

**The Popular Memory Archive: Born Digital Heritage
and the Preservation of Videogame Culture
from the 1980s**

Angela Ndalians, Melanie Swalwell, Helen Stuckey



I. Introduction

The collection and preservation of the “born digital” (artefacts that originate in digital form) has, in recent years, become a growing and significant area of debate. Finally, institutions are beginning to give serious consideration to best practice for digital preservation strategies and the establishment of digital collections. Digital technology emerges and disappears with incredible speed; a once-new piece of hardware or software becomes old and is replaced by the next technological advancement. What happens to videogame software and hardware of the 1980s and 90s? The web browsers, blogs and social media sites and content they once displayed? The artworks that relied on pre-2000 computers to create art? Are these – amongst many other – digital creations fated to be abandoned, becoming only memories of individual experience? Are they to be collected by institutions as defunct objects? Or are they to be preserved and revived using new digital technology? These are but a few of the serious questions facing collecting institutions. The question of who is responsible for collecting, preserving and historicising born digital cultural heritage is a crucial one, as is the issue of best practice – what are the best ways to preserve and make accessible such born digital heritage? The 2013 “UNESCO Charter on the Preservation of the Digital Heritage”¹ attempts to address these issues and provides guidelines for cultural heritage institutions to develop policies about the collection, preservation, dissemination and archival of digital artefacts. The intention is to ensure that born digital materials (including web pages, online-databases, software programs and digital objects in the areas of art, film, architecture and design) do not succumb to the reality of the technical obsolescence and physical decay of digital technologies. The Charter emphasises the need to safeguard this vulnerable, new form of heritage and calls for international consensus as to the strategies that should be adopted to ensure its cultural legacy.

This article addresses this question of born digital cultural heritage by examining one of the most popular digital artefacts of the contemporary era – the videogame. A recent games market report released an

update on global profits for the game industry, which is projected to reach \$137.9 billion in spending by the end of 2018². Yet despite the fact that the game industry is profiting billions of dollars and is hugely successful, it is an ephemeral medium that is very susceptible technological advances. The latest and most cutting-edge game console or videogame today can be very quickly superseded by new game technologies. The “new” becomes “old” and, eventually, defunct. Since their inception computer, or what are now more commonly called videogames, have developed a complex and layered history, which has left its mark on the memories of game players. Yet the dramatic speed with which game technologies (software and hardware) have developed and continue to develop renders game technologies defunct at an exponential rate, to the extent that game fans have become a significant resource for mapping and preserving game history. This article discusses the ambitions of the Popular Memory Archive³, an online exhibition and database created by the authors and a team of academics – including Denies de Vries who was responsible for the technical side of saving the data, the devices and the software – as part of the “Play it Again Project”. The focus is on how the archive collects information, resources and memories from the public about 1980s computer games, which, as cultural objects of this earlier phase of videogame history, are most in danger of being lost to the past.

The Play it Again Project is not situated at the dawn of the computer age but rather at the moment when the computer found its way into the homes and hearts of ordinary people. It is designed to capture the memories of those people who played their way through the era of the first home computers. Play It Again is a game history and preservation project focused on locally-written digital games in 1980s Australia and New Zealand. It is a collaboration with the Australian Centre for the Moving Image (ACMI), the Ngā Taonga Sound & Vision (formerly the New Zealand Film Archive), and the Berlin Computerspiele Museum, and the project was funded as a Linkage Project by the Australian Research Council. In October 2013, we launched the Popular Memory Archive, an online collaborative research portal. The portal provides a way to disseminate some of the team’s research, but importantly, it also provides a mechanism for collecting information, resources and memories from the public about 1980s’ computer games. The ambitions of the Popular Memory Archive are to build resources

