

GAME OVER?

Curating, Preserving and Exhibiting Videogames: A White Paper

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About this document

Game Over? is concerned with the long-term sustainability of the UK videogame industry. While the economic and cultural value of videogames to the UK and global creative sectors is widely recognised, the long-term sustainability of games heritage is under threat. Unless we act now, future generations will lose access to their cultural heritage and the next generation of UK developers will be robbed of historical reference material.

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About the authors

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Drawing on their curatorial work at the National Videogame Arcade, James and Iain recently co-authored a book on the material cultures of gaming (*A History of Videogames in 14 consoles, 5 computers, 2 arcade cabinets ...and an Ocarina of Time*, Carlton 2018).

About the NVF

The National Videogame Foundation is a not-for-profit organisation that develops the role of videogames in culture, education and society.

www.thenationalvideogamefoundation.org

About Bath Spa University

Bath Spa University is where creative minds meet. We teach and research across art, sciences, education, social science, and business. The University employs outstanding creative professionals who support its aim to be a leading educational institution in creativity, culture and enterprise.

www.bathspa.ac.uk

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1. ACKNOWLEDGEMENTS

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The members of the UK 'Continue' network and participants in the 2017 conference

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...and all of the preservation practitioners, archivists, fans and enthusiasts who are actively undertaking important game preservation work and documenting gaming culture across the world.

2. KEY RESEARCH PARTICIPANTS

The research underpinning this White Paper was conducted with the collaboration of a number of partners actively engaged in game preservation, curation and exhibition theory and practice. The work would not have been possible without the contributions of colleagues from a number of institutions including Vigamus (Italy) and The Library of Congress (US) and is based on detailed conversations and interviews with partners based in key institutions. These institutions were selected on the basis of their demonstrable leadership in the fields of game preservation, exhibition and curation, their geographical situation, and because the work of each is located within different and distinctive contexts. Readers should note that these contributors represent a selection of leaders in the field of game preservation, curation and exhibition and the list is not - and is not intended be - completist. The focus on the work and perspectives of these institutions is by no means a comment on the activity of others working in these areas.



Under the auspices of Prof. Koichi Hosoi and Prof. Aki Nakamura and supported by funding from the Agency for Cultural Affairs, The *Ritsumeikan Center for Game Studies* (RCGS) has been leading on the creation of comprehensive databases of Japanese published videogames. RCGS has archival holdings of gaming hardware, software and ephemera available for scholars to access. Given the importance of Japan's contribution to global videogame business and culture, working with RCGS was vital in revealing the state of the art in preservation practice and ascertaining national approaches to games as cultural heritage.



Berlin's *Computerspielemuseum* is dedicated to the exhibition and interpretation of videogames. The permanent exhibition 'Computerspiele: Evolution eines Mediums' ('Computer Games. Evolution of a Medium') opened in 2011 and contains over 300 exhibits. Special exhibitions focus on particular issues and themes. The Computerspielemuseum is co-founder and member of EFGAMP e.V. (European Federation of Game Archives Museums and Preservation Projects) and member of ICOM (International Council of Museums) and the German Museums Association. Computerspielemuseum was the first European museum project specifically addressing videogames.



The Strong National Museum of Play is located in Rochester, NY. It is a collections-based museum devoted to the history and exploration of play and is one of the largest history museums in the United States. The Strong houses the one of largest and most comprehensive collection of historical materials related to play and is home to the International Center for the History of Electronic Games (ICHEG), the National Toy Hall of Fame, the World Video Game Hall of Fame, the Brian Sutton-Smith Library and Archives of Play, the Woodbury School, and the American Journal of Play. For our purposes, ICHEG's location of videogames within the wider context of play, games and toys is a key defining feature.



The National Videogame Arcade is a unique cultural centre, dedicated to videogames. Housed over five floors in the centre of Nottingham, it creates exhibitions, events, content and learning programmes which inspire everyone not just to play games, but also to develop their own game-making potential. Opened in March 2015, the NVA welcomes tens of thousands of visitors a year.

3. EXECUTIVE SUMMARY

Videogames are disappearing

The ability to play, learn from, and interrogate the history of videogames is under threat as systems become obsolete, data becomes unreadable, servers and services go offline, and the knowledge and expertise of developers, players, critics and commentators is lost. Unless we act now, future generations will lose access to their cultural heritage and the next generation of UK developers will be robbed of historical reference material. There is a need to define the scope of the project of game preservation, identify stakeholders and responsibilities, and coordinate activity at national and international level. Game Over? is concerned with the long-term sustainability of the UK videogames industry.

Videogames require interpretation

As complex, multifaceted objects often based around shifting technologies and requiring considerable a priori knowledge, the lack of opportunities to develop games literacy and appreciation compounds this problem. Whilst institutional stakeholders might be aware of the complexity of working with and understanding videogames, the pathway to them learning more remains unclear. Currently, opportunities for collaboration, innovation, economic and cultural development are being missed. There is an urgent need for support for curators, policy makers and funders in this area.

Videogames need help

A number of museums, galleries and grassroots projects around the world have dedicated themselves to preserving, curating and interpreting videogames. At the forefront of this are the UK's National Videogame Arcade, The Strong National Museum of Play in Rochester, NY, the Computerspielemuseum in Berlin and Ritsumeikan University in Kyoto, Japan. However, this activity is not co-ordinated at a national or international level. With these points in mind, this White Paper aims to:

- Document the factors that affect long-term access to videogames.
- Identify exemplar case studies to illustrate the range of threats and the scope of the game preservation project
- Identify priority issues by drawing on international perspectives from experts and thought-leaders in videogame preservation and curation
- Present initial recommendations for co-ordinated national and international strategies

Key priorities

Consideration of this activity must extend beyond existing institutional policies and activity to embrace all stakeholders, including fan-activity and private collectors.

The knowledge base and centre of activity in this area exists in communities outside of institutional stakeholders.

Institutional stakeholders need to find a way to collaborate and support the work of private collectors and curators, driving the creation of new policies at an international level to allow curators to negotiate IP constraints.

1. INCREASE FORMAL INTERNATIONAL COLLABORATION & NETWORKING

Best practice in curation and interpretation needs to be shared in a coordinated way. The potential for international knowledge exchange is vast and largely untapped outside of academic journals.

ACTIONS

- (inter)national collaboration and networking activity should ideally be facilitated by a national coordinating body in each territory.
- Establish digital networking groups (real-time messaging / slack / twitter) and streaming events to instigate more informal activity.
- Having established working groups, nurture the development of cross-sector events, bringing practitioners into direct contact with each other.

2. COORDINATE DEVELOPMENT OF EFFORTS TO ADDRESS CHALLENGES OF EXISTING IP POLICY ON GAME/DIGITAL PRESERVATION

Given the complex state of copyright legislation and the paucity of understanding of its application (both from rights-holders and the exhibition/preservation community) it is of little surprise that a clear approach is lacking.

ACTIONS

- Research and document the current IP arrangements in participating territories.
- Establish resources to advise both rights holders and exhibitors on IP best practice.
- Support, extend and develop the EFGAMP network to co-ordinate reform lobbying across Europe (and beyond) involving a representative collection of stakeholders.

3. AUDIT AND MAP CURRENT PRESERVATION AND EXHIBITION ACTIVITY

There should exist a definitive repository or map of videogame history projects and collections. We propose a wide-scale audit of game preservation, curation and collecting activity that will lay the foundations for the coordination of efforts. This audit exercise should act as a catalyst for new collaborations across and between projects, institutions and private collections.

ACTIONS

- Establish partner groups to coordinate this activity, securing funding to drive this forward.
- This funding should include significant contribution from the current, commercial games sector, creating a formalised stake for the sector in its own historic value.
- This audit should reflect the activity of all kinds of collectors.
- The results of this should be open-access.
- It is crucial that robust, extensible and open cataloguing and metadata schemas are developed alongside this activity.
- The audit should include case studies and documentary materials to aid interpretation.

4. FURTHER DEVELOP VIDEOGAME LITERACY PROGRAMMES FOR A BROADER RANGE OF AUDIENCES

Since the 2011 Livingstone-Hope 'Next-Gen' review commissioned by NESTA, 'games literacy' has often been conflated with STEM / STEAM studies. We suggest games literacy is concerned with the

understanding and appreciation of games, both in their playing and their making. Furthermore, we see games literacy as being a project that must address multiple audiences.

ACTIONS

- Stakeholders should coordinate where appropriate to develop and deliver further game literacy materials to support their collections and activities. These should address differentiated audiences and their distinct concerns (e.g. potential commissioners, funders, parents, teachers, young people).
- Develop approaches across different media forms in order to maximise reach. These might include periodical magazine/journal, traditional or online broadcast media, podcast, for instance, or combinations thereof.

5. SUPPORT AND ENHANCE CROSS-SECTOR DIALOGUE ON VIDEOGAMES AND CULTURE

There is an increasing diversity of makers, audiences and applications for videogames outside the mainstream, yet there is an absence of fora within which the games industry and broader creative sectors can communicate. A mutual lack of understanding is leading to missed opportunities. Stakeholders need to proactively conference, network and drive dialogue with one another in order to discover and leverage opportunities for collaboration.

ACTIONS

- Stakeholders should coordinate to create a programme of networking events. These should maintain a regularity such that they can reflect current concerns and begin to create new, persistent organisational links. Where possible, such events should include international representation.
- All activity should be captured and published, feeding into ongoing development and discourse. In turn, this activity could feed the publication activity cited in Recommendation 4 above.
- Any such activity should include diverse representation from all groups.
- Stakeholders should coordinate to create an annual conference of record, with best practice and current thinking are formally recorded and disseminated.

6. FURTHER DEVELOP AND RAISE AWARENESS OF PRESERVATION-FRIENDLY GAME DEVELOPMENT PRACTICES

Both in training and in professional practice, we need to encourage game developers to preserve not just their codebase, but other surrounding artefacts and documentation from the process of their work. By creating preservation-friendly development pipelines and processes, the development community can begin to internalise the value of its work and actively plan for the future.

ACTIONS

- Identify a preservation framework that will document the range of materials of value in the preservation of videogames. Importantly, extending the scope of these materials beyond the software product to include production ephemera, fan materials, newly created critical reflections, for instance.
- Develop and promote best practice in preservation-friendly game development across practitioners and training providers at all levels.
- Create training tools for use by the professional community to upskill in best-practice in this area.

4. VIDEOGAMES ARE DISAPPEARING

In 2018, videogames are more widely available across a greater array of platforms than ever before. Alongside the raft of titles available for dedicated home and handheld gaming consoles; the PC ecosystem has been reinvigorated as gameplay is embedded into websites and social media services; while smartphones and tablets have firmly established themselves as key sites for gaming providing developers with opportunities to reach experienced and new players alike.

The number of games available for current smartphone devices outweighs the libraries for all the consoles produced in the 1980s and 1990s combined. Gaming is a key leisure pursuit with gameplay undertaken not only by those identifying as 'gamers'; professional play through e-sports or streaming gameplay is a growing site for creative expression and commercial opportunity; and game development and the creation of innovative gameplay remains a cornerstone of the UK creative economy and a vital cultural export.

And yet, for all this, it is true to say that *videogames are disappearing*.

Of course, what we mean by this is not that videogaming is about to witness the kind of market crash, contraction and crisis of consumer confidence as experienced in the US in the early 1980s. Rather, we wish to draw attention to the simple fact that the ability to play, learn from, and interrogate the history of gaming is under threat as systems become obsolete, data becomes unreadable, servers and services go offline, and the knowledge and expertise of developers, players, critics and commentators is lost.

As the International Game Developers Association (IGDA) Game Preservation Special Interest Group noted almost a decade ago, we need to act 'before it's too late'.

A number of museums, galleries and grassroots projects around the world have dedicated themselves to preserving, curating and exhibiting videogames. At the forefront of this, and participants in the research informing this document, are the UK's National Videogame Arcade, The Strong National Museum of Play in Rochester, NY, the Computerpielemuseum in

Berlin and Ritsumeikan Center for Game Studies at Ritsumeikan University in Kyoto, Japan.

However, while these and other universities, memory institutions and private collectors, technologists and cataloguers have recognised the urgency of the situation, is not clear what form action could or should take as the medium itself continues to transform with new types of gameplay, new platforms and technologies such as Virtual Reality and Augmented Reality joining massively multiplayer online networked games to further complicate our idea of what constitutes a videogame and gameplay and what the object and focus of preservation should be.

With the increased technological complexity and network dependencies of contemporary console, PC and mobile games, the challenge becomes ever greater and confounds traditional approaches to archiving and preservation.



