of game-as-assemblage, this concept enjoins us to consider every possible articulation of an assemblage to have the potential to hold the aura of the assemblage itself. Every part of a video game can teach something about the game, from LAN parties to fan labour. Players and fans appropriate these games and sometimes create entire storylines within a video game’s universe. These can tell us much on how the game and its story is interpreted and appropriated. Video games are inherently social, and not considering what fans create is to disregard the creativity, work, and experience of players (see [Swalwell, Stuckey, & Ndalianis, 2017](#)). Understanding parts as equal in their effect on the assemblage pushes the interpretation of games beyond what is on the screen or even on the panels of an arcade cabinet ([Guins & Reinhard, 2017](#)).

Video games are also technologies, something Slack and Wise discuss in detail. For them, ‘technologies *are* assemblages, in that they are made up of webs of corresponding, noncorresponding, and contradictory articulations. Therefore, no technology has one single essence, definition, purpose, role, or effect’ (Slack & Wise, 2015, p. 133). Understanding video games as such is necessary to appreciating their nature. Video games could be portrayed as pure entertainment devoid of meaning or as art of the highest quality. There is some truth to both positions, yet these definitions are also flawed. Putting video games in one box or attempting to impose one meaning to them limits possibilities concerning the study and analysis of this relatively new medium.

As mentioned earlier, video games bring together multiple art forms and cultural products; they draw from literature, film, drawing, and many others ([Donovan, 2010](#)). Video games pull from art that came before them, becoming, in a way, an assemblage of art forms. And each art form composing games has residual effects on video games. When discussing culture, Williams describes the notion of articulation of the residual as being ‘effectively formed in the past, but [...] still active in the cultural process, not only and often not at all as an element of the past, but as an effective element of the present’ (1977, p. 122). Acland notes that ‘for Williams, the residual, emergent, or

dominant can refer to experiences, practices, values, artifacts, institutions, and meanings' (2007, p. xxi). For preservation purposes, video games are considered artefacts, and therefore, Williams' notion is useful in understanding them. Video games are and were defined and created in a particular time frame. As they evolve, and as cultures evolve around them, their meaning and how they are understood also changes. This becomes even more meaningful as video games are currently the subject of much nostalgia, while being decidedly thought of in presentist terms. Early video games were limited in their displays, storylines, and controls due to technological limitations and simply due to the fact that they were a novel medium. All of these limitations have been lessened or worked around in the now roughly 60 years of video game history. But older video games are still often compared to their more recent counterparts. They are reinvented and reconsidered as time changes while still retaining the residues of the culture, art, ideologies, and technologies that came before them. Since video games are assemblages, they are not static.

Video games are assemblages of many different origins and the combination of arts forms, culture, and technologies. They are also social and, as a result, defined by their users. Players are parts of these assemblages. Therefore, they should be involved in the study and preservation of this medium.

Public Engagement

For many years, video games were plagued with the pervasiveness of 'the "myth of the solitary video game player" and the claims that video games not only appealed to but were actually responsible for creating socially withdrawn individuals' (Newman, 2008, p. 13). While it is true that some games are meant to be played alone, this does not mean they have no social potential. The considerable number of forums, competitions, magazines, and schoolyard discussions based around this medium is a solid example of this. Therefore, we need to keep some of this social nature of games.

The initial efforts at video game preservation were spearheaded by collectors and fans. Some of them created online databases dedicated to the preservation of video games, such as [Moby Games \(n.d.\)](#) and [Giant Bomb \(n.d.\)](#), while others gathered information on cancelled games, such as [Unseen 64 \(n.d.\)](#). The Internet Archive (IA), a non-profit devoted to building a digital library of Internet sites and other cultural artefacts in digital form ([The Internet Archive, n.d.](#)), has also been preserving video games. They consider digital games to fall under its remit because they are both cultural artefacts and the IA preserves software. Many heritage scholars – such as Lowood and Dyson – and game research centres – such as the LUDOV, the Residual Media Depot, and the Strong Museum of Play – have endeavoured to correct this. Nevertheless, the aforementioned non-academic sources are the best heritage professionals and scholars have to work with if they are researching video games. [Guins \(2014\)](#) addresses this situation when discussing the use of such sources by academia and 'demonstrates several ways in which works

that may have once seemed “nonacademic or lacking in seriousness” (p. 25) are now valuable primary sources’ (Hodges, 2017, p. 1585). In the case of video games, scholars are forced to use non-academic sources as there was not much done by academia on the subject. Since until recently much of the work for video game preservation was done by the public (Swalwell, 2016, p. 50), heritage institutions and preservation scholars must work with an assemblage of sources, ranging from public to academic and everything in between.

