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REFLECTION

A Student's Reflection on the Digital Heritage Lab

Bryony Cavallaro*

Abstract

This is a reflection on my professional placement at Swinburne University's Digital Heritage Lab, exploring the role the lab plays in the preservation of Australian digital artefacts like computer software, video games and media artworks. As technology advances, the lab confronts the challenges posed by obsolete infrastructure, machine dependency, and the fleeting window of opportunity for preservation. The absence of standardised guidelines is addressed through collaborative efforts within the EaaSI (Emulation as a Service Infrastructure) network. My placement provided firsthand experience of the variety of challenges associated with digital preservation, emphasising the need for ongoing experimentation and perseverance in the face of failure. The experience gained from the placement underscores the importance of developing ideas and approaches through practical application in the field of digital archiving.

Keywords: *Digital archives*; *Digital preservation*; *University placement*; *AusEaaSI*; *Emulation as a Service Infrastructure*

With my Master of Information Studies (Charles Sturt University) concluding in 2023, it was time for me to make a pilgrimage to Melbourne for my professional placement. I had the privilege of visiting the Digital Heritage Lab at the Centre for Transformative Media Technologies at Swinburne University under the watchful care of Dr Cynde Moya. While there, I had a crash course in the practicalities of preserving digital artefacts, like computer software, video games, and media artworks. This piece discusses the work the Digital Heritage Lab is doing, and reflects on the relationship between my university coursework and practice in the lab and the value of experimentation and perseverance when tackling technical issues unique to digital preservation.

The Digital Heritage Lab is a paradise for anyone interested in vintage technology. Its shelves are lined end to end with plastic tubs labelled and categorised by type, containing all sorts of connectors, cables, and converters for a variety of hardware. There is a vast array of computers ranging from antiquated Commodore 64, Macintosh and Windows PCs, to older gaming consoles like the Nintendo Gameboy, along with a huge collection of older computer software, floppy disks, cartridges, cassettes, and CD-ROMs containing a variety of digital artefacts by Australian studios and artists (Figure 1). The beauty of the collection cannot be

*Correspondence: Bryony Cavallaro, Email: bryony.cavallaro@sl.nsw.gov.au

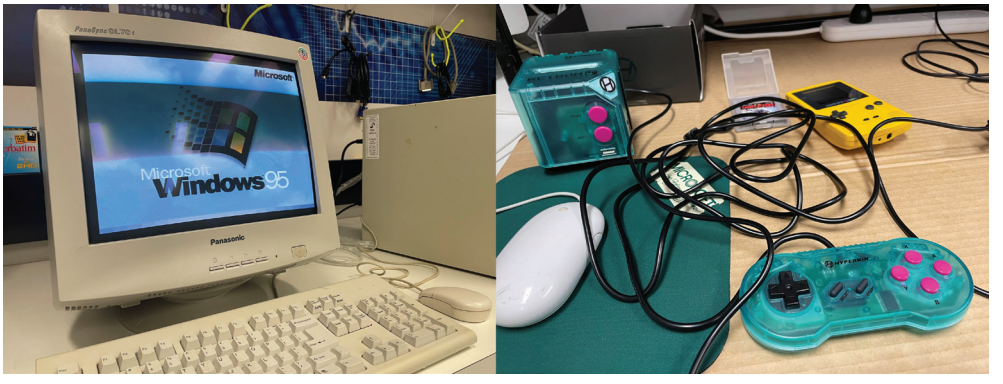

Figure 1. Desktop running Windows 95; and a Gameboy and other equipment in the Digital Heritage Lab. Photos: Bryony Cavallaro.

overstated, and Dr Moya keeps it well-stocked with anything obscure or rare (I was not aware that D15HD Male to Male converters for computers existed before my visit!).

The lab collaborates with memory institutions around Australia. It aims to: develop best practice methods for stabilising and preserving artwork and software; provide emulated access to artworks and software for research purposes; and investigate possibilities to re-display historic media artworks.[1] As technology continues to advance at breakneck speed, older pieces of software like interactive media artworks and vintage video games can quickly become inaccessible to both the public and researchers alike as the hardware required to run them becomes outdated, obsolete, or increasingly difficult to source. A CD-ROM with an artist's work could be scratched or damaged due to dust and poor storage conditions – for example, when kept in someone's home office since the mid-nineties – with the files only accessible on a Windows 95 operating system. Will that artwork therefore be lost, or is there something we as digital archivists can do to save it? The Digital Heritage Lab is in a unique position to offer solutions for researchers with its impressive hardware collection, and onsite staff with extensive knowledge.

The preservation of digital media heritage is a topic that continues to gain traction in Australia. Many libraries and museums are starting to take note of the importance of preserving significant digital artefacts like computer art installations from the nineties or video games developed on Australian soil, making the Digital Heritage Lab's mission, contents, and team particularly important. Many stakeholders, including the Art Gallery of NSW (AGNSW), the Australian Centre for the Moving Image (ACMI), and the State Library of NSW (SLNSW), rely on the assistance of the Digital Heritage Lab for its unique solutions, as well as for training in specific programmes like Applesauce and KryoFlux, both used for imaging floppy disks.

