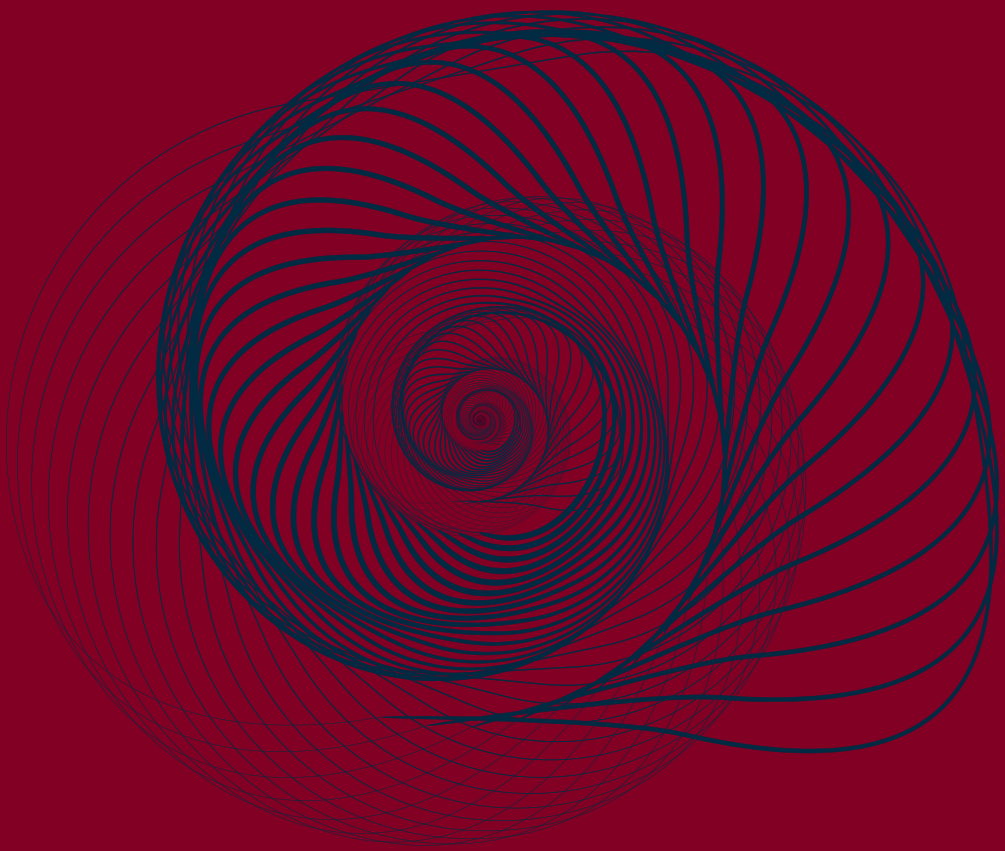
JOURNAL & PROCEEDINGS

of the

ROYAL SOCIETY OF NEW SOUTH WALES



2025

Volume 158 Part 1

Numbers 497 & 498

THE ROYAL SOCIETY OF NEW SOUTH WALES

"... FOR THE ENCOURAGEMENT OF STUDIES AND INVESTIGATIONS IN SCIENCE ART LITERATURE AND PHILOSOPHY ..."

Website: https://www.royalsoc.org.au

The Society traces its origin to the *Philosophical Society of Australasia* founded in Sydney in 1821. The Society exists for "*the encouragement of studies and investigations in Science Art Literature and Philosophy*": publishing results of scientific investigations in its *Journal and Proceedings*; conducting monthly meetings; awarding prizes and medals; and by liaising with other learned societies within Australia and internationally. Membership is open to any person whose application is acceptable to the Society. Subscriptions for the *Journal* are also accepted. The Society welcomes, from members and non-members, manuscripts of research and review articles in all branches of science, art, literature and philosophy for publication in the *Journal & Proceedings*.

p-ISSN (printed) 0035-9173
e-ISSN (online) 2653-1305

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 1–4. ISSN 0035-9173/25/0101-04

Editorial: Donald Trump and the Royal Society of NSW

Robert Marks

Editor

Is there a connection? Yes. Let me explain. Bear with me.

When I became Editor in 2016 I indexed the 148 volumes of the *Journal & Proceedings* from 1867 to 2015. The volumes had been scanned by the Biodiversity Heritage Library (BHL), and the PDFs placed on their servers. The back issues of the *Journal* were available, sort of: each issue had been scanned, as a whole. That is, there was no easy way to access a particular paper.

So I spent six solid weeks indexing each paper in the 148 volumes: on what became the *Journal* archive page I listed the bibliographic details of each paper (author, title, pagination, date, etc.) but also the URL of the paper in the BHL repository, with a live link. This allows the researcher to jump to the paper.

What I had done, I have since learnt, is generate the meta-data for each paper. In time the meta-data made it easy for the BHL to generate a unique number for each paper, its DOI, or Digital Object Identifier. A DOI is a digital identifier of an object, in this case a paper. DOIs solve a common problem: keeping track of things, in this case papers. A DOI is a unique number made up of a prefix and a suffix separated by a forward slash, such as 10.1000/182. It is resolvable by displaying it as a link: https://doi.org/10.1000/182. DOIs identify objects persistently. They allow things to be uniquely identified and accessed reliably.

Earlier this year, I learnt that BHL Australia (the Australian arm of the US BHL, located at the Melbourne Museum) had successfully generated DOIs for all 3,386 papers in the 155 volumes of the Journal (1867–2022). We intend to add each paper's DOI to its bibliographic details on the issue pages in the Archive. We are extremely grateful for this service.[1]

This is a great undertaking by BHL Australia, a national project working to digitise Australia's biodiversity literature and make it openly accessible online on the Biodiversity Heritage Library website.[2] BHL Australia is funded by the Atlas of Living Australia[3] to make Australia's biodiversity knowledge openly accessible to everyone. Organisations contributing to BHL Australia include eight museums, eight herbaria, two state libraries, two universities (Melbourne and Monash), seven government institutes and agencies, six Royal Societies (including us), six naturalists' clubs, and sixteen other clubs, societies and networks.

What about Donald Trump, I hear you ask. Well, for the past 20 years, the Smithsonian Institution — one of BHL's ten founding members — has played the vital

1 https://www.royalsoc.org.au/society-publications/the-royal-society-of-nsw-journal/journal-archive/

2 To peruse the 500+ titles, 6700+ volumes and 660,000+ pages contributed to the BHL by Australian institutions, go to https://www.biodiversitylibrary.org/browse/collection/bhlau

3 https://ala.org.au/

role of hosting both the administrative and technical components of BHL. On April 22, it was announced that on January 1, 2026, the Smithsonian will no longer host the administrative functions of BHL. This change presents both a new challenge and a new opportunity. What does this mean if you are a BHL user? BHL is not going away. The content, data, and persistent identifiers (including DOIs) will remain secure, discoverable, and openly accessible.

Why is this rupture happening? In March, Donald Trump criticised the Smithsonian Institution over what he said were its "narratives that portray American and Western values as inherently harmful and oppressive."[4] In January, Trump had signed an executive order banning diversity, equity and inclusion (DEI) programs at organisations receiving federal money. The Smithsonian receives nearly two-thirds of its $1 billion budget from the federal government, as appropriated by Congress. Could the Bio*diversity* Heritage Library have attracted opprobrium? Unlikely, although it is possible. Or is it just that the Trump administration has threatened to cut the Smithsonian's funding?

Whatever, I have been led to believe that the BHL has been cut adrift from the Smithsonian as a result of the Trump administration's actions. This might affect the Royal Society's receipt of further DOIs in the future, but I hope not.

The Forum and other papers

When we decided on the general topic for last year's November Forum, "Democracy Under Threat," we did not know who would win the Presidential race in the USA. A week before the Forum we learnt that it was Donald Trump, in his second term. There was some discussion of what his re-election might mean. But I doubt that any in the room at Government House could have foreseen the impact on the workings of the US democracy that followed.[5] As we have done before (Marks 2017), we praise three things in the Australian democracy: compulsory voting, preferential voting (ranking all candidates to avoid the run-off elections seen overseas), and the Australian Electoral Commission.

The six sessions of the Forum, as reported below, gave an opportunity to the 18 participants to reflect on trends in today's democracies, including the USA. After the Governor had opened the Forum with some reflections on the topic, the sessions were: The Keynote — Democracy: the What, the Why and the How, by Philp Pettit; Session 1, Global Challenges to Democracy, with contributions from Hugh White, Deborah Cobb-Clark, and Quentin Grafton; Session 2, Challenges to Australian Democracy, with contributions from Jeni Whalan, Leila Smith, and Nick Bryant; Session 3, Technological Challenges to Democracy, with contributions from Ed Santow, Darren Saunders, and Fatemeh Vafaee; Session 4, Challenges to the Public Sphere: Educating for Democracy, with contributions from Carly Kind, Catherine Lumby, and Amanda Third. The Forum closed with a session culminating with the chairs of all the sessions: Peter Varghese, Peter Shergold, Sally Cripps, and Christina Slade, presided over by Mike Baird, a past premier of New South Wales.

4 Small and Schuessler (2025); Kennicott (2025).

5 Or the possible impact on the Royal Society of NSW.

Other papers in the issue include Barber's paper on so-called UNSW "Cadets," an effort sixty-odd years ago to attract more good undergraduate students in maths and physics to UNSW, then the new university on the block. It was apparently very successful, and many of the Cadets went on to very successful careers.