for historians of technology and media, as well as the interested public, about this significant moment in computing history. The site provides the means to collect and share the memories of those who lived and played their way through this period. The 2010 “Preserving Virtual Worlds” report identifies the important work of lay historians and their efforts in building online collections, as well as developing tools for emulation and preservation⁴. The report proposes that one of the immediate steps that archives and museums can take to assist in the long term preservation of games is the development of systems that are accessible by, and can accept contributions from, the gaming community. The Popular Memory Archive adopts this strategy and offers one possible model for documenting the cultural memory around early digital games⁵. The archive, in turn, operates in conjunction with the videogame objects as hardware and software that have and are being collected by the Australian Centre for the Moving Image and Ngā Taonga, the New Zealand Archive of Film, Television and Sound. The heritage value and preservation of these videogames are understood both as the collected game consoles and games that are part of the museum collections *and* the cultural memories, collected objects that include video of played games, and history of the game companies and their creators that are part of the Popular Memory Archive.

The Popular Memory Archive is also conceived as a form of exhibition. It addresses the question raised by Henry Lowood, Curator for History of Science and Technology Collections and Film and Media Collections in the Stanford University Libraries, as to whether videogames are artefacts or activity⁶. The site presents the material history of games, their design and their cultures of play. We propose that the Popular Memory Archive’s database structure offers the potential to promote more inclusive exhibition practices through its ability to provide new discursive practices online and support multiple narratives. The Popular Memory Archive utilizes some traditional museum components – combining story metaphors with classification and didactics. Its search interfaces, however, allow content to be accessed in more open and non-hierarchical ways. This structure liberates the work from the representation of a singular curatorial interpretation, supporting the contribution of users and allowing for fragmentary and plural interpretations. In this article we discuss the Popular Memory Archive as a strategy for preserving, exhibiting and documenting the history of ear-

ly digital games. This is based on the premise that there is cultural significance in these early encounters, and that these personal epiphanies and remembrances can contribute to building a better understanding of the cultural value and history games and computing.

II. Play it Again and the Popular Memory Archive

The Popular Memory Archive seeks to balance a history of production, in the specific national contexts of 1980s Australia and New Zealand, with a history of use and reception. In researching the history of production, we sought to compile information on as many locally-produced 1980s games titles as possible. The Play It Again project has identified more than 900 locally-written titles (700+ from Australia and 200+ from New Zealand). From this, the team selected a shortlist of approximately 50 titles which we featured in an online exhibition. The Popular Memory Archive database is designed to support a range of perspectives about these games, providing a wide-ranging source of information about them. The data is categorized and tagged to cater for different themes to be discovered and appended. For example, pathways following games from a particular year, a creator or company, a genre or a platform can be generated. Structured as a database, the archive allows visitors to find their own narrative pathways through the information on display. Where exhibitions in the gallery use spatial narratives juxtaposing objects and grouping them to create relationships and generate stories, the online database provides a series of hypertextual possibilities for building meaning. Their journeys may take them to the arcade game “Dinky Kong” (Perspective Software, 1984), a clone of “Donkey Kong” (Nintendo, 1981) written by Mark Sibby while he was still in high school; or to the ‘true blue’ sports game “Aussie Games” (Beam Software, 1989), which drew on the success of the film *Crocodile Dundee* (1986) by exploiting Australian ‘macho’ stereotypes.

Alternatively, visitors to the archive can explore images of different box art, manuals, tapes and versions of the popular game “The Hobbit” (Beam Software, 1982), which is a classic text adventure game and one of the first major games produced in Australia; or read about the game’s creators, developers and producers; or view a variety of videos of the game being played on different systems; or access the blog entry of Veronika Megler, one of Beam Software’s earliest em-



Box art for "Dinky Kong", Perspective Software, 1984.
Available at:
<http://www.ourdigitalheritage.org/archive/playitagain/games/dinky-kong/>

ployees and co-designer of the huge hit. On her blog entry for Play It Again, Megler describes her astonishment at discovering the impact the game had on players in the 1980s, recounting stories from her encounters with fans who have tracked her down to share their memories⁷. Including the voice of developers and creators adds a further dimension to the experience of these games.