Preserving complex digital artefacts like video games and digital artworks demands knowledge across many different archiving specialities. Staff need to know about everything from collection management to audiovisual archiving. During my placement, the information I ended up applying the most was from the university course I did the previous year on Digital Curation and Preservation. But while I had completed plenty of practical assessments during my degree, covering a variety of library and records management skills – from cataloguing images to creating records management plans for fictional local councils – the practical tasks associated with digital archiving were less robust. I found myself wondering what else could be covered, such as tutorials on navigating antiquated GUIs, or the importance of checksum validation to monitor bit rot (the deterioration of digital data).

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Being on the proverbial 'front line' also had unique challenges, the most obvious being the experimental nature of the work. When practice-based research is conducted on the outer edges of knowledge, there is little to no academic support available, nor is there unanimity on what constitutes 'best practice'. During my placement at the lab, I often found the specific knowledge I needed on internet forums like Reddit, or in YouTube videos from hobbyists. I also often spoke to Dr Moya about her preferences for things such as video quality or frame rate when I captured gameplay, as standards differ between institutions.

My university coursework also put a lot of emphasis on the risks associated with preserving digital data and the unique challenges digital objects present in comparison to their 'analogue' or paper counterparts. This is the idea that you can leave a piece of paper alone in a drawer for 50 years and still retrieve the contents, but the same cannot be said for a USB stick. Where the university took the time to discuss the multitude of problems associated with preserving digital artefacts, the lab spent less time on this and more on practical efforts to come up with solutions. Examples include emulation efforts through Emulation as a Service Infrastructure (EaaSI), disk imaging to capture fragile software, and recording gameplay of vintage games so that at least some semblance of the content is preserved for the future.

I understand that universities are there to provide a foundational understanding of the subjects one is studying, but I was surprised that the lab had such a 'keep trying until it sticks' approach. During my time at university, I read about several major risks unique to preserving digital data, as described by Howell,[2] and Oliver and Harvey,[3] such as:

(1) Physical degradation of the carriers of digital data;
(2) Difficulties accessing digital material due to the required software and hardware being obsolete or updated;
(3) The vulnerability of digital materials to unique perils such as malware infection and equipment failure;
(4) Insufficient resources to ensure preservation over a longer period of time;
(5) Loss of contextual information, making material unintelligible or inaccessible (including loss of password protection and encryption metadata);
(6) A lack of time or skills available to ensure the preservation of digital material;
(7) A lack of recognition of the digital material's value at the time of acquisition, resulting in deletion, loss, or change; and,
(8) A lack of standardised practice, leading to inconsistencies across organisations.

Thinking about the major risks that digital artefacts are vulnerable to, I witnessed some of these being actively addressed in practice at the Digital Heritage Lab.

The first risk relates to digital information's life expectancy based on the integrity of the carriers. This could be the physical degradation of CD-ROMS, floppy disks, or USB sticks, or the accessibility of older internet websites and links. All are susceptible to corruption and wear and tear, in part because these media were designed for obsolescence – the assumption that something newer and better would take their place. The lab circumvents this risk by imaging software to save digital backups that can be accessed via emulators in case of future degradation, as well as keeping the carriers themselves in a controlled environment. Another technique I witnessed was the keeping of multiple copies. If, for example, some data bits on a floppy disk become unreadable, a second copy of the disk may contain the information that was previously lost. Combining the two acts as a kind of 'restoration'.

The second risk I saw being a challenge was machine dependency. The lab is aware that eventually there will be no way to maintain older computers as parts that are no longer manufactured become increasingly sparse, and the implicit knowledge of experienced repairers

is lost. Emulation is one way around the machine dependency concerns facing digital archivists today. The lab had been working with the EaaSI research programme, which acted as a browser-based computer emulator. Originally developed by Yale University Library, EaaSI was funded to link US libraries together, enabling the sharing of computer software across institutions.[4] The Australian Emulation Network, led by Professor Melanie Swalwell, focuses on collecting and providing access to high value collection items from the GLAM sector that require legacy computer environments to be accessed. AusEaaSI aims to have the same decentralised sharing network across Australia and New Zealand memory institutions. A virtual machine copy of past operating systems like Windows 95 or Mac 9.2.1 could be used within a modern browser system to load and access older software. The lab is in contact with 14 memory institutions in both Australia and New Zealand, creating a network of active participants interested in preserving the digital heritage of both countries.