Nintendo Power Glove (US version) (credit: public domain)

Grandstand Astro Wars (credit: NVA)



We are producing objects that are getting more technologically complex, more interdependent, and less accessible. And we are producing them at a rate that dwarfs their previous historical outputs, and that will terminally outpace future preservation efforts.

Eric Kaltman (Stanford University's 'How They Got Game' project)

To be clear, talk of videogames disappearing is not theoretical conjecture and already countless online worlds have closed down, servers providing authentication and multiplayer services have been deactivated, and consoles are no longer manufactured or supported. Studios close, development teams disband, rights to intellectual property are bought, sold, renegotiated, expire or fall into limbo.

The rapidly increasing scope of game preservation coupled with the expanding audiences and use-cases for historical game artefacts and interpretative materials means that no single organisation can cover all bases. As such, effort will need to be distributed with each stakeholder making a distinctive contribution whether based on existing specialism, location or a combination of factors.

While activity, research and practice in game preservation, collection and exhibition has grown considerably in recent years, this work is not explicitly co-ordinated at a national or international level. Indeed, there presently exists no single registry of existing preservation projects let alone a database of holdings. The present lack of explicit leadership at national and international level represents a further risk to game preservation,

digital heritage and the sustainability of development.

Without action, we will continue to lose access to historically significant gaming experiences, objects and artefacts. Future scholars and researchers will lose access to cultural heritage and the next generation of UK developers will be robbed of vital historical reference material.

Without planning, we will be unable to tackle the growing challenges posed by media decay, born-digital games, and increased dependency on the provision of network services.

Without leadership and direction, the work that has been done, is underway, and is planned, will remain uncoordinated and we risk duplication of effort, significant gaps in coverage, and a failure to consider the scope of necessary activity so that we might address the needs of diverse audiences and use-cases.

With these points in mind, this White Paper aims to:

- ***Document some of the risk factors affecting videogames and, through exemplar case studies, detail the range of contingent and vulnerable materials that constitute the object of preservation***
- ***Consider current strategies for game preservation and curation and opportunities for new thinking and the development of new techniques and goals***
- ***Explore interpretative strategies and opportunities to broaden the scope of the project and participation and engagement in it, and widen the use-cases for game preservation***
- ***Outline the policy implications for stakeholders presently and not presently involved in undertaking and supporting game preservation practice***

We conclude by outlining recommendations for next steps.

5. VIDEOGAMES UNDER THREAT

There are a number of technological, social, cultural, economic, material and business-related issues that conspire to limit access and curtail the lifespan of videogames and their related ephemera, peripherals and gameplay. In order to give a sense of the range of factors at play and the consequent scope of videogame preservation, here we consider some of the key risk factors.

Videogames are falling apart

It is tempting to think of videogames as being solely digital artefacts comprised of code and data.



Commodore 64 (credit: NVA)

However, the physicality and materiality of gaming is difficult to overstate. Videogame systems comprise controllers such as joysticks, keyboards, steering wheels, fishing rods, cameras, motion sensors. These hardware components are often integral to a given game's operation. Even where such controllers and peripherals are standard parts of a platform (e.g. the keyboard of a ZX Spectrum or a PlayStation control pad) and thus more standardised across games produced for that system, they are not interchangeable between systems either because they are built-in or utilise proprietary connections and protocols.

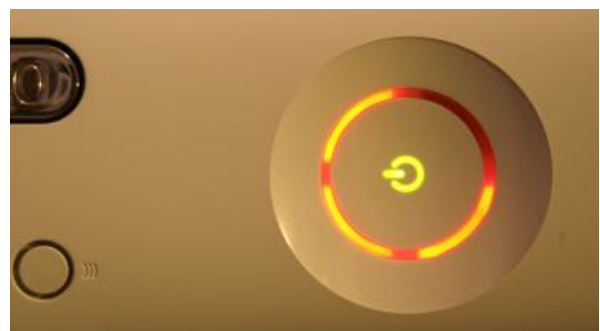
Controller microswitches, solenoids for vibration functions, and plastic housings, along with the cartridge contacts and connectors used for removable software or memory backup systems are all subject to wear and tear and failure over time and through normal usage. The unavoidable fact is that, in time, it is inevitable that present and

previous generations gaming hardware will wear out, malfunction and cease to operate.

This is significant because:

- a) home and handheld consoles, home computers, and arcade systems manufactured and sold in the 1970s-2000s such as the Nintendo Entertainment System, ZX Spectrum and Commodore 64 onwards are no longer manufactured or supported;
- b) the ability to play specific games is tied to the availability of host platforms (though see the discussion of emulation below);
- c) the availability of hardware such as controllers, and audiovisual displays may contribute significantly to the 'feel' of gameplay and, thus, constitute part of a game's specific properties.

In addition to consoles, controllers and other peripherals, the effects of this physical deterioration are felt on game-related ephemera such as collectible figures, clothing, magazines and fanzines. These materials are among many that are central to the cultural practices that surround, support and sustain gameplay.



Xbox 360 'red ring of death' (credit: tomasland/Flickr)

credit: 'casi05' by Simon Bierwald/Flickr



Bits are rotting away

We have become used to thinking about the permanence of digital data through the discourse on digital footprints and tracking. Similarly, while concepts such as 'the cloud' imbue data with an almost ethereal weightlessness, it is important to remember that for all the apparent immateriality, data are presently stored on physical media. And, as anybody who has experienced a hard disk failure or a failed CD burning operation will attest, the reliability of these physical media or 'data carriers' mean that data are, in fact, remarkably fragile.

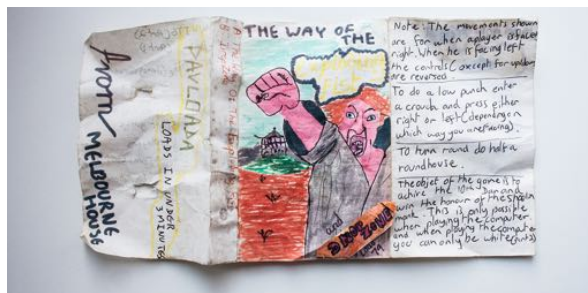
The vulnerability of cassettes, floppy disks and rotational hard disks is well-known. Magnetic interference can corrupt or even erase data from disks while mechanical failures such as tape stretching, warping or breaking may render cassettes unusable.

Semiconductors and EEPROMS used to store program data in game cartridges or on arcade boards may fail due to the effects of thermal conditions. Battery-backed memory used to store player progress is volatile with data lost as batteries expire.

What is more surprising is the fragility of optical media such as CDs, DVDs and Blu-Rays. With an exposed and comparatively delicate read surface, optical media are most obviously subject to environmental factors and the effects of handling. Manufacturing defects and even adverse chemical reactions between the CD read surface and the inks used in inlays and booklets have been blamed for 'bronzing' or 'CD rot'. With CDs commercially available only from the 1980s and used in earnest

throughout the 1990s for software distribution, any assurances of archival life issued by manufacturers are clearly based on accelerated testing and estimation. For 'burned' rather than pressed optical discs (i.e. those written in personal computer drives rather than in pressing plants) data integrity is even lower with much information failing to write correctly in the first place.

The prevalence of pressed optical media (CDs, DVDs, Blu-Rays) for game distribution and burned CD-Rs/DVD-Rs for backups of development materials, means that much data is inherently unstable. The Software Preservation Society estimates a 20-year lifespan for 3.5" floppy disks. As a key media format for games (and other software) in the 1990s, this puts the format beyond its shelf-life.



Way of the Exploding Fist counterfeit cassette cover (credit: NVA)

Pirates are copying. Pirates are preserving.

Given the vulnerability of data carriers such as disks, cassettes and optical media to physical deterioration, instituting a programme of data migration is an obvious step. Essentially, this involves extracting the data from a vulnerable or unstable carrier and re-saving it to another, or ideally redundantly saving it across numerous formats and locations.

Proprietary data and disk formats and the presence of various copy protection methods serve to make this task technically harder. Deliberately may-formed data structures designed to defeat copying work against the preservation practitioner. Moreover, legal restrictions on the circumvention of formal copy protection (known as 'TPMs' (Technological Prevention Measures) or DRM (Digital Rights Management systems) that were designed to combat software pirates and counterfeiters, also confound preservation efforts.



"The problem is that the legal situation in Europe does not allow us to save our collection from decay. That's because of copyright laws that have been added to games a long time ago to prevent pirate copies. After all, emulation is a copy process: we need to transfer code from the original data carrier to another. Copyright laws are in place to prevent exactly that... So, we essentially have to stand there watching day after day as our collection, one of the most significant collections worldwide, demagnetizes."

Andreas Lange, Computerspielemuseum

Of course, there are numerous examples of game data having been extracted (or ripped) and shared as 'ROM' files on the open Internet. Indeed, such (illegally) ripped collections of console, computer and arcade game data are among the most comprehensive and well-organised presently available and their status as illicitly-traded objects of piracy belies the labour, knowledge and care that has gone into their creation. It also reveals the depth of knowledge, technical acumen and dedication possessed by those involved in the extraction, authentication and cataloguing of these collections.

However, while such knowledge and expertise involved in extracting and packaging these games is undoubtedly valuable, replicating such a course of action, regardless of how widespread or how central to certain videogaming subcultures, is unlikely to be open to public institutions. Indeed,

even holding examples of pirated materials such as home-duplicated cassettes or hacked and modified versions of games might present challenges for institutional collectors.

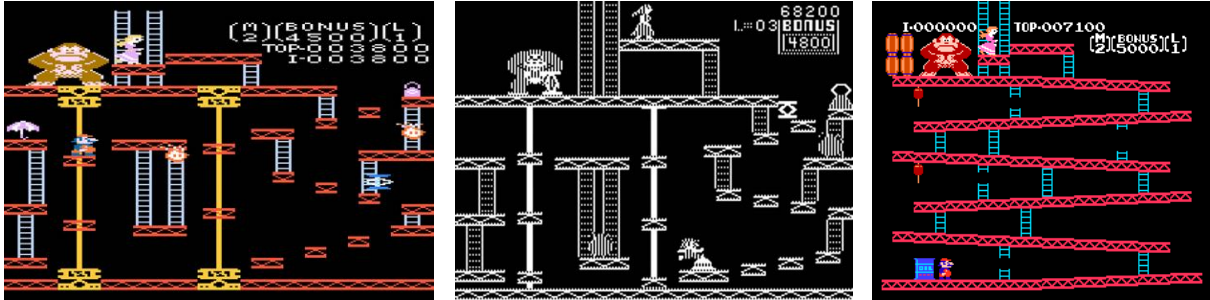
So many systems...

Since the first home console, the Magnavox Odyssey, was released in 1972, there has been a steady stream of new systems coming to market.

There are presently nearly 100 discrete home console systems (not including minor variations or clones). Adding handheld systems, dedicated consoles (hardwired to play a single game), low-powered microconsoles, home computers, PCs, tablets and mobile devices (each with various operating systems that may markedly alter capability and compatibility), along with coin-operated arcade systems, a picture soon emerges of a chaotic ecosystem which requires significant knowledge to navigate. Importantly, each system might have its own controllers and data formats.

The sheer range of formats makes identification alone a significant challenge before cataloguing and preservation can proceed. By way of example, the Game Metadata and Citation Project (an Institute of Museums and Library Services-funded project led by UCSC Library, UCSC Computer Science, and Stanford University Libraries) published a MARC-21 compliant controlled vocabulary for videogame media formats that includes nearly 60 top level entries. Among these,

Donkey Kong home computer/console ports (Atari 7800, Dragon 32 ('Donkey King'), Coin-op)



categories such as 'DVD' break down into numerous platform-specific sub-formats (PlayStation 1, 2, 3 etc.) while 3.5" floppy disk covers a range of proprietary disk and data formats so extensive as to warrant its own vocabulary and research project. To extend the discussion of formats beyond mainstream platforms identified in the GAMECIP vocabulary is to exponentially grow the problem (Dragon 32 cassettes, Neo Geo Pocket cartridges) while new formats are being added as new platforms are released (Nintendo Wii U discs and Switch game cards, for example).

(see <https://gamecip.soe.ucsc.edu/node/85> for more information)

Looking backwards

The connection between platforms and games is hard to overstate. Unlike digital audio or video whose raw data may be repurposed for different platforms using appropriate codecs, for instance, the operation of a given videogame is usually intimately connected with the system. Real time processing of graphics, sound inputs and outputs all rely on the affordances, vagaries and interactions of hardware and software. A game created for the PlayStation 3 will be programmed to take advantage of the particular combination of capabilities, affordances and limitations of that system.