Alongside this online exhibition, we had an associated online program of “events”, in the form of a curated blog with a program of guests which changed monthly. Our selection of game titles for the shortlist was conducted with this unfolding public program of guests in mind, to ensure that particular curatorial themes were illustrated. Curatorial themes included: the work of pioneering companies, including Beam Software (an Australian video game studio founded in 1977 by Alfred Milgrom and Naomi Besen, now Krome Studios); the rise of the ‘bed-room’ coder (software or videogames programmed by amateur coders); local scenes and local themes; legal issues for game archivists; videogame emulation; and a focus on the collector. These curated discussions amongst invited guests have drawn out valuable reflections from them and attracted contributions from others wishing to join the conversation. Other criteria informing our selections of games are: important game designers; formal innovation and pushing technical limits; popular or nationally significant platforms; and consideration of the quality of the games. Selections have been informed by archival research, interviews and conversations with game designers, as well as systems we already have hard and software for. As much as possible, the project focused on a breadth and depth of platforms, themes, and contrasting attributes.

In seeking to understand the rise of the micro-computer and the cultural significance of videogames, the Popular Memory Archive moves its focus beyond a technology history to a history of use and interactions. This is in keeping with Patricia Galloway’s call for the importance of personal knowledge in comprehending personal computing⁸. It also echoes the observation Oudshoorn and Pinch make: “Whereas historians and sociologists of technology have chosen technology as their major topic of analysis, those who do cultural and media studies have focused primarily on users and consumers”⁹. Rather than understanding our object of study – 1980s games – as an archaeological and static object that exists in the past, we instead consider it as a dynamic



A screen shot of the “Aussie Meter” for the sports game “Aussie Games”, Beam Software, 1989, released on Commodore 64 and ZX Spectrum

“The Hobbit”, Beam Software, 1982.

Photo of the Spectrum 48k version, Tape and Manual.

Computer Archaeology Lab, Flinders University.

Available at:

<http://www.ourdigitalheritage.org/archive/playitagain/games/the-hobbit-2/>

form that continues to have a presence in game culture, living on through the energies of retro gamer communities and informing both contemporary game design and player cultures. In brief, the gamers and their interaction with these 1980s videogames are an integral part of the digital cultural heritage of games. The Popular Memory Archive is centrally concerned with making links with a wider audience and connecting historical research into early gaming with those who lived and played their way through this period. The collation of information about selected game titles is intended to drive the program and act as a prompt to elicit participation and materials from audiences.

Videogames are more than inert, digital code. Games theorist James Newman argues that the act of playing a videogame cannot be adequately considered or appreciated without a deep understanding of the ways in which it is enmeshed within and informed by its cultures and communities, all of whom contribute to the collective knowledge of videogame culture¹⁰. Recognising that game culture in the 1980s was highly participatory, hands on, and often characterized by a DIY ethic, the project aspires to create a history of games as they have been used and experienced. We want to hear about what people did with early computers and games: what games they wrote; what these games mean and meant to them, now and then; what records they have; and what difference their involvement with games made. For the duration of the Popular Memory Archive's active life (which came to an end in late 2016) users were able to submit comments, images, video and other files to the site¹¹. Participation was possible through uploading game capture, screenshots, photos, and links to game emulations.

III. Fan Knowledge and its significance for Digital Heritage

Before detailing what the Popular Memory Archive delivered, we need to detour briefly to foreground an earlier (and still ongoing) phase of the research, namely our engagement with fan communities. It was fan communities who, years ago, took the initiative to document and preserve retro games, long before there was any institutional discussion on the cultural value of videogames. Fans have had a significant role to play in taking the initiative to document and preserve videogames – the software, the hardware they were played on, and the memories and experiences of first playing them. Game fans have understood the cultural value of videogames long before universities and

museums began addressing this issue. Operating outside institutional structures, such groups have been able to advance their work with minimal bureaucracy: they are agile, highly focused on what can be niche-fields of inquiry, and able to draw on the combined knowledge of large communities, who operate along gift economy lines¹². Whilst many have also been involved with creating specialised techniques to help with game preservation, it is the collective intelligence that fans have of games that is of most interest to us in this context. Fans have knowledge about the playing of games, the played games and the played with game¹³.