The third challenge the lab is tackling is the short window of opportunity we currently have to preserve these complex digital artefacts. Dr Moya had previously worked for the Living Computer Museum in Seattle, Washington for a decade, and brought with her extensive experience working with vintage computer systems and their software. This knowledge is shared freely with other information professionals across Australia in need of specific advice regarding vintage hardware and software. Regularly communicating and assisting partner institutions allow the lab to emphasise the sense of urgency required to collect and preserve Australian media projects. The Digital Heritage Lab regularly hosts meetings with institutions like the State Library of South Australia, the Australian Computer Museum and the AGNSW to discuss progress on preserving Australia's digital heritage. Knowledge sharing is key.

The fourth challenge is the lack of standardised 'best practice' guidelines on how best to take care of digital artefacts.[5] Prof. Swalwell and Dr Moya are currently working with other cultural institutions in the EaaSI network to develop best practice methods and guidelines so there can be a standard across Australian organisations regarding the preservation and future accessibility of complex digital artefacts. Without the resources of the lab and its team, there is a great risk that many pieces of Australian artwork, software and video games could be lost due to the risks of digital obsolescence that directly affect earlier operating systems like Windows 95 and 98 and outdated technology like floppy disks, CD-ROMS, and old hard drives.

Seeing the labour required to make everything 'work' was a challenge in itself. Prior to my time at the Digital Heritage Lab, I had only read about the theoretical ability to build virtual environments for emulation and compare prior versions of digital artefacts with new copies to manage their preservation. I then had the invaluable opportunity to participate in the full workflow: cleaning a floppy disk, imaging it using Applesauce, and inspecting the information that could have been damaged (bit loss was common); and viewing the image and converting it into a software file to test in emulation. I also helped capture information about the software or game I was imaging which could then be exported into a catalogue for the Australian Computer Museum Society. This kind of 'back end' work in digital preservation was not something I had much knowledge about before coming to the lab. Experiencing the full suite of end-to-end digital preservation through copying and comparing disks reconfirmed aspects of my learning. Taking something that was sitting in someone's garage, cleaning it, and uploading it to EaaSI to allow for the possibility of future research helped me appreciate the idea that access is a key component of understanding information architecture. Preservation does not end with safekeeping – the things preserved also need to be accessible.[6]

Something I did not expect was people's enthusiastic response when they found out about my interest in gaming as a hobby. Growing up, all my friends and family played games, so I assumed that the people I would be working with would also be avid gamers like me (regularly playing games for more than a few hours a week). This was not the case! Game preservation

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as an extension of media archiving was mostly an intellectual and professional pursuit that focused on preserving Australian game history, whether or not those games were classified as 'good' or 'bad'. I never thought my casual skill as a gamer would help Dr Moya and the lab, but I was able to capture native gameplay footage to compare with the emulation project the lab was undertaking with the EaaSI platform.

Overall though, the most valuable thing I learned was perseverance in the face of failure – a valuable life skill for information professionals. The most difficult task Dr Moya challenged me with during my placement was getting a native Windows 95 computer to stream directly onto a modern laptop for a game-play recording for comparison (native versus emulation). I had 'Frankensteined' together a Video Graphics Array (VGA) splitter, an Open-Source Scan Converter (OSSC), a tangle of HDMI cables and a Capture Card setup for a modern laptop. It was the first time I had ever had to assemble something of that magnitude in any professional context (would there ever be a textbook that describes the process of using a VGA splitter for digital archivists, I wondered). Once I had the cables set up, I then had to get the Windows 95 screen captured using Open Broadcaster Software. The best part of the process was experimenting, testing and then writing everything down to see what did and did not work. I was discouraged when all my solutions failed to get the results I was hoping for, but Dr Moya insisted I keep experimenting. I was able to use her and her knowledge of hardware as a sounding board for my ideas and they were all encouraged. Eventually, after a day and a half of attempts, I got it working and could make the recording we needed. This was an incredible breakthrough, as the lab required recordings to compare native Windows 95 footage to emulated software through EaaSI. I felt like I had made a genuine difference.

The placement with the Digital Heritage Lab was indispensable in my personal development as an information professional. I received hands-on experience with equipment and techniques currently used within GLAM institutions and was able to meet and talk with information professionals like Dr Moya and Prof. Swalwell to discuss where I would like to go in my career. The skills I learned during my short period at the lab led to an employment opportunity with the SLNSW, where I used the skills I acquired imaging CD-ROMS and floppy disks in my day-to-day work, preserving digital objects from the library's collection.

Although the academic knowledge I had gained during my university degree set a solid bedrock of archival theory, it was the practical work of experimenting – and failing – that I found more beneficial in the end. The same could be said for the wider field of digital archiving, where practical testing and experimentation remain central to the pursuit of preserving digital artefacts.

Notes on contributor

Bryony Cavallaro is currently working as a Digital Archives Assistant at the State Library of NSW while finishing her Master of Information Studies at Charles Sturt University. She is passionate about finding long-term solutions to preserving complex digital artefacts, like video games, and contributing to the development of digital preservation practice in Australia.

Notes

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