The colour palettes available to visual artists, the range of sound design tools available to musicians, the number of objects simultaneously displayed on screen are just some of the ways in which the affordances and capabilities of the hardware and software of a 'platform' give rise to the specific look, feel and properties of any given game. NES games look, sound and play differently to Commodore 64 games for these reasons. The

same game ported to both systems will, inevitably, look different as a watercolour is different from an oil painting or solo piano is different from an orchestra.

To convert a game from one platform to another means reworking the code to accommodate the particular combination of capabilities, affordances and limitations. Of course, conversions, ports and remakes are commonplace, but it is essential to remember that they involve considerably different and more complex refactoring than the processes of re-encoding audio or video.

The close links between games and platforms is important for a number of reasons. Firstly, platforms are supported and manufactured for only a limited period of time. All the Nintendo Game Boys that will ever be made have been made. They may presently number many millions but, for the reasons we have seen, chips will fail, displays will fade, capacitors will leak and there will come a time when they are no longer usable.

The uneven provision of 'backwards compatibility' further compounds the issue. Some systems offer full or limited compatibility with games produced for others (typically earlier systems produced by the same manufacturer). The original incarnation of the Nintendo DS, for instance, offered the ability to play Nintendo Game Boy Advance cartridges albeit via different controls and with a different display and aspect ratio. Subsequent iterations of the DS console removed backwards compatibility with Game Boy Advance cartridges.

It all depends

As we have noted, even though a videogame platform is intended to create a relatively homogenous target system for developers and

Ferguson TX CRT display (credit: NVA)



consumers, any given platform is comprised of numerous hardware objects, peripherals, and software layers. While it is commonplace to talk of the 'PC' as a platform for gaming, this is somewhat illusory. The gap between 'Required' and 'Recommended' specifications speaks to this fragmentation with variations in processor, operating system, memory, hard drive space, graphics card, sound card etc. all impacting greatly on the ability to run the game at all; its audiovisual output (screen resolution, number of colours, sound playback method); and the perceived feel (a function of frame rate, controller type, system responsiveness).

With the focus so often falling on computing and system specifications, the playback of audiovisual content is very often overlooked. By this, we mean that the specific properties of speakers and visual displays also impact greatly on the aesthetic reproduction of games and, in some cases, dependencies are such that the ability to play games is as contingent on the availability of audiovisual displays as a given processor or controller.

The CRT is a case in point. While the discourse of technological progress privileges high definition and high resolution displays, games created in the 1970s, 80s and 1990s were designed with the qualities of CRT displays in mind. The attendant blurriness, colour bleed, image smearing, phosphorescent glow, afterimage 'ghosting', and

visible scanlines may be viewed as imperfections to be fixed by subsequent display technologies and systems but are the qualities utilised by designers to create particular effects. The 'ghost' characters in the Atari 2600 conversion of Pac-Man gain their ghoulish ethereality as a consequence of the afterimage left onscreen after they have been drawn just as the apparent motion of the tyres rendered on the cars in Atari's *Enduro* appear as Ben Hur-like spikes when the inherent blurring and noisiness of the CRT is removed.

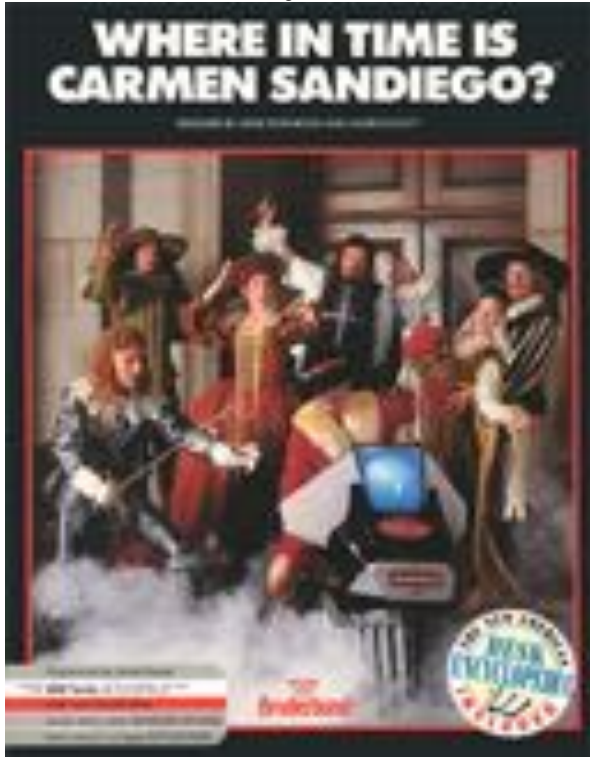
For some games, the influence of CRTs goes beyond audiovisual fidelity. The operation of light guns such as Nintendo's NES Zapper, the Sega Saturn and Dreamcast lightguns, relies on the specific way images are drawn on a CRT. With the gun actually acting as a receiver, the system calculates the position of the player's aim by scanning the sequentially rendered image. Because LCD displays render their screen images in a different manner, lightguns and associated peripherals simply do not work.

As such, to play Nintendo's Duck Hunt requires not only an NES console, a copy of the cartridge (of the same region as the console), and 'Zapper' lightgun, but also a CRT display (also designed for the same region's TV specification and typically connected by an analogue RF (radio frequency) connection absent from modern flatscreen displays and susceptible to additional noise and interference causing further signal degradation). Like the NES console, Zapper, and Duck Hunt, CRTs are no longer in production.



Atari 2600/VCS Enduro

Where in Time is Carmen Sandiego? boxart



In addition to audiovisual displays, it is essential to remember the role of instruction manuals, copy protection systems, and other digital and analogue peripherals in creating the experience and, in some cases, providing access to gameplay. Similarly, discussion in the US 'Preserving Virtual Worlds 2' project centred on the importance of a printed encyclopaedia in playing *Where in Time is Carmen Sandiego?* The book functions both as a source of historical, geographical, and cultural information for players seeking to solve the game's virtual scavenger hunt puzzles, and also a copy protection system. Given the importance of information on geopolitical relations contemporaneous with the game's development, the encyclopaedia might be considered as important a peripheral as any joystick or keyboard controller.

What is a videogame? When is videogame?

The porting to different systems, patching, updating and re-releasing can make establishing definitive or canonical versions of games difficult. Of course, this is not a problem unique to videogames or even to digital media forms, and many consumers let alone archivists and cataloguers will be familiar with different editions and versions of books, film and music.

Notwithstanding finer grained discussions about the equivalence of remastered or restored versions of a film print and remade versions of graphics in a higher definition than the original, games do bring some additional challenges.

Taking Sega's *Sonic the Hedgehog* as an example, we might reasonably define the 1991 Mega Drive version as the 'original' incarnation. Since this initial release, however, there have been countless remakes and reissues for other platforms and systems that change the gameplay in different ways (a touchscreen version for iOS devices alters the input mechanism significantly though perhaps not as much as the iPod clickwheel version!)

However, which 1991 Mega Drive release do we really mean? For Japanese researchers and players, it will likely be the 1991 version released in Japan while for those in the US, it would be unsurprising if it was the US version. For those in Europe and Australasia, however, the original 1991 Mega Drive version of *Sonic the Hedgehog* will have squashed graphics and sound and gameplay that runs 17.5% slower. This is because the version of *Sonic* released by Sega in 1991 was not optimised for the 'PAL' (Phase Alternating Line) broadcast system used in Europe and Australasia.

The consequent changes in graphics and sound along with the demonstrably slower (and arguably easier) gameplay might seem to deviate from the version designed by Sega's Japanese designers and could therefore be considered an inferior iteration. However, the decelerated, letterboxed version is the one and only version officially published by Sega for the PAL Mega Drive system. The practice of releasing unoptimised games in PAL regions was widespread through out the 1990s and 2000s and affected numerous high profile titles including Nintendo Legend of *Zelda* series. Subsequent re-releases and conversions of these games have typically eschewed the PAL versions in favour of the faster and taller Japanese/US versions making it increasingly difficult to recover the 'slower, squashed' 1991 PAL experience in 2018.

Even here, we have identifiable and manageable numbers of instances and versions about which we

Sonic the Hedgehog PAL (Europe) / NTSC (US, Japan) comparison



can debate. If we factor in the issuing of patches to fix bugs, updates to add or remove features, expansion packs that alter and extend gameplay, optional peripherals that unlock otherwise inaccessible content, we see the instability of games grow ever greater.

Taking the phenomenally successful and influential Minecraft, we might be used to thinking about how its genre-defying design challenges our ability to neatly define it. 'What is Minecraft?' is a difficult question to answer.

But, if we consider how many different versions, updates, modifications, patches, servers we can play on, creatures and abilities that have been added and removed since its original release to the community and commercial launch some years later, we see a game in near constant flux.

Given how impactful many of the alterations and augmentations are, before we even attempt to define what Minecraft is, we need to establish which version we are discussing. And, even then, versions vary across the multiple platforms upon

which Minecraft is available, with features not always added at the same time on different versions.

As such, while 'what is Minecraft?' remains an important, if perplexing, question, perhaps an even better one for historians and game preservation practitioners would be 'when is Minecraft?'



You can't touch this

It is wrong to think of game preservation as simply concerned with old games. We suggest that part of the reason game preservation has become associated with 'retro' games of the 1970s and 80s is as much a consequence of nostalgia, the interests and predilections of those driving research, development and practice, and the fact that systems from this era provide a relatively simpler challenge (though objectively still highly complex).

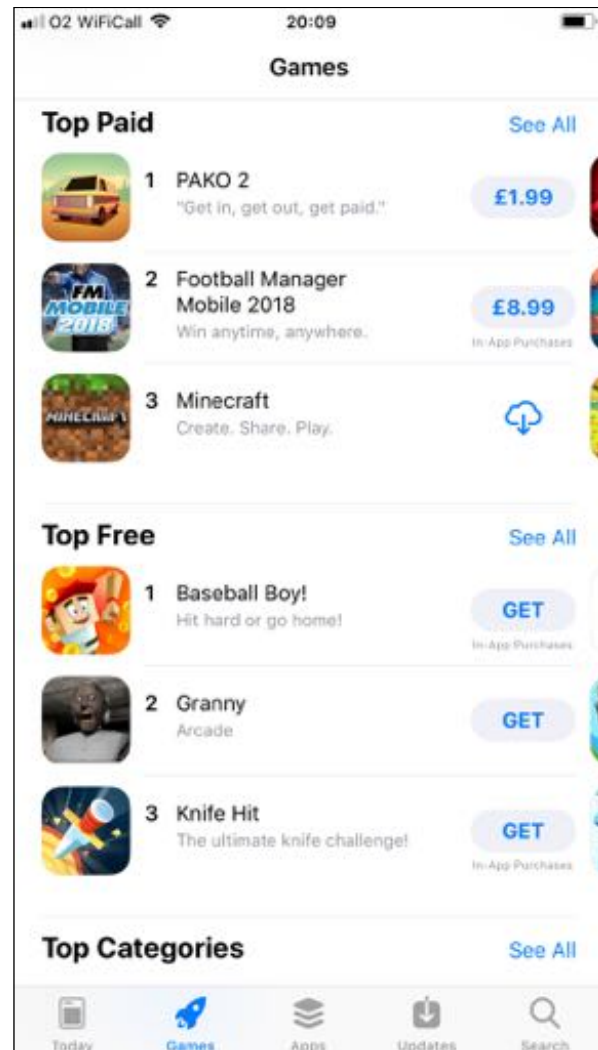
It would not be correct to single out digital distribution, born-digital games and the increased reliance on networked services for authentication and gameplay as the greatest challenges to current and future game preservation. However, they are factors that require us to fundamentally rethink how preservation is approached, what tools are deployed and what the scope of the project as a whole could be.

The prevalence of online stores and the comparative diminution of physical boxed-product sales impacts on long-term access. Flappy Bird was just one high profile game to be removed from the Apple App Store. Games can be delisted from stores for a host of reasons: because the developer or publisher only has the rights to a license for a certain period of time or because licensing arrangements change or are renegotiated by their owners, for example. Various Star Wars games have been delisted from App stores over the years including the early Augmented Reality game Star



The 'STEAM' online store

iOS 'Games' Apple Store page



Wars Falcon Gunner and, more recently, Tiny Death Star. More dramatically, with the Wii U console now discontinued, Nintendo has recently set out its programme for closing the entire Wii Store and Virtual Console making swathes of games from its current and back catalogue unavailable.

