Institutional Nostalgia – Museum Victoria's Cabinet of Computing Curiosities

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Abstract: Museum Victoria has a significant collection of objects that could be described as 'computing curiosities'. Undoubtedly, its most important exhibit is CSIRAC (formerly CSIR Mk1), which was the world's fourth electronic digital computer and the only remaining intact first generation computer in the world. The collection of computers and related items, including calculators, range in date from before CSIRAC (1949) to the iPad. This article examines some of these items, what they did and how they were used at the time.

Keywords: History, electronic digital computers, analogue computers, museum collections

1. If you go down ...

... to the lower ground floor of Melbourne Museum[1], you're sure of a room sized surprise: there displayed is the only intact first generation electronic stored program computer left on the planet. Named CSIRAC[2], it was the fourth ever made and the first computer in Australia[3].

While you watch the video presentation beside the display, people pass by, some even stop. A parent might point out to their child: "*That's the first computer in Australia – it's as big as a room*". The child might ask "*Is that the screen?*" or "*What was it used for?*" The parent will mumble something or quickly read a label before chasing after the kids on the way to the dinosaurs or the cafeteria.

Later, a lone male spends a lot of time at the display. Then his partner appears and the mono-nostalgia-logue begins: "*You remember how I stuck with DOS right up until Windows 3.0 came out in '90. I was sold and then 3.1 came out in, I think, 92, wow! It*

[1] Melbourne Museum (http://museumvictoria.com.au/melbournemuseum/) is located in Carlton Gardens, Melbourne, Victoria.
[2] CSIRAC stands for Commonwealth Scientific (and) Industrial Research (organisation) Automatic Computer.
[3] CSIRAC operated from 1949 to 1964.

was miles better. You know ... looking at this thing ... those punch cards[4] *... St Kilda Road ... the building's gone now I think ... near the Barracks. . . and dropping them ... you had to go back to the end of the queue ...*"

Museum Victoria has a historical collection of computers and related items dating from before CSIRAC to the iPad. This article will present a very few of those objects. Hopefully, you will experience an emotion somewhere in between the range bookended by the two situations described above.

2. A Treasure Chest for Posterity

The Museum's database contains over 4,400 computer related records, covering items such as hardware, a variety of media holding software and data, manuals, program listing, reference material, diagrams – block, logical, schematic, timing and mechanical, sales brochures, promotional material, correspondence, office records such as tenders and acquisitions, oral and written histories, and correspondence.

Other historical technological collections include telegraphy, telephony, radio, television, electronics, calculating technology, playback and recording, and printing including typewriting, writing, copying and duplication.

All these collections could not have been built up if it were not for the close partnership with experts and organisations outside the Museum, as well as volunteers. This is especially true for the computer collection; the Museum has worked closely with the University of Melbourne's CSIRAC History Team, which includes former CSIRAC staff and users. Again, working with the Macintosh Internet User Group, the Museum has collected over 200 items that embody the story of Apple Computer Inc.

2.1 Collections on-line

At the moment of writing, very little of the collection is on display, but there is an on-going project to put much online (http://museumvictoria.com.au /collections/).

3. Do You Remember the War?

In the early days of electronic computing, there was rivalry between digital and analogue computing. There was no certainty as to which type of electronic computer would be dominant or that one type would dominate the other.

Analogue computers were easier to program and were faster in solving certain classes of problems. This type of computer uses physical quantities as an analogue of mathematical quantities. The Phillips Analogue Computer, for example, used water to model financial liquidity (literally!).

Advances in electronics were not biased towards one form of computing or the other. Electronics made digital electronic computers practicable, while enabling

[4] CSIRAC used paper tape for most of its life; punch cards were only used in the beginning. The reference to cards reflects the fact that many more people remember punch cards.

analogue computers to use electrical voltage to represent and manipulate mathematical values.

Analogue computers provided a particularly easy way of performing integration and thus they were readily used for solving differential equations arising from dynamic systems in areas such as circuit design, chemical reactions kinetics, chemical plant simulation and structural analysis, automotive, aircraft or spacecraft design, and electrical power grid modelling. (Museum Victoria 2011c). Analogue computers also provided a more direct hands-on approach to investigating system variables and more direct continuous graphical output of results.

However, with later advances in the ability to store and manipulate information in digital form, digital computers won the contest.

