Computers as Historical Artefacts

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Computers pose a problem for traditional collection based museums in a number of ways, not the least because unlike other artefacts, one of the definitive aspects of a computer is not ‘object’.

To really understand the computer and to preserve its essence, we need to consider the software, programs and data. But to do so usually implies that machines must restored to working order. The extraordinary rate of development and subsequent obsolescence, instability of some electronic and computer components, and availability of system specific expertise, all contribute a reluctance by museums to take this approach.

A partial solution to this problem may come from a non traditional approach that draws on a unique feature of the computer itself.

1. GENERAL

The first computers were brought into the Museum of Arts and Applied Sciences in the late 1960s by the then curator of electronics, Mr Jeff Sergel.

While records show that Jeff was considering computing as a field and activity with its own history, at the time, the prevailing collecting model and interpretative strategy within the museum was primarily one concerned with illustrating evolutionary developments in various categories of machines. Computers, largely understood to be programmable calculators, were regarded as the latest expression of electronic technology, which had already brought us, amongst other things, radio and television.

In 1967, the University of Sydney contacted the Museum of Arts and Applied Sciences to determine if the Museum was interested in acquiring a computer known as SILLIAC into the collection.

Built in the Basser Department of Computing Science at Sydney University, SILLIAC was launched in 1956 and was Australia’s second computer (the first being CSIRAC built by the CSIRO Division of Radio Physics in the late 1940s). It was very large – it filled a room.

SILLIAC was involved in a number of different important scientific projects (in such fields as nuclear physics, astronomy, X-ray crystallography) and was used to train many of the first generation of Australian computer programmers.

Somewhat to the dismay of Mr Sergel, his proposal to acquire SILLIAC was rejected by the Museum’s Senior Management on the grounds of insufficient suitable storage space.

Unable to find a ‘home’ anywhere else for SILLIAC, on 17 May, 1968 the Basser Department of Computer Science held a decommissioning party. After a ceremonious last chilling of the beers in the heat exchanger (a practice the night operators liked to
pretend was a secret) those present were offered the chance to souvenir pieces of SILLIAC as it was disassembled.

I have been collecting what fragments I can ever since but will never be able to reassemble SILLIAC.

2. UNCERTAIN BEGINNINGS
It is often suggested that mechanical technologies like looms, steam engines or internal combustion engines, simply through the relationship of their parts, are inherently expressive of their own functions. By comparison, electronic equipment is regarded as unfathomable to the uninitiated, computers thought to offer the museum visitor little concerning their purpose, how they works or even about their culture of origin.

At a time when the importance of computing was only just being recognised, SILLIAC would perhaps have been seen to not offer enough in return for dealing with its formidable size. Would it mean anything to anyone other than programmers and physicists? It was, after all, just a collection of large grey cabinets.

As a comparative note: in the late 1800s London’s Science Museum rejected a Boulton and Watt engine offered to them from Whitworths’ Brewery – the very same engine now on display in the Powerhouse. Why did the Science Museum turn the offer down? Not enough storage space.

Over one hundred years later, that Boulton and Watt is the oldest intact and working rotating beam engine in the world. This heroic mechanical device with its meditative, regular and ponderous movement is now the Powerhouse Museum’s pride and joy. As a visitor it is possible to literally see how the steam engine works, its importance as a piece of technology and the way steam engines impacted on human society has become embodied in its physicality.

Computers, are newcomers to the technological landscape, and in stark contrast to the Boulton and Watt, seem to give few clues as to their nature and meaning: a state compounded by their disposability. In the way that computers are made to be, and believed to be, quickly obsolete, it seems that they do not have time to become interesting, to speak of their past and place, before they are consigned to the scrap heap.

Even today when we acknowledge that computers and information technologies are the defining technology of our age, we are often unable to imagine that an old computer has any value beyond its ability to carry out the purpose for which it was purchased. The obsolete machine then, having been deemed no long suitable to that purpose – and unable to be sold – is deemed to have no value. Or because it takes up valuable space it has negative value. It has assumed the economic status of rubbish.

British social scientist Michael Thompson discusses the phenomenon whereby objects, especially mass produced objects, have a life cycle consisting of three phases – the Transient phase where value decreases, the Rubbish phase where object have no value, and in some cases where an object survives the Rubbish phase, the Durable phases where value increase. Fortunately the value of our Bolton and Watt Engine was recognised by one of our first Trustees, Archibald Liversidge.