The research team, ACMI and Ngā Taonga recognized that much knowledge about the history of digital games is currently held by the gamer community. Elsewhere, we have reported on interviews conducted with two long time expert fan groups, Lemon64 and World of Spectrum, discussing the potential advantages in collaboration for both the Museum and fan groups¹⁴. The retro gamer site GameBase64 was started by a group of C64 fan enthusiasts from around the world who wanted ‘to preserve the memory of their beloved 8-bit computer for the generations to come’¹⁵. Their aim is to preserve game software written for the Commodore 64 computer before the deterioration of old disks and cassette tapes erases them for ever. GameBase64 have been collecting and archiving the games, as well as cataloguing information about their creators and programmers. With a list of over 24,000 entries, they make clear their reliance on the fan community and its collective knowledge when, on their website, they state ‘we are relying on you, the former Commodore 64 software user, to help us by supplying any bits of new info you might have knowledge of’.

In many instances, the sites include game emulations of older games whose original technology no longer makes them playable. The fan community creates videogame console emulators that allow computing devices to emulate a videogame console’s hardware and play it on a new platform – often directly on a computer. Sites like ‘Emulator Zone’¹⁶ provide information about accessing emulators for a range of old platforms, including GameCube, Nintendo 64, Super Nintendo, Dreamcast, Atari 2600, Amiga and many others. These game communities understood well before public institutions like museums that effective digital heritage and preservation of videogames did not consist of keeping defunct consoles and games on shelves. Rather, the preservation of vide-

ogame heritage should acknowledge the centrality of gamer experiences, memories, and their continued playability. Access to the past is made possible both by making games from the past replayable (which the Popular Memory Archive also did with some games) and through a re-making that relies on the collection of fan and player memories through combinations of fan stories, photographs and videos of game play. Lemon64 follows a similar philosophy, one that informed our methods in the Play It Again project. With over 20 regular contributors who are Commodore64 fans to the core, they have relied on the fan community to fill in the gaps in what is becoming an encyclopaedic collection. Lemon64 began as the project of fan Kim Lemon in 1998, and in 2002 Lemon began contacting software publishers and individuals for permission for the free distribution of their games on the site. It began as a site that archived Commodore 64 games on a single website to meet the needs and interests of a single fan and by 2014 Lemon64 had become one of the most active C64 online communities that relies on thousands of individuals for its continuing presence and ever-expanding knowledge. Through collective input, Lemon64 includes information and images of games, hardware, game covers, original magazine reviews, manuals, music, links or downloads of the games if available, links to other sites, interviews with game developers, and many other goodies. Many of the posts reflect on the importance of the site both in terms preserving past game technology and making it accessible to contemporary players, but also through the forum, helping preserve the memories of players who experienced these games and the hardware that drove them back in the day of their original release; in doing so they give life to the materiality of these experiences. One post by “Sokratekk” from March 2002, for example, states: “You gave birth to this project and now it has its own life, reanimated every day by the people who... visit Lemon64 some times a day. And you can see, there are a lot of 8-bit fans out there – and Lemon64 is their worldwide melting pot”¹⁷.

In considering our approach to exhibiting information about – and seeking to collect documentation of – games, we have looked to the databases created by retro computer game fan sites such as Hall of Light, World of Spectrum and Lemon64. Some of these sites have existed for nearly two decades and have evolved over time, refining their catalogues and the opportunities they present for engagement as the web has grown to support more complex data and more possibilities

for participation. Having engaged in this protracted iterative design process, these sites have produced archives that strive to address the complex nature of videogames and also reflect how an active user community searches and engages with this material. Sites such as these – built around digitally native content by a digital literate community – provide excellent resources, operating as blueprints for memory institutions who are hoping to work with online knowledge communities to develop resources, share information and create a broader community engagement with the history of computing. The Popular Memory Archive generates oral history-like fragmentary recollections from users, whether stimulated by the monthly hosted discussions, or spontaneous reminiscences. Our audience comprises a mix of retrogamers, collectors, game creators, occasional players, and other users who are simply interested in the issues.

