Histories of Computing in Oceania

Sebastian K. Boell, *The University of Sydney, NSW, 2006, Australia*
Janet M. Toland, *Te Herenga Waka, Victoria University of Wellington, Wellington, 6140, New Zealand*

This special issue explores the histories of computing in the countries of Oceania with reference to the nuanced relationship between the local and the global. Oceania includes Australia, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, New Zealand, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu [5]. The region comprises indigenous Polynesian, Melanesian, and Micronesian cultures alongside more recent colonial influences. There is notable cultural and linguistic diversity throughout, for example, in Vanuatu alone, more than 100 different languages are spoken [11]. The inhabitants of Oceania have a strong connection with the Pacific Ocean, though many of the countries in the region are tiny island states, their exclusive economic zones include large expanses of ocean territory and associated fishing rights [16]. While Pacific Islanders regard themselves as guardians of their ocean territory, rising sea levels caused by climate change pose a serious threat, especially to the lower lying islands. In terms of global geography, Oceania is often regarded as peripheral, its countries have small populations and economies that are often heavily dependent on raw materials. This peripheral location and the region's colonial heritage influenced attitudes toward the arrival of computing technology.

Oceania's colonial legacy ensured that historically, communication links with Europe were strong. The author Robert Louis Stevenson[1] settled in Samoa not only to improve his health, but also as the country provided a reliable international postal service for staying in touch with his publishers. Postal reformer Henniker Heaton[2] campaigned for cheaper postal and telegraphic charges throughout the British Empire, particularly in Australia, which was a late entrant to the imperial penny post scheme. Though this scheme was set up in 1898, Australia did not join until 1905. Underlying all Heaton's work was the belief that improved communication between different parts of the world would lead to an increase in knowledge sharing and a better understanding between nations [9]. When Harry Messel accepted a position as a Professor of Physics at the University of Sydney in 1952, he negotiated the payment for airmail delivery of overseas publications as part of his job contract (see the article by Barbara Ainsworth in this special issue). Australians and New Zealander's have always been quick to pick up on the latest trends and technologies from overseas. Advances in telecommunications technologies in the 1950s [12] meant that news travelled faster and details of new computing technologies were able to arrive long before the bulky computers themselves. Transatlantic cables laid across the vast Pacific ocean were not put in place for the benefit of Pacific Islanders themselves, but nevertheless they managed to leverage the benefits of the opportunities provided by improved telecommunications links. Early pioneers of computing in Australia and New Zealand were reading the same books and journals as computing enthusiasts in the U.K. and USA. These far-reaching linkages are also diverse, while many New Zealanders and Australians may have originally regarded, the U.K. as "home," other colonial powers such as France, Spain, Germany, and Japan also have historic interests in the region. In more recent times, the US and China have become prominent players and the competition between them means that the region is no longer at the margins of global geopolitics but at the center [16].

While Babbage lived in the U.K., important parts of his work relevant to the history of computing ended up in Australia and New Zealand [19]. Nonetheless, Australia can lay claim to its own history of computing as already, in 1949, Australia had its first working electronic stored program computer when only few similar machines existed in the world [2]. Unfortunately, the groundbreaking work undertaken in Australia is less well known than the work undertaken in the US, U.K., and Germany, with only a few publications providing an overview [13], [14]. Fortunately, CSIRAC still exists as one of few first generation computers anywhere in

[1]The Life—Robert Louis Stevenson Museum
[2][Online]. Available: https://en.wikipedia.org/wiki/John_Henniker_Heaton

1058-6180 © 2023 IEEE
Digital Object Identifier 10.1109/MAHC.2023.3324242
Date of current version 23 November 2023.

the world and it is currently on exhibition at Science Works in Melbourne, Victoria.

Perhaps due to, rather than despite the tyranny of distance, Australia was a place where innovations happened early on with the first documented computer programmed music in 1950 on CSIRAC [6], [7], one of the first computer games on SILLIAC in 1956 [10], and the first UNIX port from the PDP-11 in 1977 [15]. As Australia established an interest in computing so early, researchers created new devices that contributed to advances in the design of second generation computers. In particular CIRRUS, developed and built at the University of South Australia was world leading in its design by using microprogramming [1]. Unfortunately, the economic environment in Australia at the time was not a suitable incubator for generating interest in the commercialization of this innovation.

As components became cheaper and minicomputers revolutionized how computers were used in organizations, more original computer designs emerged in Australia. Hartley computers[3] were designed and built in the Australian State of Queensland, being one of the first designs to use the Intel 8080 processor at a time when most computers were using Motorola [14]. During the late 1970s, microcomputers were increasingly used by hobbyists [17] and in early 1980s, Microbee, a computer designed and built in Australia was widely used in schools around the country [18].