A number of possible circumstances can contribute to an object surviving the rubbish phase. But I think that one of the major issues confronting computers is that the rapid obsolescence and culture of disposability (largely market driven) consigns them to the rubbish phase before any such circumstance can postpone the trip to the dump.

![Figure 2. Early computer demonstrations at the Museum were conducted on an IBM 360 mainframe by Mr Jeff Sergel](image)

3. A CHANGE OF PERSPECTIVE
In the early 1980s, when the Powerhouse Museum project got underway, an exhibition about computing was deemed to be essential for a new modern interactive museum. During this period there was also a shift in the curatorial approach to the history of technology. The organising principle for the collecting and interpreting of technology, shifted more toward human practice and away from technological evolution.

The computing exhibition “The Information Machine” opened in 1988 with the new Powerhouse Museum. As well as detailing transformations from valve to integrated circuits, from mainframe to micros, and illustrating the fabrication of the microelectronic circuit, it endeavoured to explore how people used computers and the likely impact of computers on various human activities. This meant that we had to come to terms with
the other aspect internal to the computer – software: programs and data.

It wasn’t until we were considering how we might improve on the Information Machine that we came to realise that to understand the nature of a computer you need to look not inside the case, but into the screen. It was not so much a matter of ‘how it works’ but ‘what it does’.

In 1990, the shift in our approach to understanding of histories and preservation of technology was reflected in new collection policies and practices. The process of acquisition became much more rigorous with curators being required to consider significance from a number of perspectives and to collect as much contextual material as possible. This might include manuals, maintenance registers, and documents relating to purchase, testimony of designers, maker or uses, packaging and advertising material.

Along with some of the computers we had acquired we also collected punched cards or punched tape, disk platters, floppy disks, or magnetic tapes, acknowledging that storage media are important components of the computer. But we also knew that it was likely that there was information stored on the various media which would be highly desirable contextual material.

As we considered this matter of software as contextual material further (we were not the only museum to be pondering this question) it became clear to us that software is more than just contextual material associated with the technology. In many respects, it’s the software that is definitive of the computer – in that it’s the software that lets the computer do what it does. Perhaps its more appropriate to consider the hardware as contextual in relation to the software.

Either way as Doron Swade, former Senior Curator of Computing and Control at the Science Museum puts it “Software represents a substantial human endeavour and the intellectual, economic and material resource involved in its production and distribution represent a major technological movement.” Considered from this perspective, we felt we needed to start to extend our curatorial practice to recovering, collecting and preserving software.

As collectors of artifacts however we found ourselves struggling with the very nature of software. What is a computer program? Where is it? How do you access it? Is it the source code? Is it a program listing? Is it a runtime copy? Does that mean anything unless it is being run?

As we sought answers to these questions we found we had stumbled onto a dilemma already being anxiously considered by other institutions. It is a problem variously recognised by record managers, archivists and librarians the world over as the “machine readable records problem” or the more recently the “digital records problem” and it concerns the longevity of, and access to, (usually) digital information, both data and programs, as it is commonly agreed that the working life of digital media is rarely more than 25 years, often much less.

4. TODAY'S DILEMA

In the Powerhouse Museum’s collection there is a small Sumerian clay tablet. It is a receipt issued to Alulu for five sheep, one lamb and four grass-fed male kids to be used for a royal offering. The tablet is dated to the eleventh month of the sixth year of Amar-Sin of the Third Dynasty of Ur. 2041 BC.

This information is registered in the clay as cuneiform, a script that was developed by the Sumerians in the fifth millennium BC and was used in various forms for four millennia. The marks created by the wedge shaped stylus of the scribe can still be seen clearly, some 4000 years on, and thanks to our knowledge of cuneiform, it is possible to still decipher this record of life in Mesopotamia.

What information legacy is being left now for generations 4000 years hence?

Figure 3. A receipt to Alulu

Unlike marks on a clay tablet, contemporary computer programs and data exist as trains of ones and zeroes and are held as a series of differences in a magnetic field or changes in reflexivity on a CD ROM/DVD. As ones and zeroes, they provide no clue as to their meaning, and where the data is stored on magnetic or optical tapes it is not even possible to see the ones and zeroes to decode it.
To read that data, there is no other method than to have the machine that was purpose built to read the specific piece of program and/or data. It is unlikely that the machine will be made available, in working order, a mere 25 years later.