Fan discourse emerges from a situated knowledge that is based on lived experience. Fans and players typically understand games as a set of experiences. Retrogamer sites – sometimes motivated by nostalgia and by a personal past with the software and hardware – often frame games in an intimate dialogue. Many retro game sites are platform specific and the romance of particular machines and their idiosyncrasies plays a major role in the hearts and minds of their user communities. We aimed to cultivate this for the archive. For example, the comments that we have received on the Popular Memory Archive in response to a blog post on the infamous “Bruce Lee” scream on the loading tape of Beam Software’s 1985 game “The Way of the Exploding Fist” (WOTEF)¹⁸, focus not just on the game itself, but where people first played the game, the time it took for the tape to load, and even how they played with the game. Stu232 recalls the shock of the loading scream and how he took advantage of the killer leg swipe move which, once mastered, gave the player a noted lead in what was otherwise a very challenging game. His comment is a knowing wink to those players who used this exploit to play through the game.

Looks like I’m not the only one to have been caught out by that fecking scream during the load! <smile> My mate told me to sit close to the TV (apparently the manual advised this – according to my lying friend). I was sipping a glass of cola and all of a sudden



"The Way of the Exploding Fist", Beam Software, 1985,
cover for the Commodore 64 version.

Available at:

[http://www.ourdigitalheritage.org/archive/playitagain/games/
the-way-of-the-exploding-fist-c64/](http://www.ourdigitalheritage.org/archive/playitagain/games/the-way-of-the-exploding-fist-c64/)

that SCREAAAAAAAAAAM happened and my cola went everywhere.
<smile>.

The Popular Memory Archive delivers a context, which is critical for creating an understanding of games for future users and researchers¹⁹. It can be difficult to appreciate the innovation and achievements of early video games as rapid technological change renders the most sophisticated features of 1980s games as crude to contemporary audiences. For example, the revolutionary sense of fluid control that WOTEF offered players through its intuitive mapping of the fight moves to the joystick is lost to a generation raised on the precision and speed of current peripherals. An understanding of both the social and material conditions of the consumption and reception of these early games is difficult to collect, preserve and display. Documenting player memories is one way to approach this dilemma and to record the experience of these games when their technology was state of the art and their designs were breaking new ground, offering new kinds of experiences.

IV. Significance for the Museum

What is the significance of fan collective intelligence and the Popular Memory Archive for the Museum? For some years, Museums have been inquiring how Web 2.0 can be used effectively to provide access and engagement with collections, and there are an increasing number of examples of institutions working with online communities. Galaxy Zoo, for example, invites hundreds of thousands of amateur astronomers to contribute to mapping the obscure corners of the universe. As detailed on the website, maintained and developed by the Citizen Science Alliance (which include partners NASA and Origins), “the CSA works with many academic and other partners around the world to produce projects that use the efforts and ability of volunteers to help scientists and researchers deal with the flood of data that confronts them”. What Galaxy Zoo’s “citizen scientists” contribute to the project is not just data, but, through their forum discussions, they help crowd-source what is significant about the findings²⁰. Fan discourses help to determine cultural value and, in turn, create new modes of measuring cultural value and heritage for the Museum²¹.