In addition to online retail, with so many games relying on access to servers for authentication or to provide their online, multiplayer modes, the ongoing availability of backend systems and services is crucial. Of course, it is not realistic to expect these services to be maintained in perpetuity and it is inevitable that publishers will refocus their resources - most likely towards newer, potentially more lucrative, titles.

The list maintained by publisher Electronic Arts at <https://www.ea.com/service-updates> details recent

and upcoming closures of online services for its games while Nintendo announced the closure of its social Miiverse service at the end of 2017 which removed features from many games (<https://www.nintendo.co.uk/News/2017/August/Important-information-about-the-discontinuation-of-the-Miiverse-service-1261237.html>).

The impact of these closures is hugely significant for players and preservation professionals alike as, even where the game might still exist and be playable in some form, it can be materially altered from former versions as key gameplay modes become unavailable.



Nintendo Miiverse closure announcement page

The impact of digital continuity, compatibility and ongoing access to online servers and services reaches yet further if we consider the myriad websites that share reviews, strategy guides, cheats and hints, artwork, stories, and even fan-produced games. As vital parts of game culture and constituting a critical contextual and interpretative resource, these materials fall within the scope of a game preservation project.

Websites such as GameFAQs host many thousands of player-produced 'walkthroughs' which detail ways of playing often unintended by game developers and which, by exploiting bugs and glitches or normalising certain styles of play, perform an exploratory and regulatory function. Like the short-lived paperback boom of the 1980s which saw expert players seek to document winning strategies for popular arcade and home console games, these online walkthroughs, along with the myriad video walkthroughs or 'Let's Plays' available via YouTube and Twitch, are among the richest sources of information on how games are actually played by their players. However, as born-

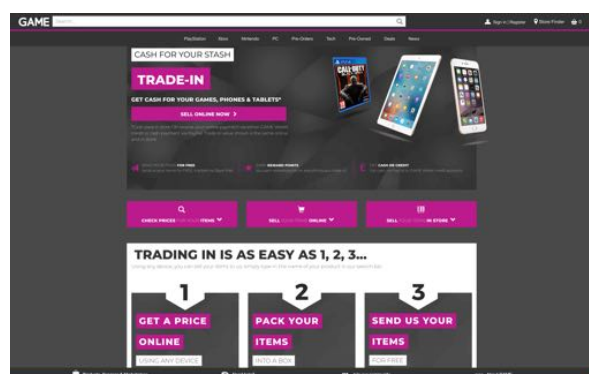
digital assets currently residing on the servers of private corporations, long-term access to them is not assured.

Buying and Selling. Games as products

Alongside the numerous technological issues that designate platforms as incompatible and obsolete with current developments and products, and business practices that see successive generations of hardware and software ultimately recast as 'legacy systems' requiring support for a defined period of time before they are considered 'end of life', there are attitudinal factors at play in defining the value of old games and games history as a whole.

The advertising, marketing and retail focus in relation to videogames foregrounds the new and forthcoming at the expense of the current and old. 'Next generation' systems and games are often described in relation to the ways they improve over previous and current iterations - faster, larger, higher quality graphics - thereby using the present as a benchmark with which to judge the inevitably more powerful future. Incentives to pre-order forthcoming titles by offering exclusive merchandise or totemic in-game items have been commonplace among publishers. Gaming publications online and in print dedicate much time and space to previewing and speculating on forthcoming titles and systems.

The emergence of the second-sale or 'trade-in' market both codes new games as more valuable than existing and old titles and accelerates the process of upgrade and renewal as the residual value of titles decreases rapidly as they age. This retail system privileges new games and encourages



GAME (UK retailer) Trade-In information

GAME (UK retailer) Pre-Order chart

Game Title	Platform	Release Date	Price	Pre-order Now
The Binding of Isaac: Afterbirth	PC	February 2018	£12.99	Pre-order Now
Star Wars Civilization VI: Rise and Fall	PC	February 2018	£24.99	Pre-order Now
Marvel Knights	PS4	February 2018	£24.99	Pre-order Now
Dragon Quest Builders	PS4	February 2018	£19.99	Pre-order Now
Under Night In-Birth Exe: LateLink	PS4	February 2018	£24.99	Pre-order Now
The Seven Deadly Sins: Knights of Blood	PS4	February 2018	£19.99	Pre-order Now

the rapid return and effective recycling of purchased games.

The result of these advertising, marketing and retail discourses is to ascribe a lower monetary value to historical videogames and set the value of games on an inevitable downward curve. By doing so, and by treating them as hardware and software products subject to 'inevitable' upgrade and disposal, these discourses position videogames as obsolete word processing applications or superseded mobile phones rather than vital constituents and reflections of cultural heritage.

In a similar way to the music industry, the videogame industry's position in relation to emulation and software piracy has created a situation where swathes of old games can be illegally - but freely - downloaded online. As Frank Cifaldi of the Videogame History Foundation says, one consequence of this is to create the impression that old games are free. This presents challenges for publishers seeking to monetise their back catalogue as well as for historians and preservation practitioners.

Everything but the game

The discussion thus far has focused on some of the ways in which the systems, peripherals and other materials required to play games are subject to disappearance, deterioration and discontinuation. However, it is essential to consider the fragility and long-term availability of other materials and practices within the broader context of the project of game preservation.

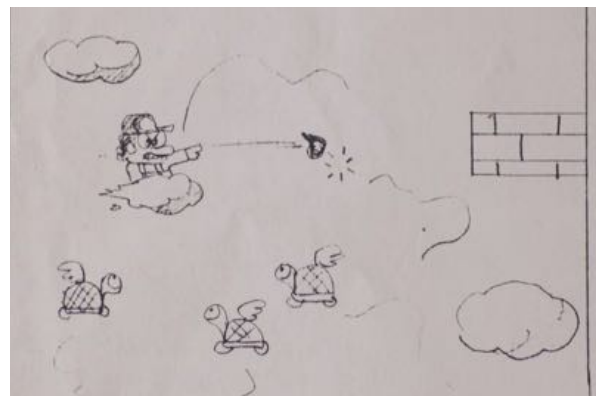
In order to gain insight into the processes of game making, access to design and development documentation are vital. However, institutional

approaches to archiving such materials vary greatly with many developers and publishers having sparse if any records of their historical output. Institutions such as The Strong and The Smithsonian have acquired papers and archives of key developers and designers such as Ralph Baer and Jordan Mechner that offer deep insight into design processes, communications with publishers and other collaborators, as well as glimpses into play testing and iteration. However, the global situation in relation to design documentation remains patchy.

Many developers we spoke with throughout our research no longer have access to such documentation in hard copy or in electronic formats. A variety of reasons were given ranging from such materials not being considered worthy of archiving either at a corporate or individual level, through to altogether more practical issues such as electronic resources being erased once projects had come to a conclusion and products had shipped.

Additionally, some respondents noted that materials may contain commercially confidential material that restricted their movement even during the development and production cycle. Even where electronic assets are available, questions of compatibility and digital continuity affect the long-term access to them.

It is also essential that we consider how gameplay is recorded and captured within the project game preservation. Many contemporary resources exist to capture and share gameplay and the consumption of spectated play has become a cornerstone of game culture and practice with the



Super Mario Bros. production design (copyright Nintendo)

rise of e-sports (professional, competitive gaming) and video/streaming services such as YouTube and Twitch.

Video capture and sharing functionality is even built into the capability of current generations of gaming platform thereby giving the recording and sharing of moments of gameplay the virtual equivalence of the sharing of a photo or video selfie. That gameplay might constitute something necessary to preserve rather than being the inevitable outcome of game preservation is a topic to which we will return later in this report.

However, here it is important to note that there are presently a host of gameplay video sharing services and protocols that range from capturing and archiving footage to live streaming with added player narration and commentary.

The value of these materials to cultural historians, students of game design and developers is almost incalculable given the detailed insights these performances and commentaries offer and, as such, developing approaches for their curation and preservation (as well as managing their growing number) represents a key challenge.



6. HOW TO PLAY JET SET WILLY (IN 2018)

Overview

Jet Set Willy is a platform game that involves navigating the titular character through a series of obstacle courses in order to tidy up his mansion following a party the night before. The game is the sequel to Smith's earlier title Manic Miner which shared much in common in terms of fundamental gameplay mechanics of jumping, exploration and collection. Jet Set Willy's gameplay takes place across 61 rooms which may be traversed non-linearly unlike its prequel and which extend beyond the mansion itself to the beach and even a yacht.

Originally created by Matthew Smith for the ZX Spectrum computer in 1984, Jet Set Willy was converted to most home computing platforms (including the BBC Micro, Acorn Electron, Commodore 16 and 64, Dragon 32, MSX, and Amstrad CPC). It was converted to the family of Atari 8-Bit computers and published by Tynesoft in 1987.



Jet Set Willy cassette, inlay and Software Protection Card (credit: NVA)

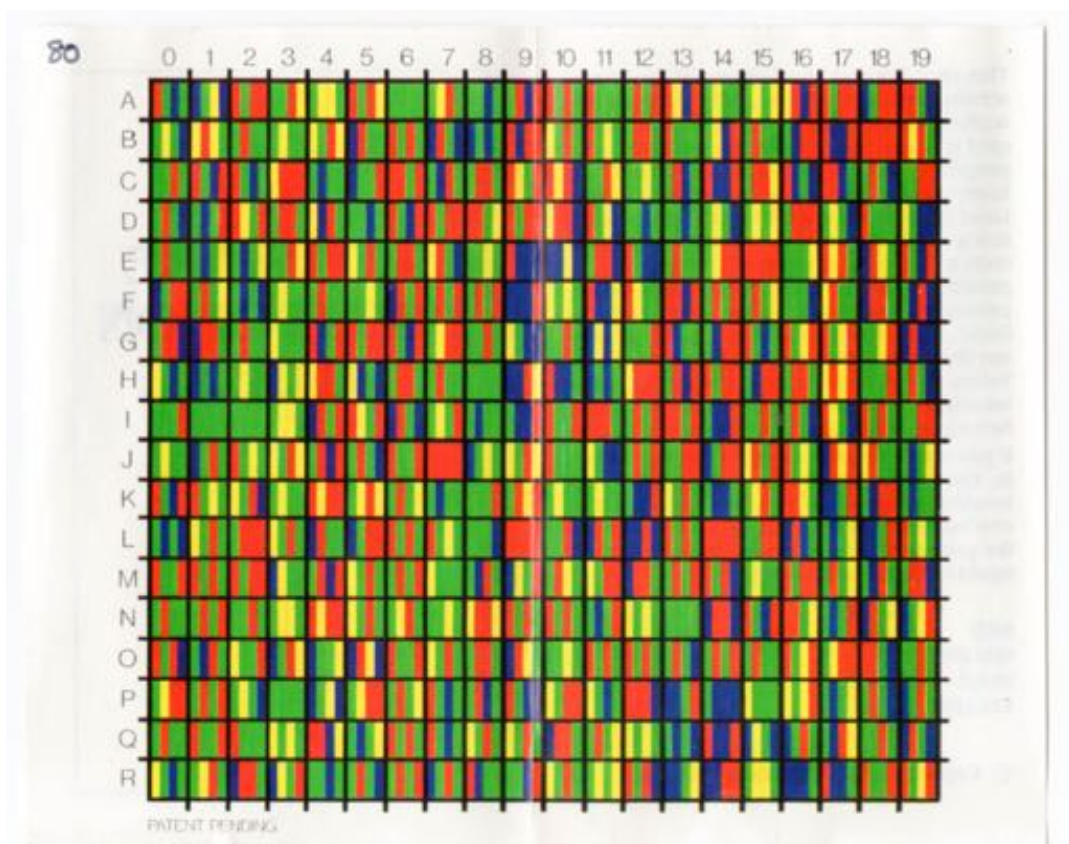
Upon its initial release, the game included a number of bugs that rendered certain rooms impassable or that caused the game to crash. These were fixed in subsequent releases and by entering additional 'POKEs' (home computer code entered by the player to alter the data accessed by the game when running).

Developed by Smith in 1980s Britain, Jet Set Willy and its predecessor, Manic Miner, are infused with humour drawn from Monty Python and may be seen as a commentary, response and satire on the social-cultural, economic and political situation in the UK at that time.

In common with many home computer games in the 1980s, Jet Set Willy was distributed on cassette making the act of duplicating the game's data as trivial as copying any audio tape and requiring only a domestic Hi-Fi. To combat piracy, Jet Set Willy was one of the first games to ship with a copy protection tool. A card containing a grid of 180 coloured codes was bundled with the cassette.