3.1 The last of the first: CSIRAC, 1949-1964[5]

The CSIR Mk1 (later CSIRAC) was built by Trevor Pearcey and Maston Beard and became operational in 1949. It was Australia's first stored-program computer, and the world's fourth, being used at the CSIRO (Commonwealth Scientific and Industrial Research Organisation) Division of Radiophysics in the University of Sydney and, from 1955 at the University of Melbourne until 1964 (Pearcey 1988). In 1951, CSIRAC was the first computer ever to play music[6].

Figure 1: CSIRAC and Trevor Pearcey
Photo courtesy of Museum Victoria

[5] 'The last of the first' is the title of a very comprehensive book about CSIRAC, compiled by Peter Thorne and Doug McCann, published by the University of Melbourne.

[6] The project to resurrect he music of CSIRAC is fully detailed in the book by Paul Doornbusch entitled 'The Music of CSIRAC' (Doornbusch 2005).

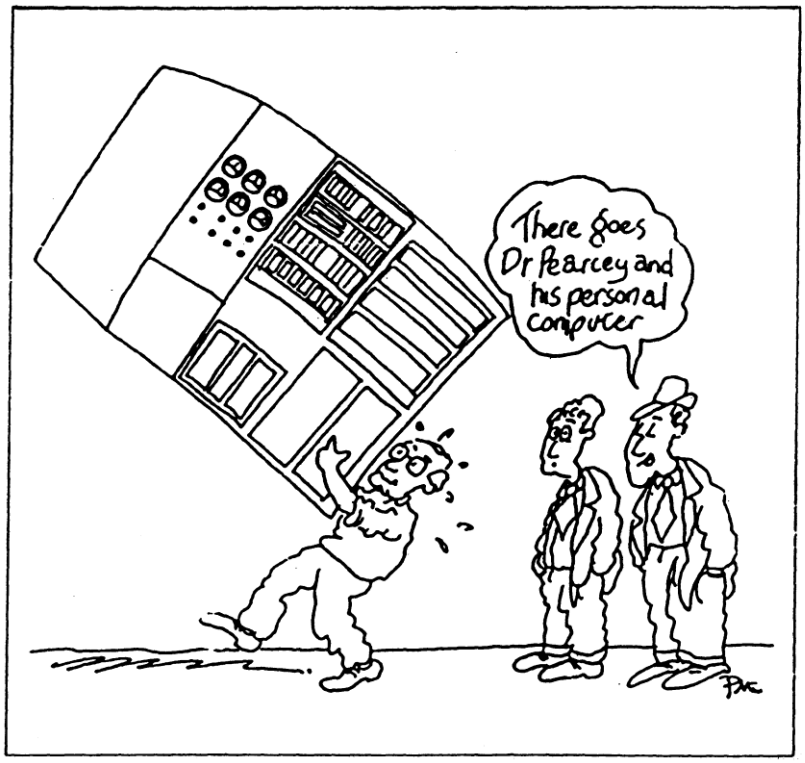

Figure 2: Cartoon of CSIRAC and Trevor Pearcey, 1992 (ACS Victorian Bulletin)
Picture courtesy of Museum Victoria

At Melbourne, CSIRAC provided a computing service for science and industry, operating for approximately 30,000 hours and tackling around 700 projects. These included calculations for weather forecasting, forestry, loan repayments, building design, psychological research and electricity supply.

CSIRAC used mercury delay line storage with a total capacity of 1024 words and an access time of 10 milliseconds. Programs were stored and loaded on paper tape and the operator, who was often the programmer, commanded a bank of switches, which had to be manipulated during program execution.

After being decommissioned, CSIRAC was immediately donated to Museum Victoria. It was already recognised as an icon as it had been in service since 1949. (McCann and Thorne 2000).

3.2 Getting into Gear; Automatic Totalisators and Bombing Computers

The first automatic totalisator system was invented in 1913 by George Julius (1873-1946). It was set up at Ellerslie Racecourse, New Zealand. Julius established Automatic Totalisators Ltd. (A.T.L) to manufacture and successfully market the machine around the world. The last one, in London, was switched off in 1987.

Museum Victoria has parts from two different totalisators, which employed electromechanical switching. One is an electromechanical calculating machine, manufactured by Automatic Totalisators Ltd of Sydney, Australia, circa 1926. Known as the 'Julius Horse Adder', the totalisator was installed in the Mentone Race Club, Victoria, where it remained in use until its closure. From 1947 it was used at the Ipswich Amateur Turf Club, Queensland, until the machine was phased out in 1978.