“Forward!” (Anaal Nathrak, 2018)

Such an approach must still take in consideration the provenance of these sources and what the groups who gathered them emphasised when attempting to preserve video games. Some fans and collectors privilege the ‘original experience’, meaning playing on original hardware and software, a position also shared by some scholars (Swalwell, 2017, p. 213–219). For instance, Reinhard goes as far as saying that the ‘game cannot be separated from the hardware on which it was played’ and that while Multiple Arcade Machine Emulator (MAME) emulators can suffice to some extent, ‘there is no substitute for learning how to play a game using the original controllers’ (2018, p. 169). Video game hardware and peripherals play a role in experiencing video gaming and contribute to platform-restricted specificities for many games. The Nintendo 64 and Wii controllers’ particular designs, for example, impact player experience, as is the case for games capable of being played or meant to be played in VR. Indeed, every peripheral and platform has particularities that impact how a game is experienced. Newman explores this when investigating the notion of originality and using *Donkey Kong* (1981) as case study. This game was initially released as an arcade game but was eventually ported on multiple platforms. Each version of *Donkey Kong* varies in one way or another – would it be because of varying CPU clock speed, screen resolution, controller, or due to additions or omissions of content. In his exploration of the complex question of which version of *Donkey Kong* is the ‘original’, Newman eventually posits that perhaps ‘only the Coin-Op cabinet contains the real Donkey Kong’ (Newman, 2012, p. 4–6). But this does not answer a quintessential question: what are game historians and preservationists aiming for, accuracy or authenticity?

The debate over accuracy and authenticity, especially among those who study representations of the past in media – like film, literature, and more recently historical video games – can shed some light as to how to approach this question. Dean, a public historian, eloquently describes the nuances between these two concepts stating that accuracy can be ‘defined as being faithful to an original’ and ‘authenticity references sincerity, credibility, and trustworthiness’ (2017, p. 257). In essence, being accurate refers to an attempt to reproduce the original as closely as possible, while being authentic suggests that the meaning of the original is put forward. Additionally, for Dean, authenticity also means to acknowledging one’s presentness explicitly

(2017, p. 257). If these definitions are applied to video games, preserving games accurately would therefore entail preserving every piece of original hardware and software in a functional state, something which the degradation of hardware and peripherals makes impossible.

Swalwell offers a compelling argument against aiming for the preservation of original – or accurate, if using the aforementioned terminology – experiences.⁵ She argues that even if it was possible to preserve hardware in the long run, players themselves change, meaning that players who play a game again will have a different experience (Swalwell, 2017, p. 219). This argument is also applicable to new generations of players who might not have played older games – player expectations evolve and past experiences colour how one interacts with older games.

Furthermore, the social nature of video games also contributes to the impossibility of preserving an ‘original’ experience. For instance, the location of a platform itself impacts play experience. Playing in an arcade, an explicitly public space, is a different experience from playing at home on a console. The first space is often a noisy and crowded environment where the music and sounds of potentially dozens of games are blasting simultaneously, while the second is much more private, as typically only family members or friends are present. Similarly, there are a wide variety of arcade and home console experiences. In addition to arcade galleries, arcade cabinets could be found in diverse locations – such as bars, convenience stores, or grocery stores – each impacting player experience differently. The same is true of homes, as the politics of a household can play a major role in contributing to gaming subjectivities, as Thornham discovered when doing ethnographic research on video games (2016, p. 9). Hardware and peripherals in and of themselves cannot preserve these specificities in experience, and as a result, an accurate preservation of the original is not possible. Instead, there needs to be an approach to video game preservation emphasising authenticity, meaning it acknowledges the presentness of a game and that some aspects of games cannot be saved unless compromises are made and scholars of video game preservation consider diverse materials and alternative tactics.