Evidence of technological innovation can also be found in New Zealand. In the first part of the twentieth century, communication links between New Zealand and the "mother" country, the U.K., were strong. The first computer society[4] was formed in 1960, months before any computers arrived in the country. Computers typically took around two years to ship and install and restrictive import controls further slowed their spread. The first computers to arrive in New Zealand were an ICT 1202 at the Department of Education [4] and an IBM 360 at the Treasury.

With an economy dominated by small business, the government was the major user of computing. The development of time sharing meant that computing became affordable for smaller companies. In fact, due to import restrictions, organizations were encouraged to use computer bureaus to pool limited computing resources [21].

This scarcity of resources did lead to innovation. In 1967, New Zealand's five trading banks decided to share their licenses to import computers and joined together to form Databank Systems, integrating their ledger accounts to become one of the earliest examples of such collaboration in the banking sector [20]. When microprocessor technology arrived in the mid-1970s, opportunities for local inventors opened up, particularly in the education sector, as schools started to take an interest in teaching computing [3].

New Zealand began to manufacture computers locally at least four computers were in the development at this time, including the Aamber Pegasus and the Decade. Two of the most successful companies were Microprocessor Developments Ltd. (MDL) and Poly Computers (later Progeni). Though inventive designs were coming out of New Zealand, the government provided limited support for start-up computing companies, and when personal computers became an international commodity around 1986, they found it hard to compete with international companies such as Apple [8]. Despite these setbacks, the histories of the computing sector throughout Oceania have demonstrated resilience and the ability to overcome, and even to benefit from, the constraints of distance.

We are pleased to present this special issue comprising four articles, a biography, and a contribution to the Anecdotes section. Events and Sightings also includes two reports on ongoing research activity in the region. As researchers in the history of computing in Australia and New Zealand, we are keenly aware of the dearth of literature in our region. When we approached the editorial board of this journal with our proposal for a special issue, we were challenged to take it further and to look for histories of computing in the broader region beyond Australia and New Zealand.

This is a challenge that, despite considerable effort, we have only been partly able to meet; the majority of the articles in this special issue are from New Zealand and Australia and represent predominantly European culture. Though these stories are of value in themselves, they provide only one strand of the multifaceted histories of the use of digital technology in Oceania. We know the stories are out there, because in February 2022, as part of the process of preparing the special issue we organized a paper development seminar that attracted speakers from Samoa, Taiwan, and Japan, in addition to our existing contacts in Australia and New Zealand. We hope that

[3]Series of Oral Histories with Pearcey Medallists and Hall of Fame 2000–2020. [Online]. Available: https://ses.library.usyd.edu.au/handle/2123/31778; https://doi.org/10.25910/j5ak-rs49.
[4]New Zealand Computer Society renamed IT Professionals in 2012.

other researchers will soon be adding to the body of knowledge in this field.

Some common themes come through from the articles in this edition. The development of computing technology in Oceania was influenced by its varied colonial heritage, however the diversity of cultures within the region has also had a major impact. Though telecommunications technologies were and are being used to reinforce existing power structures, they also offer opportunities for Indigenous peoples to fight back and reclaim their heritage. The region is an increasingly contested political space [16], and the rising influence of China creates new dynamics in global geopolitics, with digital technologies and, in particular, cybersecurity threats being used for political ends. Another theme is how scarcity and geographical remoteness leads to innovative local solutions (as demonstrated in Alex Reid's articles on Western Australia); however, these home-grown inventions typically prove to be unsustainable (see the article by Alastair Nisbet for an example). In general, they are not supported by government funding, and once large international competitors enter the market, the home-grown inventions find it difficult to compete. Distance leads to new inventive ways of thinking, but also creates barriers to ongoing success.

While acknowledging that this issue is just a drop in the South Pacific Ocean, we would argue that it makes an important contribution to knowledge. To date, the history of computing in this vast and relatively lowly populated region is underrepresented. The geographical characteristics of Oceania have facilitated the development of innovative, interesting (and often unique) patterns of information, and knowledge exchange. The region has a rich history that is currently underrepresented and more research on the history of computing technology in Oceania is needed and should be strongly encouraged.

Travelling across the South Pacific Ocean from the northeast to the southwest our first article "The Modern History of ICT in Oceania—PEACESAT and USPNet," by Reiko Hayakawa, Robert Underwood, and Jennifer Anson, explores the politically charged topic of communication links across the Pacific Ocean. Telegraph and submarine links were established not for Pacific Islanders themselves, but to support the economic and military objectives of the colonial powers at the time, Britain, France, Germany, Japan, and the United States.

Today Oceania remains a highly contested political space, though now the major players are the United States and China. The article shows how, despite the intentions of the colonial powers, Pacific Islanders were able to use their political will to gain access to satellite technology to provide affordable telecommunications services throughout the region. It tells the stories of how PEACESAT[5] and USPNet used the Internet to improve governance and education in Oceania.