Museum Victoria also has two electromechanical bombsight computers (sic)[7], designed by H&B Precision Engineers, Manchester for use with bombsights in Canberra jet bombers; one for use in the T4 Canberra bomber (1952) and the other for the Mark 8 279 bombsight (1959) (Museum Victoria 2011a). Both were manufactured for the Royal Australian Air force.

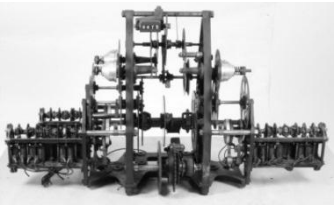

Figure 3: Section of gearing from a totalisator installation. Believed to be part of the first Melbourne totalisator, 1931

Figure 4: Electro-mechanical Totalisator: 'Julius Horse Adder', c 1926

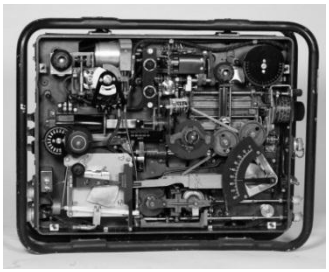

Figure 5: Bombsight computer

Photos courtesy of Museum Victoria

3.3 Establishing the Grid: the Westinghouse Network Analyser, 1950

The State Electricity Commission of Victoria (SECV) used an analogue computer, the Network Analyser, for the development of the Victorian Power System from 1950 into the 1960s.

In the 1950s, population and industry expanded in Australia and the standard of living also rose. The SECV responded by developing a grid system, as previously each population and industrial centre had been supplied independently.

The Network Analyser was used to model the connection between the Latrobe Valley and Melbourne and from Melbourne to NSW as the development of complex power systems was too difficult and time consuming to do using hand calculators. (Museum Victoria 2001).

The Analyser had some advantages over digital devices; it used a step-by-step process in which designers could develop an overall understanding of the system being modelled. With an electronic computer, the whole network was produced in one stage and the designers then had to unravel it. The Analyser played a vital role in the

[7] Electromechanical devices are sometimes called computers or computors. The term 'computer' is currently used to describe a stored program electronic machine; the first one being the 'Baby', which ran a program for the first time in 1948.

power grid, which was the actual basis of everyday life in Victoria and Australia since. Water and sewerage grids were also established using non-digital technology.

An announcement in the Melbourne Argue newspaper at the time (The Argus 1950) spoke of the Network Analyser as an 'electric brain' costing £40,000:

> *"An 'electric brain', the only one of its kind in the British Empire, will arrive in Australia in four months for the State Electricity Commission. It can solve in a few days electrical problems associated with complicated power systems which would take two skilled electrical engineers a year to work out. Technicians simply feed in the data and the machine supplies the answers."*

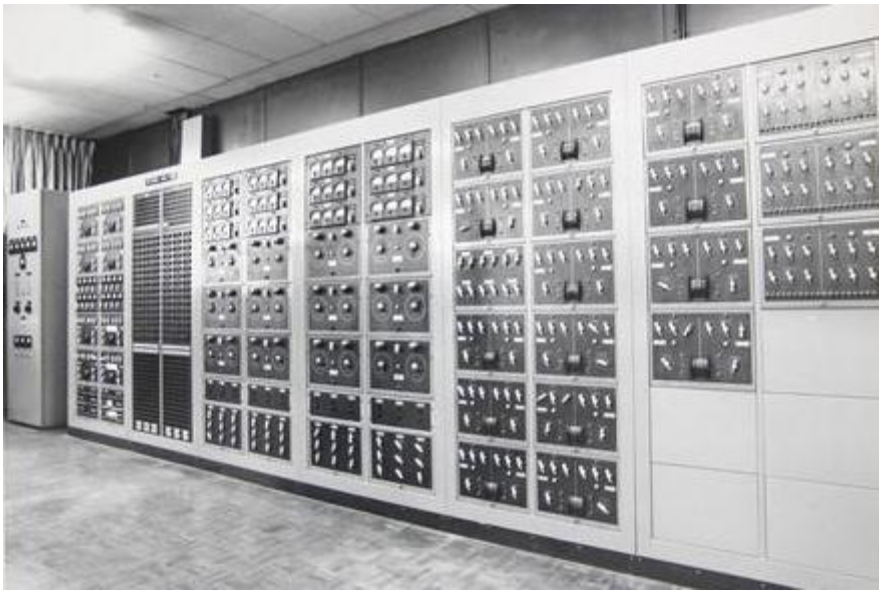

Figure 6: Network Analyser – Westinghouse Electric Corporation
Photo courtesy of Museum Victoria

3.4 Comparing Potentials – the Melbourne University Dual Package Analogue Computer (MUDPAC), 1961 – 1986

This analogue computer was principally used for the solution of engineering problems, for designing control systems and modelling large scale dynamic systems, by the Electrical Engineering Department at Melbourne University; it cost $70,000 (University of Melbourne 2004).