This is where the notions of assemblage, intertextuality, paratextuality, and the concept of the aura can come into play. Considering a wide array of material that can hold a game’s aura opens a multitude of avenues for the preservation of video games as cultural heritage artefacts, as it expands the type of materials heritage institutions and professionals can consider when building their collections or the material used to analyse the history of this medium. It also affords more flexibility when selecting material that can be used to reveal aspects of a video game that might fade with time or might have been overlooked and therefore help build authentic representations of a game. This approach would moreover contribute to the embracing of the notion that fragments of game history have a valid role to play in video game history, something Swalwell claims ‘would mark a maturation of the field’ (2017, p. 219). Indeed, the articulations, intertext, and paratext of a game all

hold a game's aura and are all part of the game-assemblage. They are fragments of that game's history and therefore also hold the aura of a game's history, and seeing them as such has potential to move the field of video game preservation forward.

Conclusion – “Until Yet a Few More Deaths Do Us Part” (Unexpected, 2011)

Video games are a relatively new art form and cultural product. They have been studied from various perspectives from education, to economics, to psychology, to design. However, research that situates video games in a broader historical consciousness is still sparse. Newman warned that video games are disappearing (2012, p. 1). While a handful of dedicated fans have put much effort in preserving video game heritage, the situation has not changed. Heritage scholars and institutions have started to show interest in their preservation. But the many issues surrounding the preservation of digital material – bit rot, hardware failure, format obsolescence, and copyright law – have slowed down preservation efforts.

Still, before devising ways to preserve games, there needs a restructuring of how video games are understood. They both are and are not text, are and are not film, are and are not software, are and are not material. Video games are assemblages occupying a liminal space as technology, culture, and art form. They also both encourage socialisation and are the result of it. Preserving and studying video games requires adaptability and a flexible understanding of what is part of a game. Video games are complex and they require that scholars, academics, and players think of them as such.

Being software, video games are also digital objects. Therefore, preserving them simply as physical artefacts is not enough. Thibodeau argues that ‘to preserve digital objects, we must be able to identify and retrieve all its digital components’ (Thibodeau, 2018). While this is true, video games are also physical and experiential. To preserve them effectively, Thibodeau's claim must be taken one step further. Physical material relating to the object – not only when it is directly related to it, or even actively part of said object – and its use must also be preserved. The concepts of intertextuality, paratextuality, the aura, and assemblages propose a way forward for the long-term preservation of video games as cultural heritage artefacts.

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ORCID iD

Dany Guay-Belanger  <https://orcid.org/0000-0001-6403-9607>

Footnotes

1. This article situates the start of video game history with the appearance of the first video games in the early 1960s, with *Spacewar!* The game's first version was completed in late 1961 and was finally finished in spring 1962. There are earlier examples of video games, such as *Tennis for Two*, but it was *Spacewar!* that launched video gaming as a medium. For a discussion on the early history of video games, see Donovan. (2010). Introduction. In *Replay: The History of Video Games* (pp. 3–13). East Sussex: Yellow Ant.
2. This is the phrasing I developed at the Canada Science and Technology Museum in conjunction with the Collections Manager, Sean Tudor, and Curator of Communications, Tom Everett, for the purposes of internal curatorial processes. See Guay-Bélanger, Everett, & Tudor (2017). *Canada Science and Technology Museum – Digital Preservation Research Report*. Ingenium, Ottawa, Canada. This document is available by request.
3. Ironically, the website cited by Monnens et al. is now dead. The Internet Archive's copy has since also disappeared...
4. In this piece, Murphy mistakenly refers to Bill C-10, as opposed to Bill C-11.
5. Please note that throughout her piece, Swalwell's use of the words 'authentic' and 'authenticity' are closer to how Dean defines accuracy. While I am making the same point as Swalwell, our respective definitions of authentic and authenticity vary.