Sinclair ZX Spectrum computer and packaging (credit: NVA)



Software Protection Card (credit: NVA)

Once the game was loaded, the player was challenged to enter the correct code in order to proceed. Without the software protection card, the game could not be played from either an original or illegally duplicated cassette.

Revealing the popular attitude towards software piracy and means of protection, methods for circumventing the card were found and even printed in computing magazines of the time (e.g. in Issue 6 of 'Your Computer' in 1984).

Playing Jet Set Willy in 2018: what you need

With the game available across multiple systems and with significant audiovisual and interface differences, deciding on target platform(s) is essential. With none of the platforms currently in production, a further decision must be made as to whether to utilise original hardware, emulation or a hybrid.

For original hardware approaches:

- ZX Spectrum 48K home computer (no longer in production)
- Jet Set Willy (ZX Spectrum version) cassette (no longer in production)
- Cassette player with audio out to load data (in theory, almost any cassette player should work though noise reduction systems must be disabled, tone controls disabled or set to ensure full frequency range response, and tape heads may require mechanical realignment if read errors are encountered)
- Jet Set Willy Software Protection Card (alternatively, the POKEs published in e.g. 'Your Computer' may suffice – though may technically constitute circumvention of the copy protection system)
- Display with RF audiovisual input (most likely a CRT TV set which are no longer in production. Some early flatscreen displays/TVs are equipped with RF inputs but many struggle with the resolution and refresh rate of the Spectrum's video signal and will not exhibit the (un)desirable visual artefacts such as 'blurring' and 'ghosting' noted above)

For emulation / hybrid approaches

- Videogame emulation environments such as RetroPie include ZX Spectrum emulators and will run on comparatively low-cost/low-powered hardware such as the Raspberry Pi.
- A copy of the Jet Set Willy game as a compatible 'ROM' (typically, this is a virtual cassette file extracted from the original data carrier and created for use with a Spectrum 48K emulator)
- Jet Set Willy Software Protection Card (though some versions of the Jet Set Willy ROM have the copy protection routine removed or modified. While this negates the need for the physical card, it is a reminder that the code has been modified)
- Display compatible with the emulation platform (depending on the emulator, there may be filters to simulate CRT artefacts such as scanlines)
- External or built-in speakers for sound reproduction
- Input device such as a keyboard (though note that the ZX Spectrum had a distinctive keyboard with small rubber keys and a non-standard layout which is linked to game 'feel' and may constitute part of Jet Set Willy's specific properties)

7. HOW TO PLAY SUPER MARIO MAKER (IN 2018)

Overview

Nintendo's Super Mario Maker (2015, Wii U) is a continuation of the company's Super Mario Bros. series. The game ships with a small collection of levels and can be played as any Super Mario game. However, the real USP of the game is that it offers a suite of playful game design tools allowing players to create their own levels. With the Wii U console connected to the Internet, these can be shared with other Super Mario Maker players across the world from within the game. Other players' levels may be downloaded, edited, commented on, and re-uploaded using the proprietary content sharing network accessed within the game. Additional features are unlocked as the game is played over a period of days with new content added by Nintendo in the months after the game's initial release. Players use the stylus and touchscreen on the Wii U's gamepad to design levels and may add and unlock new materials by tapping physical amiibo figures on the controller's NFC (Near Field Communication) reader. A special edition of the game was available that included a 30th Anniversary Super Mario amiibo figure and a hardcover art book. Additional amiibo figures are sold separately.



Super Mario Maker promotional image (credit: Nintendo)

A strong community of designers creating levels coalesced around the game. Players made creative use of features such as commenting to add narrative elements to their levels. A sub-category of uncompromisingly difficult levels, known colloquially as 'Kaizo' designs draw on amateur practices of ROM hacking (designs using unofficial and unsupported tools and code ripped from the original Mario Bros games). Although the game itself offers no built-capture facility, streaming, recording, and commentating

on the processes of level design and attempts to complete levels are shared through Twitch, YouTube and are regular fixtures at gaming events such as Games Done Quick.

Playing Super Mario Maker in 2018: what you need

The list of materials required to run Super Mario Maker includes numerous connected and contingent resources many of which are now unavailable and inaccessible just over 2 years after the game's original release.

- Wii U console (no longer in production)
- Wii U Gamepad with touchscreen and stylus (only available with console)
- Super Mario Maker Wii U game disc (disc no longer in production, downloadable version available at Wii U store which closed at end of 2017)
- Internet connection for access to updates to proprietary Nintendo update servers for: game software updates (additional features were added beyond the initial disc release) and updates to console operating system
- Access to proprietary content sharing network provided by Nintendo (currently still available)
- Access to proprietary Nintendo 'Miiverse' service for commenting (closed November 2017)
- Amiibo figures/cards (more than 100 compatible amiibo add functionality and features to levels)

The physical boxed-product also shipped with an:

- Over-sized windowed box to include the game package/disc, inlay, Artbook
- The hardback Artbook is presently downloadable as a PDF along with design layout sheets

To capture gameplay for sharing via Twitch/YouTube, an additional, third-party HDMI video capture device, PC and editing software, and Internet access is required (e.g. as manufactured by ElGato and Avermedia) along with an active YouTube/Twitch account.)



Super Mario Maker box, art book and 30th anniversary amiibo (credit: NVA)

8. WHAT IS GAME PRESERVATION?

Although videogame preservation, curation and exhibition has risen up on scholarly research and funding agendas and has become the focus of a number of public institutions and private groups and individuals, there is still no consensus as to precisely what the scope or outcome of activity should be.

This is perhaps unsurprising given the comparative newness of game preservation as a project, the wide range of potential technologies, systems and experiences within the remit of the project, and the diversity of the stakeholders, contexts and use-cases for the outputs and outcomes of videogame preservation and well as contributors to its theory and practice.

Jakks Pacific Atari joystick/console (credit: NVA)



Different use-cases will demand a focus on different specific properties of games. For researchers and historians interested in programming, access to sourcecode may be of utmost important while such materials may be of limited or no core value to projects showcasing the development of visual art or animation, for instance.

Following Rhiannon Bettivia of the University of Illinois, we think it is useful to consider videogames as 'boundary objects'. That is, videogames may be simultaneously understood in broad terms across a larger group of stakeholders while having far stronger sets of meanings for and within particular

groups. (read more at <http://www.ijdc.net/article/download/11.1.17/420/>)

It follows that each stakeholder, use-case or subset of videogames will necessarily define different specific properties. For example, those concerned with interaction design may privilege specific hardware such as joysticks, pads or mice and keyboards while musicians may be more interested in soundchip design schematics, sample data or access to information on low level audio drivers.

Similarly, projects locating videogames within a wider context of toys, play or youth culture will draw on different qualities of the medium than scholars or museum professionals exploring the output of a given development studio, or collectors seeking to uncover every unreleased game for a given platform which was cancelled while in production and prior to commercial release.

Given these factors, it is our contention that there can be no single approach to game preservation that can take precedence and each approach should be seen as part of a collaborative and distributed project.

The role of play

Given the centrality of play to videogames' distinctiveness as media forms, it is not unreasonable to assume that maintaining the long-term playability of videogames should be the

Nintendo Virtual Boy console (credit: NVA)



objective of game preservation. Presently, much formal and informal game preservation has proceeded from the stated or unstated assumption that maintaining playability is the de facto objective of game preservation. However, as is evident in the range of uses cases listed above, while maintaining playability will be central to the activities and interests of a number of stakeholders, for others patterns and styles of play will constitute something in need of documentation and preservation.

We might usefully split preservation activity into two overarching categories:

- Maintaining Long-term Playability
- Documentation, Recording and Collection

Just as access to sourcecode or the carefully scanned instruction manuals will be essential to the work of some but not all stakeholders, the ability to play historical games in the future will not be intrinsically essential in all cases.

For some stakeholders, future access to archival recordings, replays and commentaries on styles of gameplay may be of more value than the continued ability to play those same games. Some stakeholders will be interested in how games were played, the meanings made of them by players, and the social interactions that support and sustain

gameplay. Here, documentation of the ways social media are used alongside games to create collaborative spaces for building and sharing will be essential. Or perhaps documentation of the ways players create and police new gameplay styles that confound or even break a game's rules by exploiting bugs and glitches or by racing through games as quickly as possible will be key.

If one's interest in an online space such as World of Warcraft is in social dynamics, the staging of events and protests, or the spread of in-game viruses, documentation such as gameplay captures, archived blog posts, and news reports provide the only access to events already passed.

For those concerned with design processes or the management of large-scale development projects, the value of access to development documentation, oral histories and interviews with creators and makers may well outweigh that of continued playability of the games themselves.

As such, we suggest that, while certain techniques and approaches based around maintaining or reconstructing long-term playability have dominated the early stages of game preservation, it is essential to move beyond software preservation alone. It is important that we continue to develop new strategies that celebrate the distinctive and valuable contributions and requirements of institutions, individuals and groups each of whom bring different areas of expertise, interest and focus.

Here, we outline some of the many approaches and factors that comprise the larger project of game preservation in order to demonstrate the variety of stakeholders that could, and we contend, should be actively involved in game preservation.

Maintaining Long-term Playability

Activity here can be broadly split into two categories depending on whether the focus is on utilising original hardware systems or emulation.

Long-term playability using original hardware

The distinctive qualities of graphics and sound rendering as well as the specific properties of interface elements that contribute to the

Sinclair ZX Spectrum home computer (credit: NVA)



audiovisual aesthetic and qualitative feel of gameplay makes the use of original hardware an appealing proposition in the search for an 'authentic' experience.

Of course, the phrase 'original hardware' implies a certitude that is sometimes illusory and discussions will still abound over differences between versions of games, variations between releases and regions, and what constitutes an original reference hardware system where there was no single standard for graphics and sound cards or joysticks (such as with the PC and home computer market, for instance). Nonetheless, the maintenance of original or at least contemporaneous, hardware systems will be considered significant in many contexts.

Echoing the case study of Jet Set Willy above, Foteini Aravani, curator at the Museum Of London noted the challenge of working with distinctive interfaces such as the ZX Spectrum's infamous keyboard.

...video games and their systems are unique because they are totally interdependent, everything must work together, to let you experience them. Games rely on hardware, software and input/output devices, screens and joysticks, all coming together to perform correctly... we extract the source code of the game, and run it on a small, very simple computer called a Raspberry Pi, but we keep all the original devices. With the games originally released for the ZX Spectrum, you play the game with the Spectrum keyboard.

Foteini Aravani, Museum of London

Adopting a hybrid approach based around software emulation and repurposed original hardware, this may offer an attractive solution (though one in which the complexity and authenticity of the presentation and operation will be necessary to explain). Moreover, given the vulnerability of hardware and software objects to corrosion, erasure and mechanical malfunction as noted above, coupled with the fact that mainstream gaming systems released as recently as 2012 (Nintendo Wii U) are already out of production, the project of maintaining playability through original hardware – or a hybrid solution such as the MoL example above – is a necessarily time-limited one.

Long-term playability using emulation

At least partly in response to the limited lifespan of original hardware, data carriers and software objects, emulation seeks to replicate the functionality of computing systems beyond the lack of availability or obsolescence of the original resources. Essentially, emulation involves authoring software for one computing platform that mimics the behaviour of another. This allow games (or potentially any program) originally designed for the emulated system to be run on the new platform. Typically, this has involved emulating older systems so that they run on newer, more readily available hardware such as the Nintendo NES running on a Windows PC.

Associated with emulation is the extraction or migration of data and code from vulnerable data carriers such as floppy disks or cartridges which may then be redundantly stored using contemporary and more readily manageable forms and formats.

By removing the need to maintain inevitably dwindling supplies of increasingly fragile consoles and data carriers, emulation is the most viable long-term strategy for playability presently available.

It is not without issue, however. While the creation of emulators has not been successfully challenged in law and is considered fair use as an act of reverse engineering, operation of an emulated



system may require access to code that is protected under copyright. This may include proprietary 'BIOS' code required for the original system/emulator to run as well as the data and code of the games themselves. As well as proprietary code being subject to restrictions, its extraction from original data carriers such as chips or optical discs often requires the circumvention of Technological Prevention Measures (more commonly known as copy protection or DRM) as noted above.

The coverage and quality of emulation may vary considerably. Some systems are well-covered with multiple emulators offering compatibility with all or different subsets of game libraries, while other systems have extremely limited compatibility or have no functioning emulators at all. Moreover, compatibility and emulation quality may vary significantly between emulators as the Preserving Virtual Worlds project noted particularly in relation to support for sound.