Having working hardware is not the total solution however. Ones and zeroes can be words, pictures, motion picture or hyper media (combination of media), or program code. Often the only way to retrieve the full meaning of that data is to play it in the context of the document that confirmed it: i.e. a word document created in Word version x needs Word version x or some similar version to read it. Access to the data can be further restricted if that version of Word is only compatible with certain operating systems which are in turn compatible with only certain hardware platforms. Remember also storage devices need the accompanying device drivers - yet another piece of information - more code.

Keep in mind that the storage media themselves are very fragile. Magnet media such as disk and tape are considered unreliable after 15 year and despite the claims for CD ROMs of 50 to 100 (based on accelerated tests) many are faulty within two years.

Currently, within various institutions’ Records and Archive departments there are a number of strategies being promoted to safeguard digital data, including keeping hard copies of documents, relying on standards, migration (converting programs and data on a new platform) and establishing museums of working computers. But as Jeff Rothenberg from the Rand Corporation has pointed out, none of these is in anyway a satisfactory solution.

Hard copies are a strategy for retaining some information but do not actually preserve digital documents hypertext document or a program. Standards, while seemingly providing a solution, are in practice undermined by the desire of different vendors to distinguish their product and the paradigmatic nature of changes to information technologies. Migration, which is often the fall back position at the last minute, is always an expensive and troubled path.

So what about the working computer museum? Perhaps technology museums can preserve our computer heritage and offer a service to records managers, archivists and librarians.

In the United Kingdom in the early 1990s, The Computer Conservation Society, founded by the Science Museum and the British Computer Society, successfully restored and ran a Ferranti Pegasus, a first generation computer from 1958. (A Ferranti machine was used to test the designs of the Sydney Opera House, the construction of which would not have been possible without the use of computers). Unfortunately running the computer damaged the restoration work. To preserve the computer they had to turn it off. To conclude the experiment they documented the working computer on videotape and created a simulation running on a more modern computer. As the Science Museums (then) Senior Curator of Computing and Control Doran Swade commented at the time, “at best such ventures can only extend the operational life of obsolete systems’. A view supported by Rothenberg who says that “it is unlikely that old machines could be kept running indefinitely at any reasonable cost…”

Will the Powerhouse Museum have failed in its charter if it cannot preserve the non-material culture – the software and the use of the software - of the computing/digital age? To me it is still a source of anxiety, but it may not be a problem that can be solved using a traditional museum approach.

It seems that at least part of the solution could come from the computer itself, in its capacity for one computer to pretend to be another. This idea is embodied in the fundamental theory of computing as put forward by Alan Turing, the computer as a universal machine.

An alternative to keeping physical machines to run heritage software is to use emulators. Quoting Marat Fayzullin, “Emulation is an attempt to imitate the internal design of a device” …as apposed to simulation which is “…an attempt to imitate functions of a device. For example, a program imitating the Pacman arcade hardware and running real Pacman ROM on it is an emulator. A Pacman game written for your computer but using graphics similar to the real arcade is a simulator.”

While this does pose the obvious problem of having to re-write the emulators every time there is a new generation of computers, it is conceivable that we will...
be able to have programs capable of generating new
emulators automatically.

In 1996 at conference in Melbourne to celebrate the
CSIRAC’s 40th anniversary in Melbourne, Professor
Marcus Wigan from Monash University, suggested that
the best way for museums to tackle the preservation of
obsolete computers and their software, was to share the
load. Each museum or anybody who wanted to
contribute for that matter could nominate which systems
they felt they could afford to support. They could then
gather all the technical information on the system and
make this information available on the Internet, as well
as undertaking to build emulators and distribute.6

This process is already occurring with early PC
enthusiasts and vintage gamers. In 1999, we wanted to
run an old TRS-80 program called “The Dancing
Demon”, in a new exhibition. We tried at first to use a
TRS-80 but found it to be far too unreliable for the
rigors of public exhibition. Instead we hid a Pentium
machine inside the TRS-80 case and ran an emulator on
the Pentium.

![Figure 5 The Dancing Demon](image)

Most commentators now agree that the biggest mistake
is to imaging that there is a single solution to this
problem and that for now the best strategy is to be
judicious in what you want to try and keep and to
carefully consider the range of possibilities that are
available now. I think that Professor Wigan’s idea of an
internet-based coordinated global network of museums
and others sharing the responsibility of preserving
important software is worth considering more closely.
And while we may not be able to provide a final
solution we may at least be able to hand something to
the next generation.

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