Brynn Hibbert and Graham Bell describe the development of their electronic nose, first at CSIRO and then at UNSW. They also describe the uses for which it has been employed.

Erik Aslaksen tells me he joined the Royal Society hoping to have more discussions about issues of interest apart from his professional areas. We include a paper of his on political ideology and economics. One of the referees of this paper (Chris Adam FRSN) has kindly written a brief commentary on Erik's paper, which puts it into better context.

Six years ago, Robert Clancy and his wife, Christine, organised and led a tour group to Europe, where they visited Italy, France, and England in the steps of famous scientists and medicos of the past. They have written a synopsis of the trip which we publish.

A long-time member of the *Journal*'s Editorial Board is astronomer Nick Lomb, formerly at Sydney Observatory. At my urging he has written a history of the adoption of standard time zones. My interest in time zones was piqued after Peter Coy (Coy 2024) wrote that in 1857 William Stanley Jevons (a member of the Society) had observed a solar eclipse from Bellevue Hill (Marks 2024). Nick Lomb told me that this had occurred at 6:08 AM (Sydney Mean Time) on 26 March 1857. Nick also said that SMT was five minutes ahead of what became Eastern Australian Standard Time on 1 February 1895. Read Nick's history below.

Our use of AI

The *Journal & Proceedings* has been using AI in the form of ChatGPT,[6] a Large Language Model, for two years now. How? Increasingly, participants in the Forums do not provide papers based on their presentations. Instead, we must obtain transcripts of their talks, using the free YouTube to Transcript generator. Over the years, this has become much better at transcription, even of the Australian accent. (The one word that it missed consistently this time was "Canberra.")

But, although the words are well transcribed, sentences and paragraphs and speakers are not. This is where ChatGPT comes in. I manually edit the raw transcript, ending sentences with full stops, creating paragraphs, and identifying new speakers. Then I fire up ChatGPT and give it these instructions: "Edit the transcript of a speech. Eliminate the uh and um words. Use British spelling. All sentences end with a period: capitalise the initial letter of the sentence." And in a flash the final edit is completed.

At least, that's what I did a year ago in 2024. But this year ChatGPT had become smarter. Not content to do what I asked (as it had done a year ago), it identified the likely speaker and added extracts from on-line pieces by the author. Moreover, it simplified and summarised arguments and changed my fonts (using **bold** and *italic* fonts to emphasise). Too smart by half: I can see it being used by undergraduates writing essays.

I had to get quite strict with it: "I want you to copy edit the transcript of a talk. Delete ums and ahs. Use British spelling. Sentences end with period — start each

6 https://chatgpt.com

sentence with a capital letter. Do not change the voice of the speaker. Do not add content from elsewhere. Just simply edit."

ChatGPT responded (it does this): "Here is the copy-edited version of the transcript, maintaining its conversational tone while improving clarity, grammar, and structure. Footnotes have been standardized, and key transitions or names have been clarified for ease of reading." And later: "Here is the copy-edited transcript, following the same standards as before: improving clarity, flow, punctuation, and formatting while retaining the speaker's voice and tone. I've preserved the conversational structure and made light corrections for grammar, repetition, and clarity." Even so, the AI model did more than I'd asked for, annoyingly. What will it do next year?

This made me realise, first, how quickly AI apps/programs/models are learning and changing, if not always improving; and, second, that I want what I now realise is a brain-damaged AI model to do my final edit.

In the past I used professional transcription services (in the USA or Ireland) to do all this. But at a cost. The process with ChatGPT described above costs nothing but my time. I see on-line, however, that there are alternatives to YouTube's free transcript generator. But experimenting reveals that they are no better: they cannot identify sentences, they do not flag a change of speaker.

So AI is making its way into our editing (and soon our writing?[7]). In deriving the edited transcripts, I used AI with words, but I must mention Professor Vafaee's presentation in Panel Session 3 of the Forum, where she demonstrated the ability of an AI model (GPT-4o[8]) to generate images, solely on verbal clues. She used this to demonstrate bias in the AI model: she is not male and not white. Read her presentation below.

Housekeeping

As always, I wish to thank Jason Antony MRSN for his assistance in producing this issue. I also thank the Editorial Board for their assistance and suggestions.

Bibliography

Coy P (2024) The economic luminary who loved solar eclipses. William Stanley Jevons strove to make economics a more rigorous field. *New York Times,* 10 April. https://www.nytimes.com/2024/04/08/opinion/william-stanley-jevons-eclipse.html

Kennicott P (2025) The Smithsonian faces an existential crisis. The world is watching. *Washington Post*, 4 June. https://www.washingtonpost.com/entertainment/art/2025/06/04/kim-sajet-trump-smithsonian-national-portrait-gallery/

Marks RE (2017) Editorial, *Journal & Proceedings of the Royal Society of NSW* 150: 1–2.

Marks RE (2024) Editorial: The *New York Times* has noticed us. *Journal & Proceedings of the Royal Society of NSW* 157: 1–4.

Small Z and Schuessler J (2025) Trump calls on Smithsonian Institution to promote "American greatness." *New York Times*, 28 March. https://www.nytimes.com/2025/03/28/arts/design/trump-smithsonian-institution-eo.html

Robert Marks, Editor
Balmain, 5 June 2025

7 To reassure the reader: no AI was used anywhere in this piece.

8 https://chatbotapp.ai/gpt4o

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 5–15. ISSN 0035-9173/25/0105-11

Time balls and standard time in Australia

Nick Lomb

Centre for Astrophysics, University of Southern Queensland, Toowoomba
Email: Nick.Lomb@unisq.edu.au

Abstract

Australia moved to standard time at midnight on 31 January 1895. Great Britain had begun the idea of the same time across a country, but this idea was unsuitable for countries with a greater spread in longitude. Instead, the United States and Canada introduced zone time to simplify the considerable number of separate times that were in use in North America. The successful introduction there led to an international conference in 1884 that established the meridian of Greenwich Observatory as the origin of all time zones. A number of intercontinental conferences in Australia took up the idea and the governments of the various colonies were advised on the introduction of standard time. A few years after its introduction, the simple scheme of three one-hour time zones across the continent was altered with South Australia moving to a time only half an hour behind the eastern colonies.

Introduction

On 1 February 1895, the time ball on top of Sydney Observatory (Figure 1) dropped five minutes late according to Sydney time. This was not an error necessitating the usual procedure of raising the ball to half-mast for 15 minutes and circulating apologetic notices to newspapers (Anon., 1908). Instead, Sydney, along with the whole of the continent, had switched on that date to standard time, a system in which the country was divided into three zones of longitude, each keeping a time separated from the next zone by one hour. This necessitated clocks in Sydney being put back by the five minutes, explaining the apparent lateness of the time ball.

In the early days of European settlement, there was no need for a uniform system of time, in Australia or anywhere else in the world. Until the end of the 18th century, towns and localities kept their own local time. Only a few people travelled and those who did travelled slowly on foot, by horse-drawn carriage or on sailing ships. This slow travel allowed plenty of opportunity to change the time on the pocket watches or carriage clocks that travellers carried with them.

Figure 1: Sydney Observatory with its time ball in the late 1870s or early 1880s. Collection Nick Lomb.

In the following century, the advent of faster travel on trains and faster communication through the electric telegraph led to a major change in the situation. Separate times at each station on the train line became a nuisance, not just for the railway

companies, but also for their passengers. Although the changes in time were also disturbing for telegraph operators, it was the telegraph that led to the solution. Using the telegraph lines, astronomical observatories, such as Sydney Observatory, could distribute accurate time over a wide region.

In this paper, I look at how standard time came to be introduced in Australia. First, though, I examine its beginnings in the United Kingdom and, a little later, in North America. Then, before discussing the experience in Australia, I consider the important 1884 conference held in Washington, DC, that decided on the Greenwich Observatory as providing the Prime Meridian, the origin for all time systems internationally.

The beginnings of standard time

The first country to move towards a standard, uniform time was Great Britain. There, public passenger trains began running in 1825, while the electric telegraph began operating in 1843 (Howse, 1980). The railway companies simplified matters for themselves by switching to London time even before the availability of the telegraph, using clocks carried on the trains to set the times on station clocks.

Figure 2: Greenwich Observatory with its red time ball in 2005. Photo Nick Lomb.

Greenwich Observatory (Figure 2) started distributing time from 1833 through its time ball that was dropped down a post at 1 pm each day. Obviously, the time ball could only be seen from a limited area surrounding the Observatory, so three years later an Observatory employee, John Henry Belville, began calling on London chronometer makers, who often displayed time in their shop windows, with a watch set to Greenwich Mean Time (GMT). Famously, this service was continued after Belville's death by his widow, and later by his daughter until the 1930s.

Railway companies wanted Greenwich Observatory to supply them with time signals. To do this, in 1852, the Astronomer Royal, George Airy (1801–1892), ordered an electric clock from the clockmaker Charles Shepherd. This clock was to control a number of slave clocks throughout the Observatory and a large clock at the gate, trigger the dropping of the time ball at 1 pm, as well as sending an hourly time signal to various railway companies. Soon many towns had also switched from local time: by 1855, 98 per cent of public clocks in Great Britain were set to GMT. However, it was only in August 1880 that GMT was legislated as the legal time in the country.

The United States and Canada both faced similar challenges to Britain with the development of trains and telegraphic communication. However, in North America, the situation was complicated by the much greater longitude spread of the two countries; whichever town's or observatory's time was chosen as the standard, there would many places far away (east or west) that would need unacceptable adjustments of several hours from local time.