It consisted of two consoles with patch-boards and used vacuum tubes. It was in fact two computers, which could be used separately or together. When the two consoles were wired together, they provided more processing power. Output was mainly on strip-charts and sometimes on oscilloscopes. Problems to be solved by means of patch cords on a 1632-hole removable patch-board. (Museum Victoria 2011c).

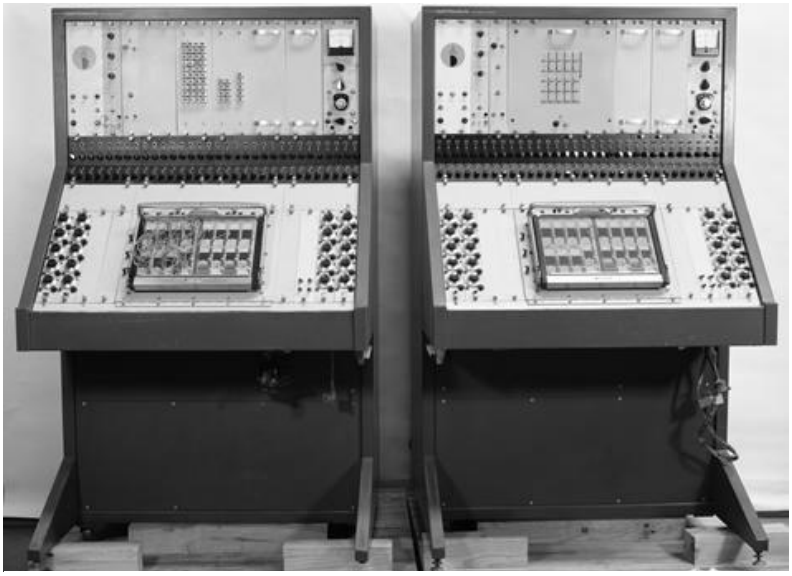

Figure 7: MUDPAC Analogue Computer
Photo courtesy of Museum Victoria

4. Squeezing More and More Into Less and Less

The first generation of computers were huge and operated using electronic valves. The term ‘mainframe’ originally referred to the large cabinets housing the central processing unit and main memory of early computers. They were installed in special rooms of their own**.**

The second generation of computers (mid-1950s to mid-1960s) processed data both in real-time and in batches. With the coming of miniaturisation; some computers left their dedicated spaces and entered the office.

Third generation computers (mid-1960s to present) excelled at multiprocessing and multiprogramming. This is the time when large machines were joined by the personal computer. The true power was soon hidden away in servers; mainframes also became smaller and more compact, even if some, the supercomputers, still occupied whole floors.

4.1 The Baby grows up: the Ferranti Sirius, 1961

The Ferranti Mark 1, probably the world’s first commercially available general-purpose computer, was produced in 1961 in partnership with Manchester University, based on the university’s development of the very first electronic stored program computer – the Manchester ‘Baby’, in 1948. (Computer History Museum 2012).

The Ferranti Sirius is a small business computer, designed to be used in a normal office environment.

The Sirius had sufficient versatility, speed and reliability to carry out the requirements of a wide range of organisations that, did not require the larger installations needed by mainframes. Sirius' reduced physical size and increased capacity was due to the development of miniaturisation as well as the increasing sophistication of the computer industry.

Figure 8: Ferranti Sirius (section)
Photo courtesy of Museum Victoria, the computer is in the Museum's Science Works Store

4.2 Networking: the Control Data Model 3200, 1964

The Museum's CDC 3200 computer represents the early period of the adoption of digital technology by Australia by institutions such as Universities. It also symbolises the early stages of the development of computer networks in Australia.

Figure 9: Disk drive; part of a Control Data model 3200 computer system
Photo courtesy of Museum Victoria

Control Data Corporation and CDC 3200 computers played a vital part in the setting up of two major computer networks at a time where there was no such term as computer network; (the first internet-type networks were developed in the late 1960s and early 1970s). The network covered Adelaide, Sydney and Melbourne.

CDC3200 computers were used by the Bureau of Census and Statistics to carry out a business data processing operation. The CSIRO employed the CDC3200 to provide a scientific computing service to its forty or so divisions as well as engaging in computing research.