Given that the focus of most emulation projects is on software compatibility, further consideration is required where the feel or operation of particular hardware devices such (as controllers) contributes to the specific properties of a given game or experience.

It is worth noting also that most currently available videogame emulators are developed by amateurs, fans and enthusiasts. This is notable as development of many emulators has been halted or abandoned potentially making them as worthy of consideration of objects for preservation as

solutions to game preservation. Of importance in this regard, however, is the announcement in 2017 that the MAME/MESS (Multi Arcade Machine Emulator/Multi Emulator Super System) emulator had been made Open Source and is available under a GPL2 license. This development may offer new ways to develop and utilise emulation software in a variety of contexts including commercial uses which may enable publishers to more efficiently work with their library and legacy titles. See www.mamedev.org

Documentation, Recording and Collection

Where the approaches above take long-term playability as their starting point, approaches focusing on documentation, recording and collection are as likely to conceive of play as the object of preservation. There are numerous approaches to documentary game preservation which are reflective of the diverse interests of stakeholders, audiences and use-cases.

Activity in this area may include the development and curation of collections of hardware and software libraries. For some uses-cases, such material may be linked to playability, but such collections may be concerned with industrial design, packaging, artwork, use of language, translation and localisation, none of which necessarily presuppose playability and the materiality of consoles, computers, the textual content of instruction manuals, may be more significant. For some stakeholders, listings of code from released, unreleased and in-development games will represent crucial holdings.



Collecting activity reaches far beyond consoles, computers, cartridges and discs and extends into ephemera and paratexts such as merchandising; clothing; toys, figurines and board games; print, broadcast and online advertising and marketing materials. Such collections will include both physical, material objects as well as born-digital and hybrid forms. As such, online capture programmes such as web archiving are within the scope of the game preservation project.

It is crucial that robust, extensible and open cataloguing and metadata schemas are developed alongside game collecting activity. At present, numerous database formats complying with different national or other standards are in operation across institutions with game holdings while private collectors often have their own proprietary cataloguing systems.

Online and crowdsourced databases such as mobygames provide useful starting points and hold much information but there remains an opportunity to create international standards for game documentation. Such developments will aid the location of assets, provide enhanced opportunities for collaboration and reduce the duplication of effort, and assist in the effective citation and referencing of game materials by

scholars, historians and developers among other stakeholders.

In order to account for historical and contemporary practices and patterns of play, programmes of capture will be required. A number of complementary options exist including video/screen capture (either newly captured material as with the Strong National Museum of Play's game capture programme or by archiving published material) and the capture of player input data to create 'replay' files (as with the Ritsumeikan Game Research Center's NES game capture system developed in conjunction with Nintendo). Gameplay capture programmes may extend beyond screen content and intercepting inputs to include social interaction both through media side/back channels (Skype, Discord etc.) and the face-to-face talk of local multiplayer and location-based experiences such as arcades.

Oral history programmes are key to capturing the insight and reflections of players, developers and other stakeholders. With much current game preservation focusing on the technical and technological aspects of gaming, projects centring on the testimony of individuals and groups have a vital role to play.

9. INTERPRETING VIDEOGAMES. THREE CASE STUDIES

Just as the scope of the material within the broad project of game preservation will be shaped by the particular requirements of stakeholders as well as the availability of materials, so too will the means by which such resources are made available and accessible to audiences and publics. While Atari's Pong may have had notoriously succinct instructions for play, not all videogame play is so straightforwardly explained.

Moreover, where the provision of playable games is not the only or primary objective, there is considerable scope (and we would argue a considerable need) for further research into interpretative strategies for museums, galleries, libraries and archives operating both offline and online. The museums that form the focus of our research here each share some commonalities in presenting publicly playable games on gallery floors as part of curated and themed exhibitions. Depending on the nature of other holdings, access to non-public parts of the collection is managed through archive and library principles. In all cases, bespoke exhibits seek to explore aspects of gameplay or design that are not immediately or intuitively evident through playing commercial games alone.

There are a wide range of interpretation strategies on show in the institutions we visited throughout our research. A number, such as timelines exploring the historical progression of gaming technologies or interfaces, or comparatively traditional museum displays of object collections, are widely used across the museums and galleries we visited. Here, we draw out three different interpretative approaches that address the historical and socio-cultural contexts of gameplay performance; histories of game development practice; and the role of playability in exploring structure, design and gameplay opportunity.



Pong's notoriously succinct instructions (copyright: Atari)

COMPUTERSPIELEMUSEUM. PLAY IN CONTEXT

Part of the Computerspielemuseum's exhibition space is dedicated to a number of themed rooms each recreating a specific historical era and locating computer and videogame play within a particular domestic context. The rooms are set-dressed with period furniture, wall and floor coverings, and contemporaneous ephemera. Visitors are invited to take a seat and play the games on offer in each room while also exploring the spaces by opening desk drawers and browsing the collections of volumes on bookshelves, for example. In contrast with the small arcade-themed

display where, as a consequence of the design of the games therein, play durations are necessarily shorter, these room settings operate at a different tempo and make possible longer gaming sessions.

Each room foregrounds a different aspect of domestic videogame practice and culture.

The 1970s living room, replete with brown and orange fabrics covering its sofas and heavy dark wood veneer furniture, showcases a multiplayer Pong clone system connected to the large family CRT. The room speaks to both the novelty of







gaming technology but also to its position at the centre of domestic media consumption. This is in no small part because the likelihood of single TV ownership demanded the Pong console occupy such a position.

The 1980s room models a converted loft space and speaks to the hobbyist computer enthusiast. Here, the Commodore 64 has moved out of the living room and into a more private space within the house where it is connected to a smaller, portable CRT display. The room is dressed with amateur electronics equipment such as a soldering iron and multimeter along with the guides to electronics and manuals for the Commodore system. As well as allowing visitors to play a collection of C64 games particularly popular in Europe throughout the 1980s, the room speaks to the interest in hobbyist electronics and hints at the necessity of modification or fixing home computing paraphernalia.

The 1990s exhibit recreates a bedroom and speaks to the increasingly individual nature of media consumption throughout this period. The videogame console takes centre stage and is attached to a CRT firmly located in this private

space within the house. Sitting alongside the console and controllers on the desk is a handheld gaming system, a portable stereo music player and selection of cassettes. Each of these devices illustrates the way in which gaming, along with music and TV consumption, shifts from being shared to personal.

Taken as a whole, the room exhibits highlight the way in which gaming moves from public to private spaces within the home. It should be noted that, while the exhibits create a tangible sense of the culturally-specific periods in which specific game systems were initially released, they underplay their continuing 'afterlives' and necessarily locate these platforms and the games played on them as historical objects.

THE STRONG NATIONAL MUSEUM OF PLAY. DESIGN IN CONTEXT

Numerous developers, inventors and designers have laid claim to the title the 'founder of videogames'. Engineer and computer scientist Al Alcorn is one contender for his work designing Pong, one of the first commercially-successful videogames. Shigeru Miyamoto's work on the Super Mario and Legend of Zelda series for Nintendo is another.

However, it is Ralph Baer that likely has the strongest claim. His creation, which would see its commercial release as the Magnavox Odyssey in 1972, was the first videogame console and

introduced many of the principles that continue to underpin system design and the videogame platform business today.

Among the Odyssey's many notable features were its introduction of the first light gun peripheral, the amount of paraphernalia the system shipped with (counters, dice, overlays for the TV screen - all compensating of the lack of graphical capability). Particularly key was the Odyssey's use of removable cartridges. This shifted the videogame business model from one involving designing and selling dedicated, single-game systems that came





The 'Brown Box' Odyssey console prototype



and went according to the vagaries of fashion and consumer demand, to a 'platform' model in which a reprogrammable base system of hardware could be rejuvenated with newly created game software. In fact, removable cartridges had been introduced with the Fairchild Channel F system (elsewhere exhibited on the Strong's gallery floors) but the Odyssey's popularity ensured that this 'razor and blades' model remained the foundation of the videogames industry's business models from that point onward.

Another important and often overlooked aspect of the Odyssey's creation is the length of its development period and the resistance that Baer and colleagues originally encountered. The size of today's global videogames industry and its economic and cultural embeddedness makes it difficult to imagine a time when the word 'videogame' did not exist and the proposition of TV gaming was a matter of serious debate. Having conceived of the idea for an interactive TV game system in 1966, Baer and colleagues Bill Harrison and Bill Rusch, would develop and refine their prototypes until their seventh 'Brown Box' model was picked up by Magnavox in 1971.

It is this early phase of development that the Strong's ICHEG teams have focused on in their exhibit recreating Ralph Baer's desk.

Magnavox Odyssey console and controllers



According to JP Dyson (Vice President for Exhibits Research and Development and Director of the International Center for the History of Electronic Games at The Strong).

'Museums have long memorialized genius. While art museums preserve great paintings and sculptures, history museums collect and preserve a wide-ranging record of the ways individuals, groups, and companies have shaped our society. The Strong's focus on the history and meaning of play has guided its efforts to preserve a comprehensive collection of artifacts that document the rich history of toys, dolls, games, puzzles, electronic games, and other playthings. Among these collections are those donated by Ralph Baer, who over the course of his life transformed the way people play. That's why The Strong is pleased to have installed a display of Ralph's desk and work area from his Florida home, where he did much of his inventing.'

...

The exhibit includes many of the tools of Baer's trade including his soldering gun, oscilloscope, ohm meter, and drawers of electronic components along with a boxed copy of his Simon visceral light and sound pattern-matching game that became a global hit in 1978. Set behind glass, the Ralph Baer workspace exhibit is elsewhere amplified and further contextualised by video clips showing Baer demonstrating the Odyssey system along with a playable version of the Brown Box prototype system.

JP Dyson, The Strong National Museum of Play

THE NATIONAL VIDEOGAME ARCADE'S 'GAME INSPECTOR': GAMEPLAY WITHOUT PLAYABILITY

According to the guide to the NVA's opening special exhibition 'Jump!' 'The Game Inspector lets you explore games in new ways. You can freely move around and zoom in and out of the levels without worrying about the timer running out, or falling down that hole, or getting squished by an enemy. You can watch videos of particular sequences in games that you might not have seen before. You can see where all the hidden rooms and power-ups are. You can see the multiple routes through the level - including ones that you didn't even know were there. It's like learning from all the best players in the world. Every Game Inspector is different, giving you the chance to do things like explore a game's history, learn how it was created, or maybe even take a look at its original packaging.'



The Game Inspector is borne of the principle that videogames do not always explain themselves best through play and, accordingly, that playability is not the inevitable outcome of preservation but rather something that might constitute the object of preservation.

In discussing the creation of the Dizzy Inspector that accompanied the 2017 retrospective of the

Oliver Twin's 'Dizzy' series of videogames, the NVA's curatorial team notes that:

'To explore even further this process of translation from design to game and to link the hand drawn paper designs to the shimmering pixels on screen, we decided to build a new exhibit. The Dizzy Map Explorer is based around a large scale reproduction of the hand drawn map for Dizzy III. Each scene experienced in the game is literally

mapped out with detail of the environment and puzzles clearly visible and a really clear sense of how these screens fit together to create the world. This is not a view one ever normally gets unless one mapped out the gameworld on squared paper – and in the process reverse engineering The Olivers' original design process.'

NVA curatorial team

Presenting the maps in this manner allows visitors to view the game space in a way impossible through gameplay and reveals the interconnections, spatial complexity and contiguity of Dizzy's world.

To further explore the process of translation, the Dizzy Game Inspector uses NFC technology to allow visitors to 'remove' sections of the large map. When scanned on the bespoke reader, a display shows video captured gameplay relating to the specific point in the game's space thereby revealing the connection between hand-drawn designs and the final pixellated game space and gameplay.

This interpretation model takes advantage of the unexpectedly flexible and plastic nature of captured videogame play. Not only does the Game Inspector model allow multiple performances to be showcased and experienced (reminding us that videogames may require many playings in order to reveal all of their ludic potential), but also the

translation of interactive play into captured video allows the use of languages, techniques and grammars of video editing and playback to explore the gameplay. Far from rendering the gameplay frozen or static, it may be rewound, free-framed, zoomed-in and explored – or 'inspected' in the parlance of the NVA.

While the game has been played many times by different players in the construction of the Game Inspector, this interpretative model proceeds from the basis that while play is important, no single playing can tell us everything the game has to offer.

Moreover, watching and scrutinising the game being played encourages and allows different ways of looking. Freed from the panic of trying to complete the puzzle in time or make that tricky jump, aspects of design that might not be noticeable are revealed. Similarly, freed from the need to play as an expert, parts of the game that might simply remain inaccessible due to a lack of knowledge or performative skill, may be inspected.