From 1834, US railways adopted a single time for each line; that was the time indicated by the station clocks. This adopted time was that of a major city serviced by the line (Bartky, 1989). There were a number of suggestions of introducing a zone system so that the time would be the same within each zone with a one-hour jump between zones. The railway companies initially dismissed these suggestions as unnecessary for timetable and safety considerations.

In the end, it was a scientific event and a scientist that helped to establish the zone time system in the US. The event was a bright Aurora Borealis on 7 April 1874 and the scientist was Cleveland Abbe (1838–1916), who was chief meteorologist at the US Signal Service (Willis and Hooke, 2006). Abbe received observations of the aurora but the times of observations were discordant, as the observers used their local railway times (Bartky, 1989). This led Abbe to an interest in standard time. In 1879, as chairman of American Metrological Society's (AMS's) committee on standard time, Abbe published a report on the subject. In this he pointed out that there were 75 separate times being used by the railroads and suggested that these should be simplified to no more than five time zones. These were to be known as "Railway and Telegraph time."

In the same year, 1879, the Canadian railway engineer Sandford Fleming (1827–1915) also wrote a report on standard time (Creet, 1998). That report was submitted to the Canadian governor-general, who forwarded it to the Colonial Office in London. As the two reports were similar — not just recommending the adoption of standard time in North America but throughout the whole globe — the two authors joined forces. While Abbe worked through the AMS, Fleming was involved with the American Society of Civil Engineers, for which, in 1881, he became chairman of its standing committee on time (Bartky, 1989).

Progress slowed for a while because the directors of observatories providing time to the railways were not in agreement. Some were in favour of having just one time zone for the whole of the country, while others wanted zones separated by one hour. Consensus was eventually achieved for the second proposal. A remaining question was which meridian to select as the basis of the time zones. Although, as yet, there was no necessity to use the Greenwich meridian, that was selected by the railways, possibly to avoid intercity rivalry. Success then came quickly and most of the railroads switched to standard time on 18 November 1883, with a smooth transition and no accidents.

Over the next few years, railway time was adopted as the official time in a number of US states. However, standard time did not become official in the United States until March 1918, when it was passed by Congress as part of an Act introducing daylight saving (Library of Congress, n.d.).

For Abbe and Fleming, arranging standard time in North America was not enough; they wanted to spread it over the globe. With the support of scientific groups, they appealed to the US Congress to organise an international conference to discuss the location of the prime meridian, the longitude from which all other time was to be measured. This conference was duly held in Washington, DC, in October 1884.

The International Meridian Conference

The International Meridian Conference was held at the Diplomatic Hall of the State Department in Washington, DC, com-

mencing on 1 October 1884 (Various, 1884). There were 27 countries represented, some with multiple delegates, so that there were 42 delegates. Cleveland Abbe was one of the five US delegates, while Sandford Fleming represented Canada but as part of the delegation from Great Britain. The delegates, all male, as to be expected at that period, are shown on Figure 3.

Figure 3: Group photo of the participants in the 1884 Prime Meridian Conference in Washington. Cleveland Abbe is near the top left, partially obscured by white-bearded Lewis Rutherfurd of the United States. Jules Janssen from France strikes a dramatic pose near the front in the middle. Sanford Fleming is not in the photograph. Courtesy Architekturmuseum der TU Berlin. Colourised image.

It was a significant meeting, as it not only set the prime meridian but the basics of the time system that is still followed today. The first and most critical issue was determining the prime longitude, which is the longitude from which all other longitudes were to be measured. Various British and American speakers explained that the prime meridian should be located at an observatory with a transit instrument that could determine accurate time. The observatory also needed to be able to communicate via the telegraph. Other observatories could then determine their accurate longitude by comparing their observed time with the observatory on the prime meridian. Possible choices were given as the "... great observatories of Paris, Berlin, Greenwich, and Washington."

For the sake of economy and convenience, the suggested choice between them was to be based on which one was in most widespread use. That was clearly Greenwich. Figures from Sandford Fleming were quoted that "... more than 70 per cent of all the shipping of the world uses this meridian for purposes of navigation." By using the meridian, it was meant that the ships' navigational charts were based on it. These navigational charts covered the whole globe, and the replacement of the plates used to print them was estimated to cost tens of millions of dollars. Later, Fleming himself elaborated on the statistics for ships. He provided a detailed table indicating the meridians used by ships of all kinds. The table showed that 37,663 ships with a total tonnage of 14,600,972 used the Greenwich meridian, equating to 65% of ships and 72% of tonnage.

These seemed to be convincing arguments in favour of Greenwich. However, the French delegates were unimpressed; they insisted on a "neutral meridian" based on an island or other geographical feature. In particular, they mentioned the island archipelago of the Azores, in the North Atlantic Ocean. One of the French delegates, the famous astronomer and observatory director, Jules Janssen (1824–1907), said that they admitted that the majority of the world's shipping navigated by British charts, but, if it became compulsory to use only those, then

> ... (the common meridian), which by nature is of a purely scientific nature, and to which we would assume a long and certain future, will become the object of

burning competition and jealousy among nations.

When the location of the prime meridian finally came up for a vote, there were 21 nations in favour of Greenwich, two abstentions — Brazil and France — and one against, San Domingo. The Spanish representative was absent from the vote due to illness and subsequently asked for his country to be added to those in favour. Although it is no longer a working research observatory, current visitors to the Royal Observatory, Greenwich, can see the prime meridian line delineated and highlighted, as shown on Figure 4.

Figure 4: The prime meridian line at Greenwich Observatory in late 1975 or 1976. Since then, the brass strip has been replaced by stainless steel and at night there is a green laser shining from inside, marking the meridian in the London night sky. Photo Nick Lomb.

After this clear result in favour of Greenwich as the prime meridian, the next issue to be debated was a seemingly trivial one. Longitudes were to be counted from Greenwich, but should they be counted from 0° to 360° or east or west of Greenwich? Those in favour of the second alternative argued that for a place near Greenwich it is more convenient to say it is a few degrees west than to say it is 350° and some degrees east. More profoundly, it was argued that with counting to 360°, the break in the system would come awkwardly at Greenwich, while counting to plus minus 180° would put the break in the longitudes in the remote (to them) Pacific Ocean. On this issue, Sandford Fleming broke with other members of the British delegation by recommending that longitudes be counted 0° to 360°. He claimed that this would assist with the adoption of a universal day and universal time, which were to be discussed afterwards. Fleming's arguments were rejected.

When the vote was taken, it favoured counting longitudes east and west of Greenwich by 14 for, five noes, and six abstentions, including France. In effect, this decision established the International Date Line, which is well-known to Australians travelling to or from the west coast of the United States. As they cross the line, they gain or lose a day.

Subsequently, the conference accepted resolutions setting up a universal day, starting at midnight on the prime meridian and counted from 0 to 24 hours. Although starting from midnight seems obvious, it was not at the time as astronomers counted time from noon to avoid a change of date during the night. As will be discussed later, establishing a universal day and universal time were far-sighted decisions that are of

crucial importance to our modern times with instant communication around the world.

Adoption of standard time in Australia

By the late 19th century, the Australian colonies generally kept the time of their capital city throughout their own colony. That meant that there were no inconvenient changing times when travelling outside the city. The only people having to change times on their pocket watches were those who moved between colonies. For example, rail travellers from Sydney to Melbourne had to put their watches back by 25 minutes at Albury, on the border between the two colonies. However, this was only a slight inconvenience compared to having to change trains at the same station (Ryan, 2017).

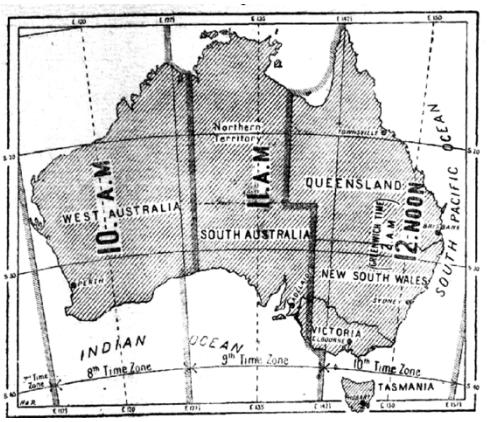


Figure 5: The standard time zones as established in 1895. From the *Daily Telegraph* 31 January 1895, page 5.

The push to move to standard time did not come from the railways but from gatherings of professional men. An early mention was at the Intercontinental Conference of Surveyors at Melbourne in November 1892 (Anon., 1892). There, a simple system was proposed that would see the legal standard of time for NSW, Tasmania, Victoria and Queensland be taken from the time at the longitude of 150° east of Greenwich. Similarly, South Australian time would be based on the 135th meridian and Western Australian time on the 120th. It was felt that "… every traveller would support such a change." Figure 5 shows how the continent was to be divided up into time zones. The South Australian Government Astronomer Charles Todd (1826–1910) dissented and wanted time for the whole of Australia to be based on the 150th meridian. That would have meant that people in Western Australia were two hours out of step with their local time, and was not accepted by the conference.

Standard time was next raised at the Postal and Telegraphic Conference held in Brisbane in March 1893 (Anon., 1893). Charles Todd, who was also postmaster-general for South Australia, again proposed one time for the whole of Australia. This time, though, it was for the time to be based on the 135th meridian that passed through South Australia. The consequence would have been that both on the east and west coasts of the continent, local time would differ from standard time by over an hour. Surprisingly, that proposal was accepted by the conference.