The machine in the Museum's collection was used by academic and administrative staff, and students at Monash University in the 1960s. It was operational from 1964 to 1979; it had replaced a Sirius computer (Museum Victoria 2012a).

4.3 Making the transition: Pacific Data Systems PDS 1020 Mini Desktop, 1964

A large desktop console, this machine is an example of the transition from floor mounted computers with work stations (minicomputers, for example the IBM System 3) to microcomputers with the standard configuration of box, screen, keyboard and later, mouse.

It used paper tape for data and program input, took about half an hour to warm up, and was built completely with solid-state circuitry.

The PDS 1020 was described by the manufacturer as an engineering digital computer that combined slide-rule convenience and calculator simplicity with the versatility and capacity of the modern general purpose digital computer. It could be used to solve a broad spectrum of engineering problems (Museum Victoria 2012c).

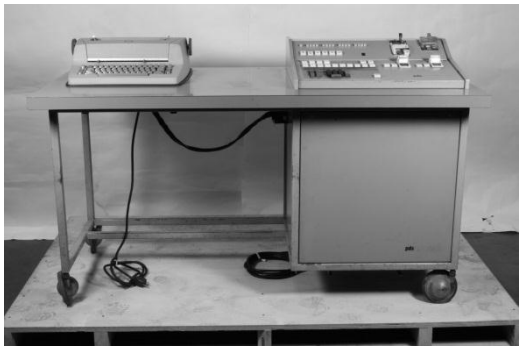

Figure 10: Pacific Data Systems PDS 1020 mini desktop computer.Desktop with typewriter and paper tape input/output
Photo courtesy of Museum Victoria

The PDS 1020 employed a delay line memory. Delay line memories were used in early computers such as CSIRAC, and were an important technological development from World War II.

4.4 In the pink: the IBM System 3, 1975

The IBM System 3 computer is intermediate in size and capacity between mainframe and minicomputers. The computing system was designed to look attractive in an office while having near to mainframe potential. This computer was used for accounts and scheduling by City of Camberwell.

Figure 11: IBM System 3
Photo courtesy of Museum Victoria

Fashion was one reason why this computer system was acquired by the Museum; note the distinctive pink colour (Museum Victoria 2012b).

This computer system is typical of the period around the 1970s when firms started to target the computing needs of small businesses, machines being designed to fit into an office environment rather than requiring a room of their own as did mainframes. Up to that time, people expected computers in neutral colours, for example, IBM machines were given neutral colours such as beige. However, some people found the pink to be disconcerting.

5. Getting More PC – the Return of Hands-On

The first generation computers were definitely hands-on; they needed a lot of human input, even when they were running programs. The arrival of the PC returned the control and power back to the digits.

5.1 Heralding changes: the IBM Model 1130, 1968

When released in 1965, the IBM 1130 computer system was IBM's lowest cost system and was intended for the technical and engineering market. A large desktop console, this machine is an example of the transition from floor mounted computers with workstations (minicomputers, e.g. the IBM System 3) to microcomputers with the standard configuration – box, screen, keyboard and, later, mouse.

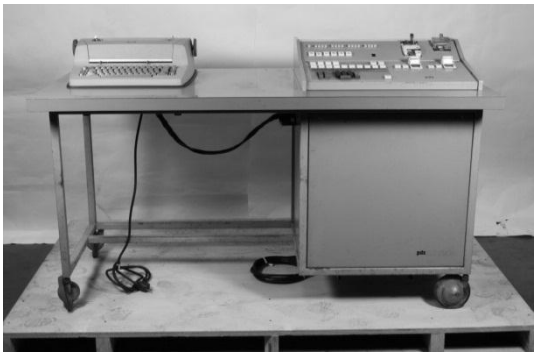

Figure 12: Magnetic disc memory system, keyboard/printer/ control panel on desk, part of IBM 1130 computer system
Photo courtesy of Museum Victoria

This machine played a role in introducing computers to the Australian newspaper industry. The machine was used by the Herald and Weekly Times.

The period was marked by cumbersome efforts made to 'automate' existing practices. The words were typed in from journalists' copy, a magnetic memory generated, and a paper type ribbon developed which was sent to the hot metal type setter. If any mistakes were made, then the whole paper tape had to be redone.

5.2 A machine for all seasons: the DEC PDP-8 Data Processor Minicomputer, circa 1968

Figure 13: PDP-8 minicomputer
Photo courtesy of Museum Victoria

The PDP-8 was probably the first successful general purpose commercial minicomputer, and was introduced by the United States firm Digital Equipment Corporation (DEC) in 1965.