In thinking about how to engage with game history, we refer again to the 2010 “Preserving Virtual Worlds” report, which proposes that one of the immediate steps that archives and museums can take to assist in the long term preservation of games is the development of systems that are accessible by, and can accept contributions from, the gaming community. Rather than being informed by a static view of game data preservation, the Popular Memory Archive offers an alternative model for documenting the cultural memory around early digital games. Lisa Gitelman reminds us that “Despite the ubiquity of the phrase raw data... data are always already ‘cooked’ and never entirely ‘raw’”. Raw data “are the starting point for what we know, who we are, and how we communicate. This shared sense of starting with data often leads to an unnoticed assumption that data are transparent, that information is self-evident, the fundamental stuff of truth itself”²². Gitelman posits understanding data “as a matter of disciplines” – from our perspective, that of games – and in doing so, a richer understanding of data as “cooked” phenomena emerges. Rather than being understood as bits of information or “abstract objects useful in the production of knowledge about the past”²³, in this project we reimagine the data we collate as a part of a collective phenomenon that extends to players. Through the collection of player memories we aim to activate this period of gaming history.

Operating online, the Popular Memory Archive already entails a shift beyond the Museum’s historic object focus. But the Popular Memory Archive does much more than this. For instance, to pick up on an earlier point about fans’ passion, passionate voices are engaging in a way that the measured tones of the Museum are not. In examining the effects of “Discussion exhibitions” at the Science Museum, London, Ben Gammon and Xerxes Mazda note that one of the motivations for visitors to read the comment of others is that the emotive language of visitor’s comments is more compelling than the display didactics²⁴. In contrast to the careful neutrality of Museum language, the passion of the retro gamer and fan captures a sense of the lived experience and its importance to the user. Oral histories, even fragments thereof, provide a nuanced and embodied relationship with the work.

V. Conclusions

The Popular Memory Archive is not just trying to reach new online audiences but to activate existing expert audiences whose memories

and skills are needed to understand the games of the 1980s era. Games are, and were, a popular media form, and so it is important to hear the voices of the community who played them. Ideally the Popular Memory Archive reflects how an online exhibition/collection can blend the voices of game designers, players and retro computing hobbyists with those of the museum professional to produce a richer understanding of this era in computer culture and to address strategies for digital cultural heritage. The Popular Memory Archive has the potential to engage the Museum in a more transparent process of meaning making, by placing on display the ambition to allow invested communities to shape narratives, become part of the information exchange, and work to directly build the archives. It also provides rich, contextual content that helps new audiences make connections to these objects.

It is hoped that the online catalogue/exhibition offers more than a traditional static and authoritative catalogue entry reflecting the more discursive, inclusive and questioning practice of exhibition and events²⁵. We feel, however, that the significance of this project is to be found in the very possible scenario where games from this era stop working. Whilst “Play It Again” will be making it possible to play selected games from this era again without needing a sophisticated knowledge of emulators, if and when these games stop working, the Popular Memory Archive will have collected popular memories, together with ephemera, artefacts and other documentation. Whilst these memories may be fragmentary, told in different voices, together with different artefacts and documentation, they will allow future researchers to piece together a sense of what it might have been like to play these games in 1980s Australia and New Zealand. Collecting and displaying memories of gameplay help contemporary audiences understand not just how that technology worked but how interacting with these systems could delight and enthrall their users. Stories of playing computer games are thus important in the history of computing because they speak to the creative and personal relationships users had with the technology.

Notes

1. UNESCO, *UNESCO Charter on the Preservation of the Digital Heritage*.

2. T. Wijman, *Mobile Revenues Account for More Than 50% of the Global Games Market as It Reaches \$137.9 Billion in 2018*, in "Newzoo", April 30, 2018.

3. The Play It Again Project is available at: <http://www.ourdigitalheritage.org/archive/playitagain/>

4. J. P. McDonough et. al., *Preserving Virtual Worlds Final Report*, 2010.

5. H. Stuckey, M. Swalwell, *Retro-Computing Community Sites and the Museum*, in H. Agius and M. Angelides (edited by), *The Handbook of Digital Games*, John Wiley & Sons, Hoboken 2013, pp. 523-547.

6. H. Lowood, "Playing History with Games: Steps towards Historical Archives of Computer Gaming". Lecture presented at *The Annual Meeting of the American Institute for Conservation of Historic and Artistic Works*, Portland, Oregon 2004.