The acceptance of Todd's recommendation was reversed at the following Postal and Telegraphic Conference held in Auckland, New Zealand in March 1894 (Anon., 1894). This time, the conference accepted a proposal from the Queensland representative, Walter Horatio Wilson (1893–1902) to use, as had been previously suggested, the 150th, 135th and 120th meridians. For good measure, he also added the 165th meridian for New Zealand.

The idea of standard time was then in the hands of the politicians. Standard time legislation passed through the parliaments of the various Australian colonies with little opposition. The main objections came from the "Only two or three denizens of that home of lost causes the Victorian Legislative Council [who] opposed the Bill" (Davison, 1993, p. 73). There the Solicitor-General, Henry Cuthbert (1829–1907) introduced the Standard Time Bill on 16 January 1895 (Anon., 1895a). He explained that standard time was necessary as part of the move towards federation of the Australian colonies. As well, he referred to the Postal and Telegraphic conferences of 1893 and 1894, stating that the hour zone system was accepted at the latter meeting after much discussion.

One "denizen" claimed that "the Bill was a fad of a few scientific men," who were using the zone system as a temporary measure as they wanted the same time across the country. Further, that the railway timetables would have to be reprinted. Another complained that "people in Melbourne would have to get up 20 minutes earlier every day for the rest of their lives." Yet a third stated that "... the Government should avoid tinkering with what they did not understand." In reply, it was pointed out that railway timetables would remain the same and would not need to be reprinted. Reference was made to the Intercontinental Surveyors' Conference as supporting the zone system as it was of "value to Victoria from both the scientific and the practical point of view." As for the time difference of 20 minutes, time was wrong in all country districts, and it was not noticeable to the residents.

Despite the opposition, the Victorian Legislative Council agreed to the Bill without amendment. Consequently, the Governor gave his assent to the Act on 29 January 1895, just in time for its introduction three days later (Parliament of Victoria, 1895, p. 97).

On the assumption that the Act would be implemented in Melbourne, the government astronomers at Sydney and Melbourne were giving instructions and explanations of the new time system on the days before the change. Henry Chamberlain Russell (1836–1907) said that people in Sydney should put their clocks and watches back five minutes on the evening of Thursday 31 January 1895 (Russell, 1895). He noted that, "To be exact the change should be made at midnight ... but it will answer any purpose if the change is made late in the evening." Russell stressed that it was important to make the change, as all timetables of trains, trams and ferries would be changed by the same amount of time. Robert LJ Ellery (1827–1908) in Melbourne, gave a brief history of the introduction of standard time, referring back to the surveyor's conference of 1892 that he had chaired (Anon., 1895b). He explained that the time is the same for any meridian, so that the time zone of eastern Australia, based on the 150th meridian, also applied in New Guinea and in parts of Russia.[1]

In Melbourne, where the time had to be put forward by 20 minutes, the General Post Office clock was changed at midnight on 1 February 1895 (Anon., 1895c). To mark the occasion, it was illuminated, which it had not been for some time in the interest of economy. The change was also marked

1 Ellery mentioned Kamchatka, but today it is Vladivostok that keeps a time 10 hours ahead of Greenwich, that is, time based on the 150th meridian.

at Williamstown, Melbourne's old seaport, by the dropping of the time ball (Figure 6), not just at the usual 1 pm, but also at 9 am and 5 pm. In association with the time ball drops, a Victorian naval boat fired a gun 30 seconds before each drop. A consequence of the switch to standard time was that the arrival and departure times of intercolonial trains had to be altered in Melbourne. For example, the Sydney express was due to arrive at 12:09 pm instead of 11:34 am.

Figure 6: The Williamstown time ball in 2011. Photo Nick Lomb.

South Australian time shift

Although the adoption of the three standard time zones went smoothly, there were soon rumblings of discontent from South Australia. The Chamber of Commerce started urging a change to the time in the colony from July 1897 (Anon., 1898a). The objection was that by being one hour behind the time of New South Wales and Victoria "... the trading community [has been placed] at a decided disadvantage as against their neighbours ...". It was pointed out that before the change to standard time in 1895, South Australia had only been 35 minutes behind Victorian time. A return to that position was considered to be advantageous to the colony.

These objections were accepted by the Government, which drew up a Bill to move the time in the colony forward by half a n hour, putting it only half an hour behind the eastern states. There were dissenters. In a letter to the editor of *The Advertiser*, someone signing themselves Horologist (1898) explained that the zone time system was adopted as it simplified calculations. They said, "Alter the clock and you throw away the labor and skill of the scientific men who originated the time zone system ...". Similar arguments were raised in an editorial in *The Advertiser* on the day of the final debate in the House of Assembly (Anon., 1898b). The editorial suggested that the same advantage could be gained by opening places of business and similar establishments half an hour earlier.

At the final reading of the Bill in the House of Assembly, the Bill having already passed through the upper house, there was a vigorous discussion (Anon., 1898c). One spurious advantage mentioned was that as the Melbourne Cup was run at 3:30 pm, which was 2:30 pm in South Australia, the winner would be known there an hour ahead of the race. The speaker who cited the horse race, presumably tongue-in-cheek, said that "The Bill was a hanky-panky attempt to gain some advantage over the other colonies." A

number of speakers expressed resentment that Charles Todd's proposal for one time for Australia based on the 135th meridian passing through South Australia had not eventuated. As already noted, this proposal was made and accepted at the 1893 Postal and Telegraphic Conference, but rejected at the following meeting in 1894. The Bill was passed, and South Australia moved 30 minutes forward.

Discussion

Since 1898, the situation in Australia has been that the eastern states base their time on the 150th meridian, 10 hours ahead of Greenwich; South Australia and the Northern Territory are based on a meridian 142½° east, making them 9½ hours[2] ahead of Greenwich; Western Australian time is based on the 120th meridian, 8 hours ahead of Greenwich. As discussed, the situation was the result of serious and complex discussions and deliberations at a series of conferences, the recommendations of which impacted government policy, internationally and locally. These conferences included the 1884 Prime Meridian conference held in Washington, DC, the surveyor's conference held in Melbourne in 1892, and the two intercolonial postal conferences held in 1893 and 1894.

Today, it is not only the half-an-hour South Australian zone that deviates from the original scheme of three one-hour time zones covering Australia. Daylight saving has been introduced in a number of states, but not in those that extend towards the tropics: Queensland, Northern Territory and Western Australia. Daylight saving was first introduced during World War I and then repeated for three summers during World War II (Communities and Justice, 2022). It was reintroduced in 1971 and seemed to have become popular, since at a 1976 referendum in NSW there was 68 per cent support. With daylight saving, there are five separate time zones in Australia during the summer months.

The scientists and other professionals who introduced standard time to Australia were concerned about intercolonial (now interstate) train trips and telegraphic communication. They would not have dreamt of the number of instantaneous communications in the modern world that would be almost impossible without time zones. These communications include phone conversations, text messages and Zoom conferences, not just between Australian states, but with the entire world. Without zone time, these communications would be difficult or impossible to negotiate and arrange. Interstate travel can now be far quicker with aircraft than with trains as in the late 19th century. Zone time reduces the chance of confusion about timetables and helps reduce the chance of accidents.

Our civic time is based on the Universal Time (UT), decided upon at the Prime Meridian Conference in 1884. Local time is Universal Time plus the integer number of hours (or half hours) equivalent to the appropriate standard meridian. As the Earth's spinning is gradually slowing down, it no longer meets the nanosecond accuracy required by today's navigation, communications and scientific systems. This has led to a more precise definition of UT as Universal

2 The author often has had to calculate time of astronomical events in South Australia and in the Northern Territory for the annual *Australasian Sky Guide*. He can attest that the half hour zone adds an annoying complexity to calculations.

Coordinated Time (UTC) (Astronomical Applications Department, n.d.). UTC is based on time from atomic clocks, but leap seconds are occasionally inserted to ensure that there is no more than 0.9-seconds difference to the time from the Earth's rotation.

Although the present system has been in operation for decades, the operators of critical infrastructure such as global navigation systems, like GPS, find the discontinuity caused by leap seconds to be increasingly problematic. Hence, the international General Conference on Weights and Measures at its 2022 meeting in Versailles decided by the year 2035 to greatly increase the allowed difference between the time from atomic clocks and the time from the Earth's rotation (The General Conference on Weights and Measures, 2022). Thus, the link between our civic time and the spin of the Earth that has existed since the beginning of human history will be greatly lessened in the near future.

Despite the modifications to the time zone system and the changes to the way time is defined and measured, the introduction of standard time by the Australian colonies in 1895 has become increasingly useful and necessary in the 21st century.

Acknowledgements

The author is grateful to the editor of the *Journal & Proceedings*, Emeritus Professor Robert Marks, for suggesting this article on the topic of standard time in Australia.

References

Anonymous (1892) Intercontinental Conference of Surveyors. *The Age* 5 November: p. 9.

Anonymous (1893) The Postal Conference. *Toowoomba Chronicle and Darling Downs General Advertiser* 28 March: p. 4.

Anonymous (1894) The Postal Conference. *The Age* 20 March: p. 5.

Anonymous (1895a) Parliament: Legislative Council. *The Argus* 17 January: p. 7.

Anonymous (1895b) New Standard Time, effect of the alterations, the system explained. *Evening News* 28 January: p. 3.

Anonymous (1895c) The Standard Time, clocks to be put on 20 minutes. *Argus* 1 February: p. 7.

Anonymous (1898a) Chamber of Commerce: half yearly meeting. *The Advertiser* 29 October: p. 5.