Ultimately, the Game Inspector, whether in its guise exploring Dizzy or Super Mario Bros., is an example of an exhibit and interpretative strategy that puts into practice the principle of 'gameplay preservation' and that counterintuitively exploits the relative plasticity of gameplay captured as video.



A montage of screenshots from the Super Mario Bros. Game Inspector exhibit

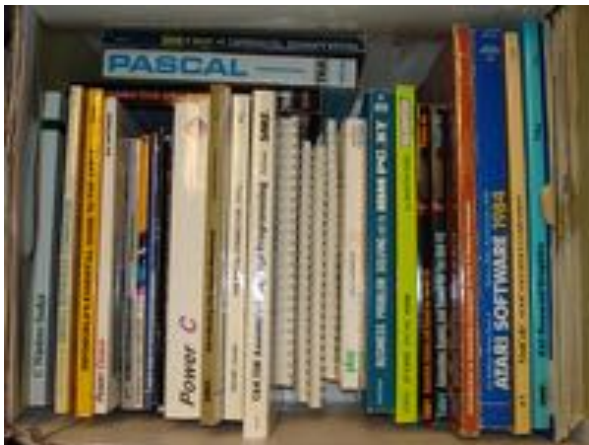
10. WHO CARES?

The cast of individuals and institutions invested in the preservation of games is wildly varied.

In this next section, we draw attention to a range of collecting, exhibition and interpretation projects. Our aim in highlighting these particular projects is not to present a complete account of extant work as the sheer number of projects currently operating at different scales and in different contexts renders this impossible (indeed, one of the Recommendations of this project is that such an audit be undertaken). Rather, these projects have been selected to demonstrate the diversity and range of motivations and approaches, and to highlight examples of best practice and leadership.

The Cabrinety collection

The motivation to preserve videogames in order to preserve their intrinsic cultural value has itself emerged from the very personal instinct to collect. The model that best exemplifies this being the Cabrinety collection, bequeathed to Stanford University libraries on the occasion of student Stephen M. Cabrinety's death in 1995.



Cabrinety collection materials (credit: Stanford University Libraries)

This collection is emblematic of the value and motivation for the collection of videogames being driven by an entirely personal, emotional cause. It was Cabrinety himself who founded C.H.I.P.S. (Computer History Institute for the Preservation of Software) in 1989. As the Stanford University Libraries note, 'His dream was to permanently locate his collection where it could serve as a museum, an educational tool and an archive for

scholarly research'. The critical mass of material he had accumulated was accessed into the permanent collection, forming one of the most important formal resources available.

Whilst Cabrinety was acutely aware of the route of formal accession for his collection into a formal institution and the resource it would form for academic research, we should not assume that all collection efforts are similarly focused on such an objective.

The software series exceeds 700 linear feet, includes more than 18,000 unique software packages, and contains dozens of media formats (such as floppy disks, computer cassettes, and game cartridges.) A sizeable amount is still in its original packaging.

The Cabrinety-NIST Project is a collaborative large-scale digital preservation effort between SUL and NIST (National Institute of Standards and Technology) to create forensic disk images and high-resolution photographic scans of materials in the software series of the Stephen M. Cabrinety Collection in the History of Microcomputing, ca. 1975-1995.

NIST creates all the forensic disk images and checksums (unique digital signatures) for every piece of media in each Cabrinety software package, handles the technological hurdles

associated with extracting data from obsolete media formats, and provides network tools as needed. SUL handles re-processing of the Cabrinity collection, creates item-level registration and metadata records for each software package, captures high-resolution photographic scans of all physical materials, and handles tracking and logistical details as collection boxes are shipped cross-country between SUL and NIST. Once the Cabrinity-NIST Project is complete all the photographic scans, forensic disk images, and checksums will be ingested into the Stanford Digital Repository for long-term preservation.

Ritsumeiken University, Kyoto

Professor Hosoi Koichi and Aki Nakamura from Ritsumeiken University have been driving their cataloguing and preservation activity. Based within the university's Ritsumeikan Center for Games Studies (RCGS), their efforts are made particularly distinct by their unique collaboration with Nintendo.

Instigated by Prof Hosoi, this has resulted in privileged access to a small number of original Nintendo software titles for the purposes of preservation.

Outside this collaboration though, the institution has found it hard to engage the broader videogame sector, "... they are not so interested in getting involved as such activities as preservation should be cultural affairs and not business," notes Prof. Nakamura.

RCGS' efforts are currently funded by the Japanese Agency for Cultural Affairs.

International collaborations are key to RCGS' mission and in 2016, they collaborated with the curatorial and exhibition teams at the The Strong



Nintendo NES exhibition (credit: The Strong/ICHEG)

National Museum of Play's 'International Center for the History of Electronic Games' (ICHEG) on an exhibition.

Detailing the history of the Nintendo company and its Nintendo Entertainment System console, 'Playing with Power: Celebrating 30 Years of the Nintendo Entertainment System' showcased hardware, software, design documentation and other ephemera including an interview with hardware designer Masayuki Uemura discussing his career and the development of the system.



EFGAMP

EFGAMP (the European Federation of Video Game Archives, Museums and Preservation projects) is a pan-European not-for-profit that acts to encourage the creation of archives and to increase accessibility to digital heritage. A key part of its effort to that end is in awareness-raising for the broader project of digital preservation and the specific challenges it faces.

- The objectives of EFGAMP:
- Advance the availability of digital interactive heritage
- Gather and circulate knowledge about digital preservation
- Strengthen the European information society
- Represent members and partners of EFGAMP on a European and global level
- Network with other digital preservation communities worldwide
- Lobby to advance the conditions of digital preservation and the accessibility of digital interactive entertainment heritage

The members of EFGAMP represent a comprehensive cross-section of the European preservation community, including institutions and private collectors.

At time of writing these include :

- Computerspielmuseum (Germany),
- MO5.COM (France),
- The Finnish Museum of Games (Finland),
- Institute for Sound and Vision (Netherlands),
- The National Videogame Foundation (United Kingdom),
- RetroCollect (United Kingdom),
- The Royal Library, National Library of Denmark
- Copenhagen University Library (Denmark),
- The National Library of Sweden,
- The Software Preservation Society (United Kingdom)
- KryoFlux P&S Ltd (United Kingdom),
- Subotron (Austria),
- VIGAMUS – The Video Game Museum of Rome (Italy)

EFGAMP has increasingly also become active in copyright reform as it pertains to the preservation effort, forming a coordinating effort for developing new policy and raising awareness.

ICHEG (the International Center for the History of Electronic Games), Strong National Museum of Play, NY

The Strong is an independent 501(c)(3) not-for-profit educational organization. It is funded in part by the Margaret Woodbury Strong Trust but also depends upon private contributions from individuals, corporations, and foundations and upon competitive grants from public agencies such as the Institute of Museum and Library Services (IMLS) and the New York State Council on the Arts (NYSCA).

A division of The Strong National Museum of Play, the International Center for the History of Electronic Games (ICHEG) is focused on collecting, studying, and interpreting videogames, other electronic games, and related materials.

ICHEG collections (credit: The Strong/ICHEG)



Part of ICHEG's mission is to account for the historical and contemporary of development of electronic games and their influences and impacts on how people play, learn, and connect with each other, including across boundaries of culture and geography.

With over 60,000 items, The Strong's collection of videogames and electronic game-related historical material is the largest and most comprehensive in the US and among the largest in the world. The collection includes gaming hardware and software, packaging, advertising and marketing materials, game-related publications and merchandising. Additionally, The Strong/ICHEG's collections include personal and business papers of key individuals and companies in the electronic game industry.

The Game Preservation Society, Tokyo

The Game Preservation Society 'is a Nonprofit Organization formed by a group of volunteers who possess professional skills and knowledge in the preservation of games.' Led by Joseph Redon and based in independent premises in Tokyo, it seeks to establish and preserve an exhaustive, complete collection of Japanese videogames from the 70s, 80s and 90s across all formats.

Holding a remarkable 20,000 games (with multiple copies of many) and over 30,000 supporting objects, the collection of the GPS is remarkable in its scale and infrastructure.

Since being founded in 2011, 17 core members and 28 supporters volunteer their time to archive, preserve and share their work with the public. The activities receive no public subsidy and refuses

support from commercial game publishers in order to remain independent.

This corporation is dedicated to spreading and encouraging research and development of the preservation techniques and methods of electronic games, its related machines and documents.

To achieve the aforementioned goal, we conduct the following activities:

- 1) Activities pertaining to the research and development of the preservation techniques and methods of electronic games, and its related machines and documents, as well as the provision of such information.
- 2) Activities pertaining to the spreading and encouragement of the preservation techniques and methods of electronic games, and its related machines and documents, as well as the provision of such information.
- 3) Activities pertaining to the supporting of and collaboration with archivists and related businesses and organizations which aim to spread the preservation techniques and methods of electronic games, and its related machines and documents, as well as the provision of such information.



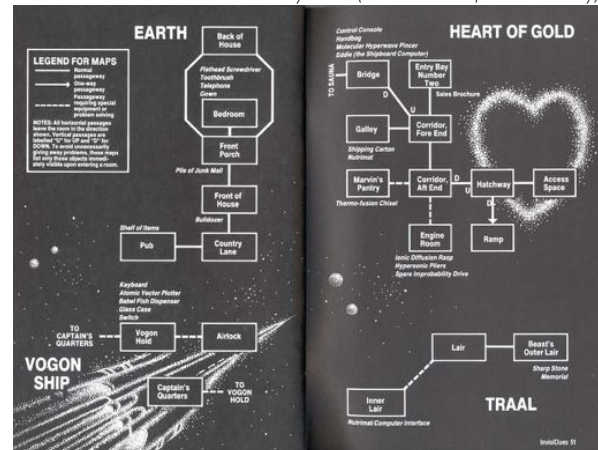
Game Preservation Society collections (credit: GPS)

The Infocom Gallery

Infocom were one of the most celebrated independent software developers and publishers of the 1980s, specialising entirely in Interactive Fiction adventure games.

One of a number of Infocom archive sites on the internet, the Infocom gallery hasn't been updated since 2004, having been founded in 1998. Very often such projects are at the mercy of server

Hitchhikers Guide to the Galaxy hints (credit: The Infocom Gallery)

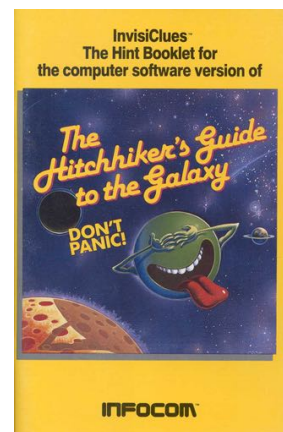


subscription or domain name subscriptions lapsing, so it is remarkable that the archive remains available after almost 20 years since inception.

That this site remains active is highlighted here as a testament to creators' awareness of the issue of software preservation and, importantly, the importance of the

preservation effort extending beyond the codebase itself. The founders of the archive demonstrate a clear dedication to the practise of preservation and an understanding of it as an act of cultural responsibility, which they are motivated to undertake where the IP license holders have failed.

As "David and Julian" the founders of the Infocom gallery explain on their homepage...



A couple of years ago, two little collections known as The Lost Treasures of Infocom, parts 1 and 2 were published. Everything Infocom released in just two collections -- seemed too good to be true. And it was, in a number of ways. First, the collection was incomplete -- Leather Goddesses was not included. Second, no feelies -- no plastic palm, no AMFV pen, no Wishbringer stone, no microscopic space fleet...

Then there were the manuals. Instead of reproducing the original documentation in all its full-color glory, Activision opted for what looks like

cheap Xerox copies, thrown together in reduced size as little paperback books... duh. That's why we're making this page. Infocom deserves better.

This used to be the paragraph where we asked people to not promote our site, for fear of being shut down by Activision. However, we have come to believe that Activision at least tolerates our work here, so we no longer feel a need for too much caution. So go ahead. Post it in newsgroups. Link to it.

Just to clarify: It is not the purpose of this project to damage Activision's Infocom franchise (there doesn't seem to be much left of it lately). We are only trying to do justice to the works of Infocom. The authors of this site have been consistently disappointed by the low-quality, black & white reproductions of the original Infocom documentation in collections such as the Lost Treasures or Masterpieces and have therefore decided it is time for a webpage with high-quality scans of those materials. This site does not carry anything that can be bought from Activision. All it contains is material that, in all likelihood, will never, ever be commercially available again.