7. V. Megler, *Ruminations on 'The Hobbit', Play It Again... Remembering 1980s Gaming*, March 13, 2014. Available at: <http://www.ourdigitalheritage.org/archive/playitagain/ruminations-on-the-hobbit-fandom/>

8. P. Galloway, *Personal Computers, Microhistory, and Shared Authority:*

Documenting the Inventor – Early Adopter Dialectic, in "IEEE Annals of the History of Computing", vol. XXXIII, n. 2, 2011, pp. 60-74.

9. N. Oudshoorn, T. Pinch, *Introduction: How Users and Non-Users Matter*, in N. Oudshoorn, T. Pinch (edited by), *How Users Matter The CoConstruction of Users and Technology*, The MIT Press, Cambridge (MA) 2003, pp. 1-25.

10. See J. Newman, *(not) Playing Games: Player-Produced Walk-throughs as Archival Documents of Digital Gameplay*", in "The International Journal of Digital Curation", v. 6, n. 2, 2011, pp. 109-127; J. Newman, *Best Before: Videogames, Supersession and Obsolescence*, Routledge, New York - London, 2012; J. Newman, *Playing with Videogames*, Routledge, New York - London 2008.

11. The research team are in the process of continuing a similar project but focusing on 1990s Australian videogames.

12. See H. Jenkins, *Interactive Audiences? The "Collective Intelligence" of Media Fans*, in H. Jenkins, *Fans Bloggers and Gamers Exploring Participatory Culture*, New York University Press, New York 2006, pp. 134-151; A. Ndalians, *Chasing the White Rabbit to Find a White Polar Bear: Lost in Television*, in R. Pearson (edited by). *Reading Lost: Perspectives On A Hit Television Show*, I. B. Tauris, London 2009, pp. 193-310.

13. See, for example, R. Donahue, K. Kraus, *Do You Want to Save Your Progress?: The Role of Professional*

and Player Communities in Preserving Virtual Worlds, in "DHQ: Digital Humanities Quarterly", n. 6, 2012; H. Lowood, *Found Technology: Players as Innovators in the Making of Machinima*, in T. McPherson (edited by), *Digital Youth, Innovation, and the Unexpected*, The MIT Press, Cambridge, 2007, pp. 165-196; J. Newman, *Best Before: Videogames, Supersession and Obsolescence*, Routledge, London - New York 2012.

14. H. Stuckey, M. Swalwell, *Retro-Computing Community Sites and the Museum*, in H. Agius, M. Angelides (edited by), *op. cit.*

15. GameBase64. Available at: <http://www.gb64.com/index.php>.

16. Emulator Zone. Available at: <https://www.emulator-zone.com/>

17. Lemon 64. Available at: <https://www.lemon64.com/>

18. The Way of the Exploding Fist: <http://www.ourdigitalheritage.org/archive/playitagain/games/the-way-of-the-exploding-fist-c64/>

19. J. McDonough et al., *Preserving Virtual Worlds Final Report*, 2010.

20. T. Owens, *Digital Cultural Heritage and the Crowd*, in "Curator: The Museum Journal", vol. LVI, n.1, 2013, pp.121-130.

21. See R. Donahue, K. Kraus, *op. cit.*; K. Kraus, *A Counter-Friction to the Machine: What Game Scholars, Librarians, and Archivists Can Learn from Machinima Makers about User Activism*, in "Journal of Visual Cul-

ture", vol. X, n. 1, 2011, pp. 100-112; J. Newman, *op. cit.*

22. L. Gitelman, *Introduction*, in L. Gitelman (edited by), *"Raw Data" Is an Oxymoron*, The MIT Press, Cambridge 2013, p. 2.

23. *Ibidem*.

24. B. Gammon, X. Mazda, *The Power of the Pencil Renegotiating the Museum Visitor Relationship*, in "Exhibitionist", Fall 2009, pp. 26-33.

25. R. Srinivasan et al., *Digital Museums and Diverse Cultural Knowledge: Moving Past the Traditional Catalog*, in "The Information Society", vol. XXVI, n. 4, 2009, pp. 265-278.