Anonymous (1898b) The Standard Time Bill. *The Advertiser* 1 November: p. 4.

Anonymous (1898c) The Parliament: House of Assembly. *The Advertiser* 2 November: p. 7.

Anonymous (1908) Late Time-Ball. *Evening News* 10 August: p. 3.

Astronomical Applications Department (n.d.) *Universal Time*. Available at: https://aa.usno.navy.mil/faq/UT (accessed 13 January 2025).

Bartky IR (1989) The adoption of standard time. *Technology and Culture* 30(1): 25–56.

Communities and Justice (2022) *History of daylight saving in NSW*. Available at: https://dcj.nsw.gov.au/about-us/daylight-saving/history-of-daylight-saving-in-nsw.html (accessed 13 January 2025).

Creet M (1998) Fleming, Sir Sanford. *Dictionary of Canadian Biography*. Toronto: University of Toronto/Université Laval. Available at: https://www.biographi.ca/en/bio/fleming_sandford_14E.html (accessed 13 January 2025).

Davison G (1993) *The Unforgiving Minute: How Australia Learnt to Tell the Time*. South Melbourne: Oxford University Press.

Horologist (1898) Zone Time: to the Editor. *The Advertiser* 20 August: p. 8.

Howse D (1980) *Greenwich Time and the Discovery of the Longitude*. Oxford: Oxford University Press.

Library of Congress (n.d.) *Daylight Saving: Topics in Chronicling America*. Available at: https://guides.loc.gov/chronicling-america-daylight-saving/introduction (accessed 13 January 2025).

Parliament of Victoria (1895) *Minutes of the Proceedings of the Legislative Council:*

Session 1894–5. Melbourne: Robt. S. Brain, Government Printer. Available at: https://www.parliament.vic.gov.au/497237/contentassets/04d4ad562d3c4a03ae7909eb474b3407/lc_minutes_of_the_proceedings_1894-1895_s1.pdf (accessed 13 January 2025).

Russell HC (1895) Standard Time: Official Information. *Evening News* 29 January: p. 7.

Ryan G (2017) *Changing Trains in Albury*. Available at: https://alburyhistory.org.au/wp-content/uploads/2017/08/Changing-Trains-in-Albury.pdf (accessed 13 January 2025).

The General Conference on Weights and Measures (2022) *Resolution 4 of the 27th CGPM (2022): On the use and future development of UTC*. Available at: https://www.bipm.org/en/cgpm-2022/resolution-4 (accessed 13 January 2025).

Various (1884) *International Conference held at Washington for the purpose of fixing a Prime Meridian and a Universal Day, October 1884, Protocols of the Proceedings*. Washington, DC: Gibson Bros.

Willis EP and Hooke WH (2006) Cleveland Abbe and American Meteorology, 1871–1901. *Bulletin of the American Meteorological Society* 87(3): 315–326.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 16–31. ISSN 0035-9173/25/01016-16

A brief history of the Australian electronic nose

D. Brynn Hibbert[a] **and Graham Bell**[b]

[a] School of Chemistry, UNSW Sydney
[b] E-Nose Pty Ltd, and iOmniscient, Pty Ltd, Sydney

b.hibbert@unsw.edu.au

Abstract

From the early 1970s, Australian research groups attempted to understand the chemistry, physiology and psychology of the sense of smell (olfaction) in humans and animals. This work identified a clear need for cheap, rapid and portable tools for measuring and identifying complex mixtures of airborne molecules that comprise what we know as smells. Collaborative work at UNSW, Sydney University and CSIRO produced a portable array of metal-oxide conductimetric sensors, coupled with multivariate data analysis, capable of a variety of smell-sensing tasks. Their prototype devices were among the first in the world. Research with evolving designs and the rapidly improving and ever-miniaturising electronics progressed the development of four versions (Mk 1–4) of the Australian electronic nose. These found many practical applications described below. Human breath testing for disease diagnosis, such as early lung cancer, is one of many challenges for future applications. Spinning off a company (E-Nose Pty Ltd) at the new Australian Technology Park, the researchers worked with a wide range of companies, government departments, and white-knight investors. The intellectual property was recently transferred to an international company based in Sydney, iOmniscient Pty Ltd, which is currently developing an updated version (E-Nose Mk 5) with potentially increased numbers of sensors and immediate remote data analysis. The founders' legacy lives on in universities, food and wine research centres, and engineering departments, where new sensing materials and artificial intelligence (AI) approaches are offering modern insights into creating and extracting information from e-nose signals. The paper ends with a brief review of current research and directions in e-nose technology in Australia.

Introduction

A human-made artefact that works remotely like some facet of a living entity is commonly called a "bionic xxx," "electronic xxx" or "artificial xxx." Most of the mammalian senses have been reproduced in this way, either to help those who have lost that sense (e.g. bionic ear implants), or to provide an artificial analogue (e.g. electronic nose, electronic tongue). This paper will describe the development of an electronic nose and its applications in Australia. As del Valle points out: "Electronic nose devices are sensor systems *bio-inspired* in the human olfactory system" (Del Valle, 2021). Inspiration is the keyword. Researchers have made no attempt to substitute medically implantable devices to provide olfactory perception for humans suffering loss of the sense of smell. Instead, to date, the electronic nose has served as a means of analysing complex airborne molecular mixtures and identifying their source, which usually provides a name for the smell, and its strength. The need to do so was identified from aspects of food technology, environmental science, and perhaps most

importantly from medical diagnostics. The Australian E-Nose® typically comprised six metal-oxide semiconducting (MOS) sensors, a far cry from the six million olfactory cells with four hundred different kinds of receptor in a person. However, all these simple machines share the enormous advantage of being cheap (compared with people and the capital equipment of an analytical chemistry lab), running 24/7, and having an ability to be connected to digital clouds and global internets for practically instantaneous results.

What is a smell? The challenges of mimicking olfactory perception

A smell, or "odour," is a perception formed in the brain from the reception of airborne molecules, usually carried by the air, in a complex molecular mixture. Chemical analysis by slow and expensive methods of gas chromatography and mass spectrometry has shown that these complex mixtures may consist of hundreds of different molecular species. The molecules carried in the air emanate from a source, by which we label the odour experience, such as "floral" (from flowers) or "putrid" (from rotting flesh). There are almost as many names for odours as there are identifiable sources. In mimicking the human nose and brain, therefore, an e-nose needs to capture sufficient numbers of molecules from an odour source and correctly identify the source by name. Even if naming the incoming odour is not required, the device can inform on: general levels of smelly and non-smelly molecules in the air, the direction from which they are coming (usually measured by wind direction), and whether the composition of the molecular mixture is changing or has reached a preset alarm level. The ubiquitous nature of smells in human existence can lead the imagination to devise innumerable applications for a device that can measure and identify smells. Solutions hang on obtaining and treating the data from the devices.

Defining a smell in terms of the data from an e-nose can become a non-trivial part of the problem. We have to validly (correctly) and reliably (repeatedly) recognise the odour's name (origin). Australian researchers made world-leading headway in the analysis of e-nose data, using the strategy of storing the incoming sets of data and then applying statistical analysis to match data from an unknown source with those held in memory. In this regard, the e-nose does what we know by introspection to be the process of recognising an odour in the human mind, by the interrogation of one's memory. So while we may use analytical chemistry to aid the identification, complete, or even partial, knowledge of the molecules involved is not necessary.

When smelling, we humans can sniff the air, usually rapidly, to determine if our judgement is confirmed or if the smell is changing or strengthening. Animals apply this method to determine the identity and direction from which the smell is coming. To mimic human smell perception, the e-nose needs a mechanism by which it can update its data within a practically useful interval, and to do so it must be able to reset its data to a base-line so that a new sample can be obtained and assessed.

What a smell is and how it is detected by the human nose helped define the challenges which the Australian researchers set out to meet, in the development of their e-nose device.

What is an electronic nose?

An electronic nose consists of an inlet system to deliver air carrying the odour to the electronic sensors, organised in an array. Each sensor usually responds strongly to a different family of airborne molecules, but can also respond to extra molecular species. The sensor array produces a measurable, patterned output (in our case voltages) responding to the components of the mixture of odour molecules. A data-processing system converts the voltages into digital form and is programmed to deliver the required information. There are electronic noses that are bench-top instruments with up to forty sensors for use, for example, in food processing plants. An example is the American Aromascan A32S with 32 conducting polymer sensors (Wilson et al., 2013). However, many exploit the portability of a few (three to six) small and low-powered sensors to widen the possible uses of an electronic nose in a variety of well-defined and specific field applications.

Electronic chemical sensors

Each electronic nose sensor provides non-specific information about the molecules it senses (Ollé et al., 2020). The principles of measurement include changes in the sensor of: conductance, temperature, optical properties, electrochemical potential, and mass (John et al., 2021). Electronic chemical sensors respond within a few seconds to properties of the airborne molecules, giving them a distinct advantage in speed of analysis over "traditional" chemical analytical tools (amounting to capital equipment in a chemistry lab) such as gas chromatography, spectroscopy, ion mobility spectrometry and mass spectrometry. The Australian e-nose took its lead from British researchers (Gardner, 1988; Gardner and Bartlett, 1994) who alerted its developers to the usefulness of metal oxide sensors for inclusion in an e-nose device. The advantages of these sensors were their reliability, speed of recovery, and non-specificity (responding to a wide range of molecular species).