The machine used discrete transistor circuitry and was designed by Gordon Bell (Slater 1989). More than 50,000 systems were sold, a record at that time.

The machine was used by the CSIRO Division of Trobophysics (later Material Science) for examining, for example, crystal structure and

phenomena associated with friction. The computer was also used by Monash University (Museum Victoria 2011a).

5.3 Holistic Medicine: the Searle Medical Computer, 1971-1987

The Searle Medical Computer is an early example of the use of digital technology in medicine; it was donated to the Museum by the Shepherd Foundation.

The Shepherd Foundation opened its Automated Multiphasic Health Testing (AMHT) Centre in South Melbourne in May 1971. AMHT was used for patient data gathering, analysis, storage, and print-out. George Fredrick Shepherd, founder of the Sheppard Foundation, believed that everyone was entitled to an annual medical check-up at a reasonable cost.

The PDP8/1 computer (see previous paragraph), was the heart and brain of the Centre. Searle Medidata of Waltham, Massachusetts developed the software.

The first stage of the testing was referral of a patient by their doctor. Then, during the patient's visit to the Centre, a computerised questionnaire was completed, covering many aspects of the patient's medical and personal history. The AMHT profile included information on electrocardiograph, pulse, blood pressure, anthropometry, Achilles tendon reflex relaxation time, chest x-ray, audiometry, hearing, vision, blood biochemistry, full blood examination, urine chemical and dipslide culture. A report, including advice, was sent to the referring doctor. (Sheppard Foundation 2011).

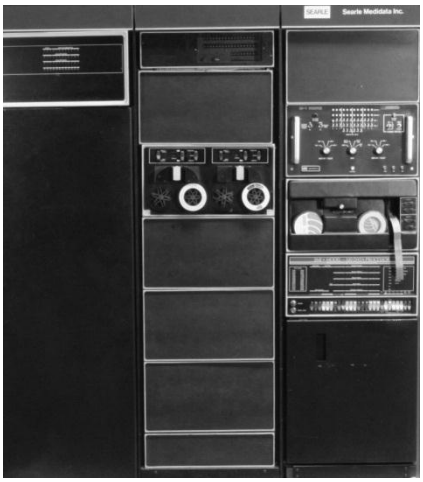

Figure 14: Searle Medidata Medical Computer based on PDP-8/1
Photo courtesy of Museum Victoria

The initial charge was $50, most of which was covered by Medicare (Museum Victoria 2011b). For 16 years, the Centre flourished; among its many achievements, the two that stand out relate to female patients – the introduction of mammography for women over 50 years or age and of pap smears (Museum Victoria 2012e; Museum Victoria 2012d).

The history of AMHT was marked by controversy. Some members of the medical profession saw AMHT as a form of population health screening with possible adverse effects such as incorrect or over-diagnosis. Others viewed it as a valuable tool dealing with the whole health care process.

6. Reviving Old Memories – Yesterday and Tomorrow

6.1 Yesterday . . .

In the late 1990s, the CSIRAC History Team developed modern equipment to read CSIRAC's obsolescent paper tapes[8]. A project to re-construct the CSIRAC music was the stimulus for the construction of this system to read the original CSIRAC paper tapes (Demant 2010). Equipment was set up to read the paper tapes and save the data in electronic form. The equipment was assembled in 1997, long after CSIRAC had ceased all operations in 1964. CSIRAC used to read paper tapes using paper tape readers of a a very different design and vintage.

The project gives us hope that younger but still obsolescent software can be resurrected . . . well, at least the worthwhile stuff.

6.2 . . . and Tomorrow

A first generation iPad, 2010, was acquired by the Museum in 2012. This particular iPad was one of over 500 iPads, distributed in June 2010 to eight Victorian schools as part of an initiative by the Victorian Government to trial the impact of iPads on learning and teaching.

The participating schools included the Victorian College of the Arts Secondary School, which donated this iPad to Museum Victoria in 2012. The programme, utilising the iPad for learning in schools, was still in operation at the time this item was donated to the Museum.

Figure 15: The launch of the iPad School Project by the Department of Education, Victoria, 2010
Photo courtesy of Museum Victoria

[8] The project was developed in order to recreate the music that CSIRAC had been programmed to generate. CSIRAC was the first computer ever to do this, in 1950.

One of the children, who participated in that project, will one day see that iPad, and their grandchild will exclaim: " . . *A what? . . . And you . . . actually touched it ... with your finger!?*"

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