References

- Acland, C. R. (2007). *Residual media*. Minneapolis, MN: University of Minnesota Press.
- Adams, D. (1979). *The hitchhiker's guide to the galaxy*. New York, NY: Pan Books.
- Allen, G. (2000). *Intertextuality: The new critical idiom*. New York, NY: Routledge.
- Anaal Nathrak (2018). Forward! [Song]. *On A new kind of horror* [Album]. Metal Blade Records.
- Arsenault, D. (2015). *Shovel Knight redug: The retro game as hypertext and as uchronia*. First Person Scholar. Retrieved from <http://www.firstpersonscholar.com/shovel-knight-redug/>
- Benjamin, W (1968). The work of art in the age of mechanical reproduction. In H. Arendt (Ed.), *Illuminations* (H. Zohn Trans.) (pp. 217-251). New York, NY: Schocken Books.
- Bill C-11. (2012). *An act to amend the copyright act. Royal Assent Jun 29, 2012, 41st parliament, 1st session*. Retrieved from <http://www.parl.ca/DocumentViewer/en/41-1/bill/C-11/royal-assent/>
- Charbonneau, O., Guibord, M., Labory, M. H., Ménard, O., Moreau, B., Morissette, S., & Dixon, R. (2019). *Droit d'auteur en contexte scolaire: Un modèle d'utilisation équitable des œuvres littéraires et artistiques dans les écoles du québec/Le chantier du droit d'auteur en milieu scolaire*. Talk presented at the 2012 Congrès des Milieux Documentaires, Montréal, Canada. Retrieved from <http://spectrum.library.concordia.ca/974927/>
- Colin, C. (2015). *Exploring videogames with Deleuze and Guattari: Towards an affective theory of form*. New York, NY: Routledge.

- Computer History Museum (2012). *Digital repository best practices for cultural heritage organizations*. Mountain View, CA: Kott K. Retrieved from https://d1yx3ys82bpsa0.cloudfront.net/blog-pdf/Best_Practices_Report_2012-02.pdf
- Consalvo, M. (2017). When paratexts become texts: De-centering the game-as-text. *Critical Studies in Media Communication*, 34(2), 177-183.
- Consalvo, M. (2007). *Cheating: Gaining advantage in video games*. Cambridge, MA: MIT Press.
- Davis, N. Z. (1983). *The return of martin guerre*. Cambridge, MA: Harvard University Press.
- Davis, N. Z. (2000). *Slaves on screen: Film and historical vision*. Toronto, Canada: Vintage Canada.
- Davis, N. Z. (2003). Movie or monograph? A historian/filmmaker's perspective. *The Public Historian*, 25(3), 45-48.
- Davis, N. Z. (2006). Un débat en coulisses: Trumbo, Kubrick et la dimension historique de Spartacus, 1960. *Actes De La Recherche En Sciences Sociales*, 161-162(1), 80-95.
- Dean, D. (2017). Negotiating accuracy and authenticity in an Aboriginal King Lear. *Rethinking History*, 21(2), 255-273.
- Dean, D. (2012). Theatre: A neglected site of public history?. *The Public Historian*, 34(3), 21-39. doi:10.1525/tph.2012.34.3.21
- Dean, D. (2015). Staging the settlement: Shekhar Kapur and the parliament of 1559. *Parliamentary History*, 34(1), 30-44.
- DeLanda, M. (2006). *A new philosophy of society, assemblage theory and social complexity*. New York, NY: Continuum.
- Donovan, T. (2010). *Replay: The history of video games*. East Sussex, England: Yellow Ant.
- Dyson, J. (2017). Collecting, preserving, and interpreting the history of electronic games: An interview with Jon-Paul C. Dyson. *American Journal of Play*, 10(1), 1-19.
- Entertainment Software Association (2020). *Essential facts about the computer and video game industry*. Retrieved from https://www.theesa.com/wp-content/uploads/2021/03/Final-Edited-2020-ESA_Essential_facts.pdf
- Giant Bomb. (n.d.). Giant bomb - video game reviews, videos, forums and wiki. Retrieved from <https://www.giantbomb.com/>
- Glas, R., de Vos, J., Van Vught, J., & Zijlstra, H. (2017). 'Let's play' videos, game preservation, and the exhibition of play. In A. A. Mol, C. E. Ariese-Vandemeulebroucke, K. H. Boom, & A. Politopoulos (Eds.), *The interactive past: Archeology, heritage & video games* (pp. 135-151). Leiden, the Netherlands: Sidestone Press. Retrieved from https://www.scribd.com/embeds/348615539/content?start_page=1&view_mode=scroll&access_key=key-GKqNp4U1kYgWbo34HgU&show_recommendations=false
- Guay-Bélanger, D., Everett, T., & Tudor, S. (2017). *Canada Science and Technology Museum — Digital preservation research report*. Ottawa, Canada: Ingenium.
- Guins, R. (2014). *Game after: A cultural study of video game afterlife*. Cambridge, MA: The MIT Press.
- Guins, R. & Reinhard, R. (2017). *Raiford Guins & the history of games - episode 8. 8Bit test pit*. Retrieved from <https://www.archaeologypodcastnetwork.com/gaming/8>