Colonization also had devasting effects on the Māori language and culture in Aotearoa/ New Zealand. In "Computing Technologies for Resilience, Sustainability and Resistance," Petera Hudson, Hēmi Whaanga, and Te Taka Keegan show how Māori appropriated computing technologies for cultural resistance. Māori leader Apirana Ngata[6] fought for the revitalization of Māori languages, resulting in educational reforms in the 1970s, which established Māori language immersion schools throughout Aotearoa. Many of these schools used innovative local software to assist with language teaching and document Māori teaching skills. Though major languages dominate social networking environments, there are opportunities to use these platforms to encourage interactions in smaller language families such as Te Reo Māori. Interactive storytelling, apps, virtual reality, and gaming platforms are used to connect Māori communities. Māori tech entrepreneurs are active in creating software developed by Māori, with Māori, for Māori. Having control over data is another way colonialism has threatened to destroy Indigenous people's knowledge systems and impose their own classification techniques. Indigenous data governance is a way of taking back control.

Education is also the theme of Alastair Nisbet's article on "Educational Computers in New Zealand Schools: 1977 to 1983," which documents a six-year period when microprocessor technology enabled New Zealanders to invent computers specifically designed for local education: the Poly and the Aamber Pegasus. Though the initial outlook was promising, the New Zealand government pulled out of a large order to implement the Poly throughout the education system, losing the opportunity to establish the country as a world leader in educational computing. In 1984, Apple undercut the local market by announcing a 25% discount on the Apple, making it the cheaper option for local schools. A New Zealand company, Wormald Technology, also developed a specialist series of computers for the visually impaired, which was successful

[5][Online]. Availabe: http://peacesat.hawaii.edu/
[6][Online]. Availabe: https://teara.govt.nz/en/biographies/3n5/ngata-apirana-turupa

for a number of years before being bought out by a US company in in 2005. Though New Zealand designed and built computers with potential, the reality was that, due to economies of scale, overseas companies were able to reduce their costs to a point that made local competition impossible.

Continuing our travels across the Tasman sea to Australia "Trevor Pearcey and the development of CSIRAC-An Australian first-generation computer" by Barbara Ainsworth tells the story of the first computer to be built in Australia in 1949, and the first computer ever to play music. Though Trevor Pearcey wrote about this himself in a 1984 article in this journal [2] the story of the CSIRAC is not widely known. The article examines archival data and oral histories to analyze communications between Trevor Pearcey and Maston Beard and overseas computer pioneers, particularly Douglas Hartree. The article demonstrates the importance of personal networks and knowledge sharing between the USA, U.K., and Australia at a critical phase in 1946 when the understanding of digital computing took a major step forward. The Australian team used accepted ideas in logic and hardware, but also added on several unique ideas facilitated by their geographic isolation.

Our journey ends in Perth, Western Australia, perhaps the most isolated state capital city in the world, where Alex Reid's biography of Monte Sala tells the remarkable story of a talented inventor who established an electronics industry in Western Australia and created an original device for encrypting data that formed the basis of SWIFT, the international bank clearing house. A second article by Alex Reid in the Anecdotes section recounts the numerous computing innovations that came out of the University of Western Australia, demonstrating yet again that isolation can encourage rather than inhibit original thinking.

ACKNOWLEDGMENTS

We would like to thank all the authors of the articles in this special issue and also all the peer reviewers who provided formative feedback. The technical support provided by the University of Sydney Business School enabled us to run the paper development session, we would also like to thank all the presenters and attendees at that event. The guidance provided by the Editor-in-Chief, David Hemmendinger, has been invaluable; thanks also to Gerardo Con Diaz who helped us develop the initial call for papers, and for the insightful suggestions of Ramesh Subramanian, who supported us along the way. We hope that readers will enjoy this issue and also be inspired to add their own contributions to the histories of computing in Oceania. We are pleased to be taking the next step in this research journey by organizing a panel on "The Diverse History of Computing in Australasia" for the Australasian Conference on Information Systems, December 2023.

BIBLIOGRAPHY

[1] C. J. Barter, "The CIRRUS computer: Its design, history, and significance," [n.d.]. [Online]. Available: https://connect.adelaide.edu.au/nodes/view/26006

[2] M. Beard and T. Pearcey, "The genesis of an early stored-program computer: CSIRAC," *Ann. Hist. Comput.*, vol. 6, no. 2, pp. 106–115, Apr.–Jun. 1984, doi: 10.1109/MAHC.1984.10014.