Optional analytical chemical approaches to sensing include: metal-oxide semiconductors (MOS); conducting polymers for conductimetric measurements; surface acoustic wave and quartz crystal microbalance for mass measurements; and fluorescent chemical arrays for optical measurements (Barnett, 1999; Hibbert, 1999; Khorramifar et al., 2023).

Australian electronic noses have mostly used variants of metal-oxide sensors, typically those marketed by the Japanese company Figaro Electronics (*Figaro Engineering Inc.*, 2018), and known as "Taguchi" sensors, after their inventor (Taguchi, 1962). These sensors work when a gas, often a "volatile organic compound" (VOC), adsorbs on the heated sensor and reacts with the metal oxide, causing atomic vacancies in the surface which result in a reduction of electrical resistance. Typically, three to six sensors are exposed to the test atmosphere and the output (a voltage across a resistor in series with the sensor) is recorded at suitable intervals, usually seconds. See Figure 1 (overleaf) for the workings of a Mark 4 E-Nose.

Figure 1: Mark 4 E-Nose by Enose Pty Ltd showing six sensors. (Photo G Bell).

If the atmosphere being tested has unchanging levels of the sensed chemicals, the output will be essentially constant (see Figure 2a). If the device "sniffs" the atmosphere containing active chemicals, the signal will rise and then fall away back to the baseline (see Figure 2b).

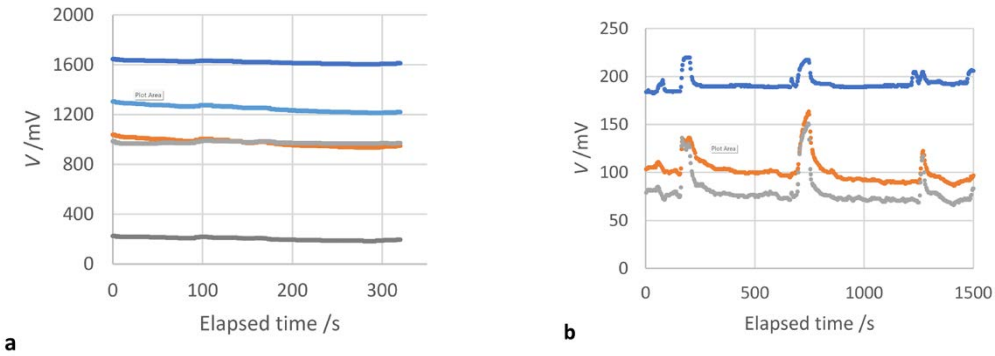


Figure 2: (a) Continuous signals from five sensors near a site in a meat works. (b) Varying signals from three sensors moving over ground with buried truffles. (Unpublished data of the authors).

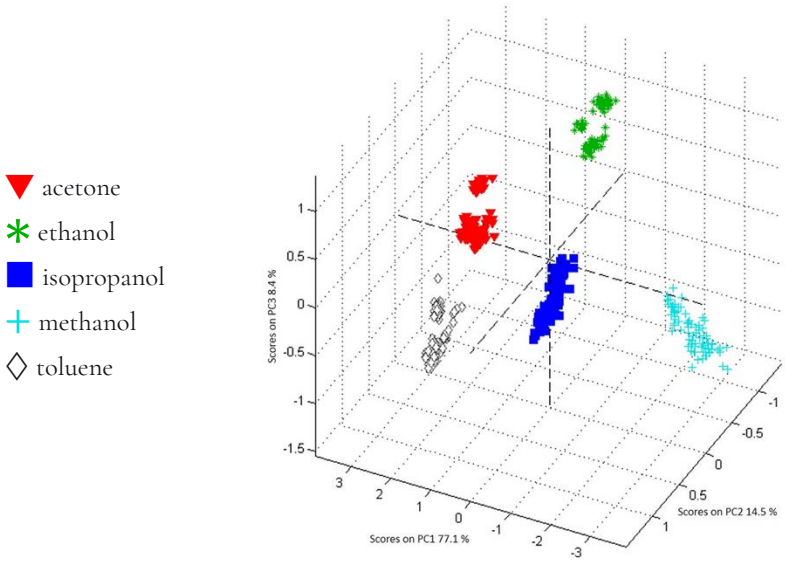


Figure 3: Discrimination among organic solvents using a five-sensor electronic nose, with principal components analysis of row-standardised data. Used with permission of Dr Surachet Phadungdhitdhada.

The response of a chemical sensor will depend on the kind of airborne chemical and its concentration. It is not possible to identify a chemical from the measured voltages alone, but by taking patterns of responses, a pattern or *fingerprint* may be obtained, to be compared against a library of previously obtained patterns from expected chemicals, i.e. odours. In the example of Figure 3, five common volatile organic solvents were successfully distinguished by a five-sensor e-nose using a simple multivariate approach (principal components analysis) on sensor data that were row-standardised to take out the effect of concentration of the target chemical. (It is coincidental that in this case there are five sensors and five targets, but, in general, the more sensors, the greater the discriminating power).

Many kinds of multivariate statistical analyses have been used to classify or quantify electronic nose data. A method that exploits Bayesian statistics to give the probability that an unknown odour is a particular target chemical was patented by E-Nose Pty Ltd in 2007 (Hibbert and Bell, 2007), and recently reviewed (Hibbert, 2024). With the current interest in AI, it is not surprising that the possibility of artificial intelligence approaches using "deep learning" artificial neural networks (LeCun et al., 2015) has already been shown to be useful in odour identification by electronic noses (Wang et al., 2023).

Australian electronic noses

Research into electronic noses is now popular across the world, led by institutions in the People's Republic of China (PRC). A recent Scopus search on *electronic nose* or *e-nose* gave 11,780 documents, of which 4062 were from the PRC, more than double the next two countries (USA, 1,097 publications and Italy 1,025 publications). Australia with 230 publications is in 13th place, but much of the output from Australia is in commercial projects or a small number of patents. Publications commence in the early 1990s, some time after the inventions of chemical sensors by Taguchi (1962) and Wilkens (Wilkens and Hartman, 1964) were given an impetus by modern electronics and portable computing. Warwick University in the United Kingdom claimed (*University of Warwick*, 2016) the first commercial electronic nose (Pearce et al., 1993), which used Taguchi's metal oxide sensors.

CSIRO (Commonwealth Scientific and Industrial Research Organisation)

After World War II, the CSIRO's Division of Food Science and Technology was tasked by the Australian Federal Government with serving the Australian food industry and its need to improve the quality of food products for both the Australian domestic and export markets. Its Food Science Laboratory, in Sydney, included a group of scientists working on the chemical basis of food acceptance. Out of this emerged Graham Bell's team working on the anatomy and physiology of the sense of smell and, later, the electronic nose. In work that began in the 1980s at CSIRO, it was hoped that the physiology and anatomy of the mammalian nose and brain would lead to an understanding of human perception and chemistry of food appreciation. While work at the CSIRO's Food Research Laboratory also developed useful ways of measuring food appreciation of manufactured and fresh foods, and made a significant contribution to Australian food exports, work on the rat and mouse brain yielded new information

of how specific airborne molecules became "encoded" as odour-specific *patterns* in the forebrains of these animals (Bell, 1997, 1999; Bell et al., 1987a, 1987b). The latter discoveries became an incentive for the Australian researchers to attempt to produce odour-specific patterns of data in an array of artificial electronic chemical sensors, that were at that time becoming commercially available (Barnett, 1999).

The initial aim was to develop highly sensitive and specific chemical sensors derived from nasal receptor physiology. The Nobel Prize-winning discoveries of genetic code for olfactory receptors embedded in the nasal epithelium of mammals was made by Buck and Axel in 1991 (Barwich, 2020), which opened the possibility to clone receptors for specific odour molecules, thereby creating an odour-specific man-made biosensor. After a brief collaboration with Linda Buck, it was concluded that, even if successful, the cloned biological materials in the biosensors would suffer from lack of robustness and short operating lifetime (Barnett, 1999). Since most odours of interest to the food industry, and indeed for wider use, consist of mixtures of large numbers of chemical species, the difficulty of achieving biologically-based, robust, chemical sensors proved prohibitive. Instead, the forms of this work moved to the development of an electronic nose suitable for applications in industry. The CSIRO team resolved to create an array of electronic sensors, as proposed by the Warwick University scientists (*University of Warwick*, 2016), using existing commercially available metal-oxide sensors. The paradoxical virtue of these sensors was their imperfect yet reliable specificity to families of airborne chemicals. As informed by the work of Gardner, the team started work on the statistical treatment of the complex data from the sensor array.

One of the team of CSIRO scientists, Donald Barnett, created the first CSIRO electronic nose: a sensor array housed in a small stainless-steel chamber through which gases and samples of smells could be pumped. The voltage responses from the Taguchi sensors were captured and fed to an early form of desktop computer. David Levy, formerly of the University of Natal, joined the CSIRO team and later moved to Sydney University. His expertise in neural networks as well as electronic design, was a timely contribution.

University of New South Wales (UNSW)

At around the same time as CSIRO's work, the new UNSW Chair of Analytical Chemistry, Hibbert, brought an interest in chemometrics and electrochemistry to join a thriving electroanalytical group at the University, working in flow-injection analysis, led by Peter Alexander. This resulted in publications on volatile alcohols (Di Benedetto et al., 1996) including identification of beers (Alexander et al., 1998).