- Guins, R. & Lowood, H. (2016). *Debugging game history: A critical lexicon*. Cambridge, MA: The MIT Press.
- Harman, M. (2010). Why source code analysis and manipulation will always be important. In 10th IEEE International Working Conference on Source Code Analysis and Manipulation, Timisoara, Romania, 12-13 September 2010, New York: Institute of Electrical and Electronics Engineers, (pp. 7-19). doi: [10.1109/SCAM.2010.28](https://doi.org/10.1109/SCAM.2010.28)
- Heineman, D. S. (2015). Henry Lowood: Archiving and games. In R. A. Brookley & D. J. Gunkel (Eds.), *Thinking about video games: Interviews with the experts* (pp. 69-90). Bloomington, Indiana: Indiana University Press.
- Hodges, J. A. (2017). How do I hold this thing? controlling reconstructed Q*berts. *New Media & Society* 19(10), 1581-1598.
- Hodges, J. A. (2016). *MALware technical report: Timothy Leary's Mind Mirror*. Media Archaeology Lab. doi: [10.13140/RG.2.2.17077.73446](https://doi.org/10.13140/RG.2.2.17077.73446)
- Koenig-Woodyard, C. (1999). *Gérard genette, paratexts: Thresholds of interpretation*. Translated by Jane E. Lewin and foreword by Richard Macksey. Cambridge, MA: Cambridge University Press: 1997. ISBN: 0-521-41350-8 (hardback), 0-521-42406-2 (paperback). Price: £50 (hardback), £16.95/\$29.95 (paperback) [Review of Paratexts: *Thresholds of interpretation*]. *Romanticism on the Net* 13. Retrieved from <https://www.erudit.org/en/journals/ron/1999-n13-ron425/005838ar/>
- Infocom. (1984). *The Hitchhiker's guide to the galaxy*. Cambridge, MA: Infocom.
- Joseph, D. (2013). The Toronto Indies: Some assemblage required. *Loading.... The Journal of the Canadian Game Studies Association*, 7(11), 92-105.
- Latour, B. & Lowe, A. (2011). The migration of the aura, or how to explore the original through its facsimiles. In T. Bartscherer & R. Coover (Eds.), *Switching codes: Thinking through digital technology in the humanities and the arts* (pp. 275-298). Chicago, IL: University of Chicago Press. Retrieved from <http://www.bruno-latour.fr/sites/default/files/108-ADAM-FACSIMILES-GB.pdf>
- Lowood, H. (2017). *Replay: Games, performance, preservation*. Montreal, Canada: Talk presented at at the Concordia Media History Research Centre Canada.
- Lunenfeld, P. (Ed.). (1999). *The digital dialectic: New essays on new media*. Cambridge, MA: MIT Press.
- Meerzon, Y., Prince, K., & Dean, D. (2015). *History, memory, performance*. New York, NY: Palgrave Macmillan.
- Moby Games. (n.d.). Video games database. Credits, trivia, reviews, box covers, screenshots - Moby Games. Retrieved from <https://www.mobygames.com/>
- Monnens, D., Vowell, Z., Ruggill, J. E., McAllister, K.S., & Armstrong, A. (2009). Before it's too late: A digital game preservation white paper. H. Lowood (Eds.). *American Journal of Play*, 2(2), 139-166.
- Murphy, D. (2013). Hacking public memory: Understanding the multiple arcade machine emulator. *Games and Culture*, 8(1), 43-53.
- Newman, J. (2008). *Playing with videogames*. New York, NY: Routledge.
- Newman, J. (2012). *Best before: Videogames, supersession and obsolescence*. New York, NY: Routledge.