Once a work of art has been abandoned, and is in danger of vanishing into oblivion, salvage rights apply. This site is a digital museum. Its exhibits are electronic replicas of some very specific and unique works of art that have touched many people's lives in the 1980s. In digital years, that was centuries ago, much more than the 75 years it takes for copyrights to expire legally. That is why we feel that our site, while technically in violation, does not violate the spirit of copyright law. Copyright laws were never intended to be destructive, only protective. That is what this site is doing: protecting the works of Infocom, both from the ravages of time and from corporate indifference.

David and Julian

C64.com

The drivers for the creation and maintenance of c64.com are similar to those underpinning The Inform Gallery. c64.com is a web-based project dedicated to the preservation of Commodore 64



games and packaging, but also encouraging education around them. The remarkably well produced site, actively updated, is remarkably clear in its motivations - documented in the FAQ.

what is c64.com?

C64.COM exists purely to preserve the culture around the Commodore 64 that might otherwise cease to exist due to the fact that the mainstream computer culture has moved away from the Commodore 64 in the early 1990s. The site contains exclusive material about the Commodore 64 home computer that we all love....We at C64.COM aim to save and store an important part of the history of the people who participated in the active era of the Commodore 64.

The creators of the site self-identify as,

"...a bunch of independent individuals who are C64 enthusiasts (read: geeks by nature :).

C64.COM is our hobby and a project that we maintain on our free time."

This completist, carefully assembled archive is motivated only by a personal affection for the subject.

Whilst it's tempting to dismiss such efforts as nostalgic piracy, the makers of C64.com are clearly focussed on a declared mission of public engagement. Their project is not just to spread software, but *understanding*.



As their FAQ notes.

[1.8] Can't I just download all the software at once?

We don't provide mass downloads of software because it is against our principle of spreading knowledge about C64 software and their authors. We invite you to spend time browsing the database, getting to know the software and the people behind them, and downloading what you like instead of blindly hauling a large stash of files.

The mission here is clearly developed far beyond a popular perception of simple distribution. c64.com, like many other archives, has a clear and declared mandate to spread understanding and appreciation.

Completist but completely separate

In the collections outlined in the preceding pages we can see a range of projects, characterised as much by their difference as their similarities. Whilst all are recognisably preservation and archival projects, apparently all operating within the broad field of videogames, with software, controllers, metadata and contextual materials as their currency – a closer look reveals some fundamental differences.

Collections can be motivated, at their most fundamental level, by a number of different factors. For collaboration and coordination to take place effectively, partners need to be able to understand and negotiate with each others different operational modes and value systems.

We have seen collections driven and sustained by governmental funding. Whilst such collections might enjoy a high level of infrastructure and sustainability, their futures and constraints are often defined by research and cultural policy within a given territory, over which they have influence but not control.

We have seen collections driven and sustained by individual passions where a very personal and sincere love of a platform or piece of software informing an instinct to collect and preserve that wholly disregards any legal frameworks that might surround the object. These collections often enjoy no less comprehensive or well-considered metadata schemas than their counterparts in institutional holdings, yet their contexts and even their ideological frames can make them harder to collaborate with for the academic fraternity.

Whilst many of the efforts aspire to be completist collections of videogames, in many other ways they are completely different. Collaboration needs to extend well beyond simply being able to exchange consistent metadata schemes. If the preservation and interpretation effort is to succeed to its fullest potential, collectors and institutions need to find a means to acknowledge and negotiate the complex set of motivations that sustain each others work.

11. RECOMMENDATIONS

As evidenced by our research with our partners in this project, whilst a huge amount of activity is taking place there remains little coordination between them. This is causing a problem less of International replication as much of the work has a discrete focus within a localised area, but of missed opportunities for enhancing individual work. By leveraging communication and collaboration at a number of different levels, the focus and outcomes of all projects could be greatly enhanced.

This collaboration should be as diverse and inclusive as possible, encompassing not just the public-funded research activities of institutions but also the work of private collectors and organisations. As such, the mode of communication and coordination must be inclusive, positive and meet the task of interpreting the differing motivators and means of operating of all parties engaged in this work. In this way, the international community as a whole will be able to discover new ways of working together and fill in gaps in each others' knowledge and experience.

This paper is aware of the challenges that some institutions will face in engaging with each other. Operating cultures, funding mechanisms, ethical, functional and legislative constraints will often generate frictions in collaboration which might appear insurmountable. Whilst some close collaborations might prove impossible to meaningfully activate, we see it as essential that all parties at least acknowledge and understand the presence of each other on the map of activity.

This paper presents six key strategic recommendations, with suggested actions for implementation following. The presentation of these actions is not intended to imply that individual institutions might not already be pursuing some of them, but that there remains a huge untapped potential for coordination and collaboration.

Recommendations

1. Increase formal international collaboration & networking
2. Coordinate development of efforts to address challenges of existing IP policy on game/digital preservation
3. Audit and map current preservation and exhibition activity
4. Further develop videogames literacy programmes for a broader range of audiences
5. Support and enhance cross-sector dialogue on videogames and culture
6. Further develop and raise awareness of preservation-friendly game development practices.

RECOMMENDATION 1

INCREASE FORMAL INTERNATIONAL COLLABORATION & NETWORKING

Best practice in curation and interpretation needs to be shared in a coordinated way. The potential for international knowledge exchange is vast and largely untapped outside of academic journals.

The means for aggregating, curating and distributing the knowledge and experiences of the varying participants needs to be published in a means that is accessible to all organisations. Whilst academic mailing lists (such as that operated by the International Game Developers Association (IGDA) Game Preservation Special Interest Group) and journals (such as Game Studies and the International Journal of Digital Curation) exist and enjoy rich participation, they are not only focused on game history, heritage and preservation and are not primarily intended for consumption beyond the academy. Similarly, the message boards of enthusiast collectors do not always reach the more specialist institutional audiences.

We think a role exists for a group curated, online publication that can aggregate relevant materials for the community at large and provide a point of focus for discussion.

Additionally, if the community can support it, we suggest using real-time messaging (slack / twitter) to nurture further interest groups and grow relationships. Whilst not suitable for all, such groups can be a powerful site for seeding new collaborations.

ACTIONS

- (inter)national collaboration and networking activity should ideally be facilitated by a national coordinating body in each territory.
- Establish digital networking groups (real-time messaging / slack / twitter) and streaming events to instigate more informal activity.
- Having established working groups, nurture the development of cross-sector events, bringing practitioners into direct contact with each other.

RECOMMENDATION 2

COORDINATE DEVELOPMENT OF EFFORTS TO ADDRESS CHALLENGES OF EXISTING IP POLICY ON GAME/DIGITAL PRESERVATION

Given the complex state of copyright legislation and the paucity of understanding of its application (both from rights-holders and the exhibition/preservation community) it is of little surprise that a clear approach is lacking.

Concepts such as 'abandonware' and a lack of clear understanding around exhibition have led to confusion and to the danger of large projects being based around assumptions of presumed goodwill rather than clear legal agreements.

Stakeholders need to collaborate to address the challenges and restrictions raised by current copyright legislation.

There is a need to document and understand current legislation in IP/copyright as it pertains to game and digital preservation and exhibition work in individual territories. This should draw on experience from other media legislation and practice.

International advocacy groups such as EFGAMP should play a lead role in driving this debate, education and associated lobbying activity.

ACTIONS

- Research and document the current IP arrangements in participating territories.

- Establish resources to advise both rights holders and exhibitors on IP best practice.
- Support, extend and develop the EFGAMP network to co-ordinate reform lobbying across Europe (and beyond) involving a representative collection of stakeholders.

RECOMMENDATION 3

AUDIT AND MAP CURRENT PRESERVATION AND EXHIBITION ACTIVITY

There should exist a definitive repository or map of videogame history projects and collections.

As documented earlier in this paper, this is no shortage of collection, exhibition and cataloguing work in progress around the world. This activity needs to be mapped and collated with emerging processes and established standards shared.

We propose a wide-scale audit of game preservation, curation and collecting activity that will lay the foundations for the coordination of efforts. This audit exercise should act as a catalyst for new collaborations across and between projects, institutions and private collections.

In addition to capturing the holdings of different groups and their cataloguing processes and standards, it is essential that this audit accounts for different institutional/organisation/personal motivations and collecting priorities, funding and sustainability, and the frameworks (e.g. legal, administrative) within which they currently operate.

ACTIONS

- Establish partner groups to coordinate this activity, securing funding to drive this forward.
- This funding should include significant contribution from the current, commercial games sector, creating a formalised stake for the sector in its own historic value.
- This audit should reflect the activity of all kinds of collectors.
- The results of this should be open-access.
- It is crucial that robust, extensible and open cataloguing and metadata schemas are developed alongside this activity.
- The audit should include case studies and documentary materials to aid interpretation.

RECOMMENDATION 4

FURTHER DEVELOP VIDEOGAME LITERACY PROGRAMMES FOR A BROADER RANGE OF AUDIENCES

Since the 2011 Livingstone-Hope 'Next-Gen' review commissioned by NESTA, 'games literacy' has often been conflated with STEM / STEAM studies. Here we use it in a different, but complementary sense. We suggest games literacy is concerned with the understanding and appreciation of games, both in their playing and their making. Furthermore, we see games literacy as being a project that must address multiple audiences. Parents, young people, professionals from other aligned creative industries and the culturally curious general public are key.

It is imperative that a way is found to share and develop the understanding of videogames beyond the worlds of development, academia and 'gamer' culture. There exists an opportunity to explore creating a number of different 'trusted voices' across a variety of different media forms. These might include magazines or broadcast and online media. It is vital that the collective understanding of videogames not be limited to specialists.

This heightened understanding can also lead to increased commercial opportunities as commissioning bodies from other creative sectors grow to understand how they can work with videogames in their respective fields.

Coordination in the development of these efforts, particularly in the avoidance of duplication, would be of enormous benefit.

ACTIONS

- Stakeholders should coordinate where appropriate to develop and deliver further game literacy materials to support their collections and activities. These should address differentiated audiences and their distinct concerns (e.g. potential commissioners, funders, parents, teachers, young people).
- Develop approaches across different media forms in order to maximise reach. These might include periodical magazine/journal, traditional or online broadcast media, podcast, for instance, or combinations thereof.

RECOMMENDATION 5

SUPPORT AND ENHANCE CROSS-SECTOR DIALOGUE ON VIDEOGAMES AND CULTURE

There is an increasing diversity of makers, audiences and applications for videogames outside the mainstream, yet there is an absence of fora within which the games industry and broader creative sectors can communicate. A mutual lack of understanding is leading to missed opportunities. Stakeholders need to proactively conference, network and drive dialogue with one another in order to discover and leverage opportunities for collaboration

Institutions should support and encourage grass-roots organisations already instigating such activities. Strategic activity needs to be coordinated and include representation from a diverse range of stakeholders.

ACTIONS

- Stakeholders should coordinate to create a programme of networking events. These should maintain a regularity such that they can reflect current concerns and begin to create new, persistent organisational links. Where possible, such events should include international representation.
- All activity should be captured and published, feeding into ongoing development and discourse. In turn, this activity could feed the publication activity cited in Recommendation 4 above.
- Any such activity should include diverse representation from all groups.
- Stakeholders should coordinate to create an annual conference of record, with best practice and current thinking are formally recorded and disseminated.

RECOMMENDATION 6

FURTHER DEVELOP AND RAISE AWARENESS OF PRESERVATION-FRIENDLY GAME DEVELOPMENT PRACTICES

An awareness of the importance and value of preservation within the development community of videogames needs to be developed in a number of ways. Whilst some progress has been made in the last few years around acknowledging the cultural value of the work that has been created, this needs supporting with actionable guidance.

Developers and publishers need to be given toolkits to help them preserve the work they have created in sustainable, extensible ways. These might build on the kinds of cultural games literacies espoused in recommendation 4, but importantly extend to providing practical processes that they can implement.

Both in training and in professional practice, we need to encourage game developers to preserve not just their codebase, but other surrounding artefacts and documentation from the process of their work. By creating preservation-friendly development pipelines and processes, the development community can begin to internalise the value of its work and greatly assist in heritage efforts and actively prepare and plan for the future.

ACTIONS

- Identify a preservation framework that will document the range of materials of value in the preservation of videogames. Importantly, extending the scope of these materials beyond the software product to include production ephemera, fan materials, newly created critical reflections, for instance.
- Develop and promote best practice in preservation-friendly game development across practitioners and training providers at all levels.
- Create training tools for use by the professional community to upskill in best-practice in this area.