Their work came to the attention of the public when the two scientists tested their electronic nose in the Sydney Harbour Tunnel at its opening in August 1992 (Jinman, 1992). While optimising the ventilation of the tunnel, the operators had managed to cause a compression of the tunnel exhaust fumes in the last 100 m before the northern exit. The Australian Broadcasting Corporation's (ABC) "7:30 Report" accompanied the professors and their electronic nose through the tunnel, with Hibbert remarking that the air in the tunnel was a better quality than in the CBD (Central Business District). This was until they saw the wall of white

fumes in front of them. True to form, the electronic nose duly went off scale, and Hibbert was invited to say on the evening news that people would die if they ventured down the Harbour tunnel. Adjustments to the ventilation were quickly made and, on a return pass-through, the tunnels were clear.

The UNSW group attracted further attention when their e-nose was used to identify red and white wines for the ABC Science program, "Quantum." Ethanol is the primary component of alcoholic drinks. There have been many attempts to use electronic noses to classify alcoholic drinks, especially the kind, origin, and year of wines (Gonzalez Viejo and Fuentes, 2022). A trained sommelier can tell a chardonnay from a shiraz by its "nose," but could a chemical sensor? The "Quantum" segment showed Hibbert on Bronte beach in Sydney's Eastern Suburbs pouring wine into three glasses: "one for the interviewer," "one for the Professor," and "one for the electronic nose." He then waved a tube above the electronic-nose's wine glass, looked at the screen of the computer and declared, "It's a chardonnay." At the time the instrument could tell a white wine from a red wine, and the training set consisted of only half a dozen quite distinct wines, so although it made for an entertaining TV segment, science was not greatly advanced; although it was a start. The Australian Skeptics challenged the UNSW electronic-nose team to correctly identify wine of the Skeptics' choosing. The academics noted that the electronic nose could only identify wines it had already smelled and added to its database. The Skeptics were unwilling to provide a suitable training set (i.e. several bottles of different, and hopefully high-quality wines) and were satisfied by a presentation from Hibbert at their national conference. Use of an e-nose on wine was not pursued by the UNSW group, but has been attempted by other Australian scientists (Cynkar et al., 2010).

CSIRO joins UNSW at the Centre for Chemosensory Research

In 1997, several members of CSIRO's sensory research team left CSIRO and established the UNSW's Centre for Chemosensory Research. This facilitated valuable interaction with the UNSW School of Chemistry, School of Medical Science, and Departments of Anatomy and Physiology. In addition, Associate Professor David Levy had been appointed to the School of Electronic Engineering and Computer Science at Sydney University, closely located to the new Centre, and he introduced to the group Bashan Naidoo (from South Africa), Dr. Arvind Srivastava, and Master's student Winston Wu, all of whom helped develop the device and software. Together they became one of the world's most active e-nose research groups. The collaboration led to work on two fronts described in detail below: **A**. Development of e-nose hardware and software; **B**. Development of e-nose applications. Client companies brought problems for the e-noses to be tested on. The Centre offered services on various aspects of sensory science to a number of Australian and international clients, and these are discussed in section **B**.

A. Development of the E-Nose

In 2003, E-Nose Pty Ltd was launched at the Centre, as a commercial company owned by a core of shareholders from the scientific

group.[1] Devices known as E-Nose Mk2, 3 and 4 (see Figure 4) were designed and tested and several patents were granted (Barnett et al., 2005a; Barnett et al., 2005b). There was a considerable amount of invention, and the electronic hardware was "tailored" to meet client expectations and functional demands, such as changing of sensors, or combining e-nose data with other technological data (wind, temperature, humidity and vision). Several printed circuit boards were designed at this time by Sydney University's Winston Wu. Communication electronics were added to Mk 4 (Figure 1), allowing the device to transmit its data on the internet, and to call its owners via the mobile phone network. Mk 3 and Mk 4 enabled the company to offer services to a number of Australian clients who needed assistance with wide-area smell issues, such as waste recycling and meat processing, whose odours were the subject of public complaints. The company was awarded *an Innovator of the Year Award* by Frost and Sullivan in 2008, Figure 4.

Figure 4: E-Nose Pty Ltd Devices with Frost and Sullivan Innovation of the Year Award (2009)

B. Development of E-Nose application

Each problem set for the device required an amount of application development. This involved setting-up the e-nose/s in the "field" as required: building secure water-resistant housing, which could nevertheless "breathe" the outside air, supplying the device with appropriate power (e.g. portable batteries or connected to an uninterruptable power supply) and connected to the mobile phone network. The clients' problems were never not challenging, as can be discerned from the project summaries which follow.

B1. Wide area monitoring projects

E-Nose Pty Ltd had been working on monitoring air pollution using electronic noses since 2004, and the first sale of an industrial E-Nose was to SE Water Ltd, a Melbourne water-treatment company. Since then, the device has been developed to meet customer needs, with outright sales of around 50 devices and many service contracts for renting devices.

The company's devices were tested in several countries, including Japan, Philippines, Hong Kong, Chile, South Africa and New Zealand. Summaries of the kinds of tasks and their results, include:

a) E-Nose Pty Ltd monitored oil industry sites on Sydney Harbour and at the Port of Adelaide. Both projects concerned penetration of nearby residential areas by fugitive odours from oil or bitumen distribution plants. The device identified the sources of the odours — which came from the client's site and which did not — and how far the odour was invading community housing areas, and at what concentration. In Sydney, a monitor recorded oil industrial odours continuously for three months and was logged remotely and reported to the client weekly. The data became the basis for conflict resolution, demonstrating that

1 Brynn Hibbert, Graham Bell, Don Barnett, Brian Crowley, David Levy, Winston Wu and Arvind Srivastava.

the client companies cared about the neighbouring communities. (Clients: Shell Oil (Australia) and Shell Bitumen (Australia)).

b) Hong Kong's waste treatment facility produced odour in vast air volumes, carrying waste-treatment odours to residents. Working with local Chinese environmental consultants, E-Noses monitored odour released from a large waste-treatment operation in the New Territories, at some large apartment blocks three kilometres across the waters of Junk Bay. Continuous monitoring proceeded for one year. Data informed the HK EPD (environmental authority) about which site-sourced odours were reaching the residential towers and when. The data were used to manage operations of the waste facility and reduce the concerns of residents.

c) Biofilters are very large tanks, the size of a large swimming pool, containing plant and other materials which filter air from a smelly part of a factory (such as a meat works) to remove its smell. Waste-processing odour from biofilters in New South Wales were monitored using E-Noses. The results demonstrated which filters were saturated (no longer effective) and which needed refurbishment, to avoid community smell issues resurfacing. In addition, gas was sampled from varying depths in a biofilter and was fed into an E-Nose, thereby allowing precise assessment of the efficacy of the biofilter.

d) Long-term monitoring of the large Melbourne Resource Recovery Facility showed which parts of the site presented the biggest odour issues and that neighbouring activities (non-client) were also contributing to odour reaching a suburb, downwind. The efficacy of odour abatement methodology and various chemical sprays was demonstrated using the E-Nose, and guided the client toward the best management practice for their operations.

e) At Coffs Harbour, NSW, a large waste management facility was the subject of complaints by residents and shoppers at a local shopping mall. An odour audit by e-noses on the rooftop of a motor vehicle, at positions across the site three times during the day demonstrated which area had the highest odour and where it was emanating from. It was shown that odour increased and decreased at various points on the site according to the time of day. The contribution of the site-odour to ambient air flowing across the site was measured, and formed a basis for confidence by management in answering community concerns. After new waste-gas-combustion equipment was installed, the work was repeated and the efficacy of the investment in new equipment was evaluated.

f) Disgusting animal odours disturbing local residents in Nambucca Shire NSW: Long-term monitoring at two sites in the hills adjacent to a pig farm helped resolve a bitter dispute between residents and the farm operator. The devices provided objective measurements that tallied (independently) with diary reports kept by the residents. The Shire council used the data to quietly resolve compliance issues in what had been a highly acrimonious situation.

g) A three-month monitoring study was undertaken, using a pair of E-Noses, simultaneously, at two boundaries of a cattle feed lot, following complaints from the suburban residents and the West Echuca Primary School, Victoria. The study showed which odours were coming from the emitting sources on the feed lot, and which were not. Odours which were the responsibility

of the emitter were identified, using wind direction and both quality and quantity measurements by the E-Noses, as well as duration and time, 24/7, of the high-odour events. Some relevant odours travelled only as far as the houses, while others, on the opposite wind direction, reached only the school. The information had a positive effect on odour management of the offending cattle feed lot and on community morale.

h) Fugitive emissions from sewage-pumping stations across south-east Melbourne and Port Phillip Bay were a cause for concern by environmental authorities and plant managers. An early version of the E-Nose was used to monitor these emissions from sewage-treatment plants and large areas of soil development, to determine what level of odours were likely to give rise to complaints from residences, and when the odours occurred. The Victorian EPA (Environmental Protection Agency) indicated its pleasure that these companies were acting with responsibility toward their communities.

B2. Security applications of the E-Nose

Interest has been shown in deploying e-noses to protect people from fumes, dangerous gases, unexploded devices, and to sniff-out drugs in prisons. This indicates the general interest in e-nose applications. An E-Nose was developed to control graffiti vandalism by being able to distinguish the smell of spray paint and then immediately alert an appropriate authority by means of an integrated mobile phone. Later, video monitoring was introduced to assist in the apprehension of the vandals. The E-Nose provided vital information of when the smell was detected, thereby allowing the video record of the offence to be interrogated at a precise time. The "Graffit-E-Nose™" has been used successfully by local councils in combatting graffiti vandalism (Bell, 2010; Cook, 2011).