[3] T. Bell, *Primary, Secondary and Tertiary Computing Education in Aotearoa New Zealand in From Yesterday to Tomorrow: 60 Years of Tech in New Zealand*, J. M. Toland Ed, Wellington, New Zealand: IT Professionals, 2021. [Online]. Available: https://history.itp.nz/

[4] B. E. Carpenter, "The first computer in New Zealand," *IEEE Ann. Hist. Comput.*, vol. 42, no. 2, pp. 33–41, Apr.–Jun. 2020, doi: 10.1109/MAHC.2020.2990647.

[5] R. Crocombe, *The South Pacific*. Suva, Fiji: Univ. South Pacific, 2001.

[6] P. Doornbusch, "Computer sound synthesis in 1951: The music of CSIRAC," *Comput. Music J.*, vol. 28, no. 1, pp. 10–25, Mar. 2004, doi: 10.1162/014892604322970616.

[7] P. Doornbusch, "Early computer music experiments in Australia and England," *Organised Sound*, vol. 22, no. 2, pp. 297–307, Aug. 2017, doi: 10.1017/S1355771817000206.

[8] B. Doran and A. Trotman, "Preserving our heritage: New Zealand made computers," *Rutherford J.*, vol. 5, pp. 1–9, 2018.

[9] B. K. De Garis, "Sir John Henniker Heaton (1848-1914)," *Australian Dictionary Biogr.*, vol. 4, 1972. [Online]. Available: https://adb.anu.edu.au/biography/heaton-sir-john-henniker-3745

[10] A. H. Jorgensen, "Context and driving forces in the development of the early computer game Nimbi," *IEEE Ann. Hist. Comput.*, vol. 31, no. 3, pp. 44–53, Jul.–Sep. 2009, doi: 10.1109/MAHC.2009.41.

[11] M. D. Myers and F. B. Tan, "Beyond models of national culture in information systems research," in *Human Factors in Information Systems*. Hershey, PA, USA: IGI Global, 2002, pp. 1–19.

[12] K. Newman, *Connecting the Clouds: The Internet in New Zealand*. Auckland, New Zealand: Activity Press, 2008.

[13] T. Pearcey, *A History of Australian Computing. Caulfield East*. Dandenong, VIC, Australia: Chisholm Inst. Technol., 1988.

[14] G. Philipson, *A Vision Splendid: The History of the Australian Computing*. Sydney, Australia: ACS Foundation, 2017. [Online]. Available: https://www.acs.org.au/content/dam/acs/acs-publications/ACS-ebook-2017_A-Vision-Splendid_The-History-of-Australian-Computing.pdf

[15] J. E. Reinfelds, "Anecdotes: The first port of UNIX," *IEEE Ann. Hist. Comput.*, vol. 11, no. 3, pp. 208–210, Jul.–Sep. 1989, doi: 10.1109/MAHC.1989.10025.

[16] E. L. Rose, D. Salesa, M. Benson-Rea, M. Raskovic, and T. Osegowitsch, "Letter from the Eds.: Engaging with oceania: Some background about the region–and why it matters for IB research," *AIB Insights*, vol. 21, no. 1, pp. 1–5, 2021.

[17] M. Swalwell, "Questions about the usefulness of microcomputers in 1980s Australia," *Media Int. Aust.*, vol. 143, no. 1, pp. 63–77, May 2012, doi: 10.1177/1329878X1214300109.

[18] A. Tatnall, "The Australian educational computer that never was," *IEEE Ann. Hist. Comput.*, vol. 35, no. 1, pp. 35–47, Jan.–Mar. 2013, doi: 10.1109/MAHC.2012.16.

[19] G. J. Tee, "The heritage of Charles Babbage in Australasia," *Ann. Hist. Comput.*, vol. 5, no. 1, pp. 45–60, Jan.–Mar. 1983, doi: 10.1109/MAHC.1983.10006.

[20] J. M. Toland, "Consortium computing and time slicing in the banking sector: Databank Systems ltd New Zealand," *EEE Ann. Hist. Comput.*, vol. 43, no. 2, pp. 18–29, Apr.–Jun. 2020, doi: 10.1109/MAHC.2020.3007065.

[21] J. M. Toland, "Big brother in New Zealand: Anticipating the computer," in *Prophets of Computing: Visions of Society Transformed By Computing*, D. Van Lente Ed. San Rafael, CA, USA: ACM/Morgan & Claypool, pp. 421–456. 2022.

SEBASTIAN K. BOELL is a researcher in information systems, University of Sydney, NSW, 2006, Australia. His research interests include long-term effects, consequences, and implications of information and communication technologies (ICT) on organizations and organizing. Contact him at sebastian.boell@sydney.edu.au.

JANET M. TOLAND is an associate professor in information systems with Te Herenga Waka, Victoria University of Wellington, Wellington, 6140, New Zealand. Her research interests include the history of information systems with a focus on social and ethical issues. Contact her at janet.toland@vuw.ac.nz.