- Nintendo R&D1. (1981). *Donkey Kong*. Kyoto, Japan: Nintendo.
- Owens, T. (2018). *The theory and craft of digital preservation*. Baltimore, MD: Johns Hopkins University Press.
- Reinhard, A. (2018). *Archaeogaming: An introduction to archaeology in and of video games*. New York, NY: Berghahn Books.
- Research Libraries Group and Online Computer Library Center (2012). *Trusted digital repositories: Attributes and responsibilities*. Mountain View, CA: Research Libraries Group. Retrieved from <https://www.oclc.org/content/dam/research/activities/trustedrep/repositories.pdf>
- Rogowski, S. J. (1993). Floppy disk. In A. Ralston & E. D. Reilly (Eds.), *Encyclopedia of computer science* (3rd ed., pp. 557-558). New York, NY: Van Nostrand Reinhold.
- Slack, J. & Wise, J. M. (2015). *Culture and technology: A primer* (2nd ed.). New York, NY: Peter Lang.
- Smithsonian American Art Museum. (2012). *Playing Pong in 2100: How to preserve old video games - Part One [Video file]*. Washington, DC. Retrieved from https://www.youtube.com/watch?v=g_noQCDZsc
- Software Preservation Society. (n.d.) *Bit rot*. Retrieved from http://www.softpres.org/glossary:bit_rot
- Stachniak, Z. (2014). *Notes on software recovery and preservation*. Ontario, Canada: Talk presented at Canadian Science and Technology Museum.
- Stanford Libraries. (2018). *Video game preservation workshop: Setting the stage for multi-partner projects*. Retrieved from https://www.eventbrite.com/e/video-game-preservation-workshop-setting-the-stage-for-multi-partner-projects-tickets-39405135822?utm_source=eb_email&utm_medium=email&utm_campaign=event_reminder&utm_term=eventname
- Swalwell, M. (2016). Classic gaming. In R. Guins & H. Lowood (Eds.), *Debugging game history: A critical lexicon* (pp. 45-52). Cambridge, MA: The MIT Press.
- Swalwell, M. (2017). Moving on from the original experience: Philosophies of preservation/play in game history. In M. Swalwell, H. Stuckey, & A. Ndalianis (Eds.), *Fans and videogames: Histories, fandom, archives*. New York, NY: Routledge.
- Swalwell, M., Stuckey, H., & Ndalianis, A. (2017). *Fans and videogames: Histories, fandom, archives*. New York, NY: Routledge.
- Taylor, T. L. (2009). The assemblage of play. *Games and Culture*, 4(4), 331-339. doi:10.1177/1555412009343576.
- The Internet Archive. (n.d.). About. Retrieved from <https://archive.org/about/>
- Thibodeau, K. (2018). Overview of technological approaches to digital preservation and challenges in the coming years. Retrieved from <https://www.clir.org/pubs/reports/pub107/thibodeau/>
- Thornham, H. (2016). *Ethnographies of the videogame: Gender, narrative and praxis*. New York, NY: Routledge.
- University of British Columbia. (n.d.). *Bill C-11: The copyright modernization act*. Retrieved from <http://copyright.ubc.ca/guidelines-and-resources/support-guides/bill-c-11-the-copyright-modernization-act/>

- Unexpect. (2011). Until yet a few more deaths do us Part [Song]. In *On Fables of the Sleepless Empire* [Album]. Independently released.
- Unseen 64. (n.d.). *Unseen 64: Beta, cancelled & unseen video games*. Retrieved from <https://www.unseen64.net/>
- Williams, R. (1977). *Marxism and literature*. Oxford, England: Oxford University Press.
- Yacht Club Games. (2014). *Shovel Knight*. Marina del Rey, CA: Yacht Club Games.
- Yost, J. R. (2008). From the editor's desk. *IEEE Annals of the History of Computing*, 30(1), 2-3. doi:10.1109/MAHC.2008.7.
- Zabolitzky, J. G. (2002). Preserving software: Why and how. *Iterations: An Interdisciplinary Journal of Software History*, 1, 1-8. Retrieved from <https://cray-cyber.org/old/static/Documentation/PreservSoftw.pdf>

Author Biography

Dany Guay-Bélanger is a public historian and game scholar whose research explores the history of video games and their preservation as cultural heritage artefacts. He is currently doing his PhD at the Université de Montréal, the Francophone member-at-large of the Canadian Game Studies Association and Project Coordinator at the Video Games Observation and Documentation University Lab (LUDOV). Dany is also the host of the Deadplay podcast.