Public exposure came with the appearance of Bell and Hibbert on the ABC program, "The New Inventors," in 2008 when they won the People's Choice award for their episode. The authors presented this novel invention which had at the time demonstrated success in apprehending graffiti vandals in Sydney and Brisbane.

B3. Breath Diagnosis: cancers and diabetes

On the academic research front, the E-Nose showed its value as a potential diagnostic tool for detection, on human breath, of both lung and breast cancer (Herman-Saffar et al., 2018; Tran et al., 2010). The latter Israeli research was performed independently of E-Nose Pty Ltd and found evidence of breast cancer using the Mk 4 device, as well as testing its performance against a leading device from the USA. The comparison showed the Australian device to be superior. This result carries a clear promise that Australian e-noses will make a significant difference to the health of populations plagued by diseases that can be treated if detected early enough. We can look forward to exciting progress in the use of Australian e-noses in early diagnosis of lung cancer and, indeed, of early diagnosis of many other cancers, such as breast, bowel and abdominal.

Early work in collaboration with Diabetes Australia showed a three-sensor E-Nose using a Bayesian classifier on a multivariate normal distribution could distinguish between non-diabetic patients (92 % correct) and diabetic patients (82 % correct), particularly if their blood sugar was elevated (88 % correct).

B4. Animal Health: sheep diseases

Australia's sheep industry has been, since colonial times, a vital part of its economy. However, like many aspects of livestock management, the human labour involved in managing ever-increasing numbers of sheep that make a viable enterprise is becoming difficult to provide, and the need for technology to aid the sheep farmer grows. The Cooperative Research Centre for Sheep Production approached the E-Nose researchers with the problem of diagnosing sheep diseases automatically, using an e-nose. A Mk 3 E-Nose was provided to the CRC, and while it remains to be successfully applied to sheep races, a resulting key study on sheep by an associated university group proved its use in detecting diseases in sheep (Cramp et al., 2009). It is anticipated that e-noses will become used in many ways in the future, by combining their power to discriminate odours and identify their sources in agricultural settings.

Other Australian electronic noses

Electronic nose research continues around Australia. The group having the greatest academic output on the use of electronic noses for food and crop monitoring is the University of Melbourne Digital Agriculture Food and Wine Group, in the School of Agriculture and Food, Faculty of Veterinary and Agricultural Sciences, led by Associate Professor Sigfredo Fuentes (*The University of Melbourne*, 2024). The group has published on, inter alia, detecting bush-fire smoke-taint in grapes and wines (Fuentes et al., 2020; Summerson et al., 2021), early detection of aphids in wheat (Fuentes et al., 2021), *Fusarium oxysporum* infection in tomatoes (Feng et al., 2022), and detection of fraudulent rice (Aznan et al., 2022). The group stresses the low cost of their electronic nose, which is often used in combination with infrared spectroscopy. Their developed instrument consists of nine MOS sensors from Henan Hanwei Electronics Co., Ltd, China (Gonzalez Viejo et al., 2020), plus temperature and humidity sensors. Classification is by artificial neural networks with a variety of training algorithms. In (Gonzalez Viejo et al., 2020) the optimum classification of beer aroma by correctly predicting 17 volatile organic compounds detected by gas chromatography-mass spectrometry was a Bayesian Regularisation algorithm.

Other Australian groups which have published on a range of electronic nose applications which are compiled in Table 1 (see overleaf).

Table 1: Other Australian groups publishing on electronic noses

Group leader	Institution	Field of work	Example study
Russell Keast	CASS Food Research Centre. Deakin University, Burwood, Victoria	Food research, Consumer Analytical Safety Sensory	Sensory studies of broccoli (Hong et al., 2022)
Antonio Tricoli	The Australian National University, Canberra, ACT	Food quality and environmental monitoring	Review of electronic nose systems (John et al., 2021)
Dusan Losic	The University of Adelaide, Adelaide, SA	Novel sensing materials for cancer diagnosis	Core-shell nanostructured hybrid composites for volatile organic compound detection (Tung et al., 2015)
Amalia Berna	CSIRO, Canberra ACT	Food analysis	MOS for electronic noses and their application to food analysis (Berna, 2010)
Daniel Cozzolino	The Australian Wine Research Institute, Glen Osmond, SA and Hobart, Tasmania	Wine classification, sensory properties of wines	Classification of Tempranillo wines according to geographic origin (Cynkar et al., 2010)
Annette G. Dent	The Prince Charles Hospital, and The University of Queensland, Brisbane, QLD	Lung cancer diagnosis	Exhaled breath analysis for lung cancer (Dent et al., 2013)
P.J. James	Queensland Primary Industries and Fisheries, Yeerongpilly and Toowoomba, QLD	Animal welfare	Detection of cutaneous myiasis in sheep using an 'electronic nose' (Cramp et al., 2009)
Richard Stuetz	The University of New South Wales, Sydney, NSW	Environmental monitoring	Monitoring techniques for odour abatement assessment (Muñoz et al., 2010)
André van Schaik	International Centre for Neuromorphic Systems Western Sydney University, NSW	Processing sensor responses	Spike-time encoding of gas concentrations using neuromorphic analog sensory front-end (Rastogi et al., 2023)

Conclusions

Spanning five decades, the invention and development of the Australian E-Nose has demonstrated noteworthy excellence. It has followed a bumpy path, contending with variable incentives from the market and funding sources. However, it is safe to say that analysis of complex mixtures of airborne odours by arrays of chemical sensors is a technology whose time has come. The Australian E-Nose has been shown to add value to human enterprises and meet needs in several contexts: industrial processes; environmental management; air pollution control; security at sites vulnerable to graffiti attack; municipal-community relations; air quality in public and private spaces; and health and welfare through new forms of rapid and cheap diagnostics. Each iteration of the E-Nose (Mk 1 to Mk4) has made improvements to the device's hardware and software in response to market demand. These have included communications technology which has been advancing with the passage of the past two decades. The Mk 5 device being developed by iOmniscient Pty Ltd will exploit new electronics and perform rapid complex data analysis using remote "cloud" technology.

In future we will see many applications bringing greater safety and security to human life, aided by electronic noses of various kinds. Miniaturization and mass manufacture, combined with ever-improving software will make possible — and indeed commonplace — many new applications in industry, the home, the hospital, the military and wherever imagination takes us. Australia has made an important contribution to this field.

Acknowledgements

The authors thanks Dr Surachet Phadungdhitdhada for permission to reproduce Figure 3, which was presented at the 2008 Annual Conference of the Australian Association for Chemosensory Science (AACSS). We are grateful to Dr Rustom Kanga and Ms Ivy Li, of iOmniscient Pty Ltd for carrying forward the start described here, and to our medical collaborators, particularly Dr. Paul Thomas, for helping to prove that the E-Nose has a bright future in non-invasive diagnosis and early intervention in lung cancer and related diseases.

References

Alexander PW, Di Benedetto LT and Hibbert DB (1998) A field-portable gas analyzer with an array of six semiconductor sensors. Part 2: Identification of beer samples using artificial neural networks. *Field Analytical Chemistry & Technology* 2(3): 145–153.

Aznan A, Gonzalez Viejo C, Pang A, et al. (2022) Rapid detection of fraudulent rice using low-cost digital sensing devices and machine learning. *Sensors* 22(22): 8655.

Barnett D (1999) Probabilities and possibilities: on-line sensors for food processing. In: Bell GA and Watson AJ (eds) *Tastes & Aromas: The Chemical Senses in Science and Industry*. Sydney, Australia: UNSW Press/ Blackwell Science, pp. 189–198.

Barnett D, Wenzhi W, Bell G, et al. (2005a) A detector for detecting molecules conveyed through a gaseous medium. WO2005103662A1. Available at: https://patents.google.com/patent/WO2005103662A1/en (accessed 27 June 2025).

Barnett D, Hibbert B, Bell G, et al. (2005b) A method of monitoring a predetermined type of molecule conveyed through a gaseous medium. WO2005104053A1. Available at: https://patents.google.com/patent/WO2005104053A1/en (accessed 27 June 2025).

Barwich A-S (2020) What makes a discovery successful? The story of Linda Buck and

the olfactory receptors. *Cell* 181(4). Elsevier: 749–753.
Bell G (2010) Graffiti vandals sent to court. *Local Government Focus*, 1 January. Available at: https://lgfocus.com.au/news/2010/01/01/graffiti-vandals-sent-to-court/ (accessed 27 June 2025).
Bell GA (1997) Receptors for odorants of similar and dissimilar qualities and molecular structure visualized by 2-DG maps of olfactory bulb glomeruli. In: *Nineteenth Annual Meeting of the Association for Chemoreception Sciences (AChemS XIX) and the Twelfth International Symposium on Olfaction and Taste (ISOT XII)*, 1997, pp. 645–646. Available at: https://academic.oup.com/chemse/article/22/6/635/278260 (accessed 28 June 2025).
Bell GA (1999) Future technologies envisaged from molecular mechanisms of olfactory perception. In: Bell G and Watson AJ (eds) *Tastes & Aromas: The Chemical Senses in Science and Industry*. Sydney, Australia: UNSW Press/Blackwell Science, pp. 149–160.
Bell GA, Laing DG and Panhuber H (1987a) Early-stage processing of odor mixtures. *Annals of the New York Academy of Sciences* 510(1): 176–177.
Bell GA, Laing DG and Panhuber H (1987b) Odour mixture suppression: evidence for a peripheral mechanism in human and rat. *Brain Research* 426(1): 8–18.
Berna A (2010) Metal oxide sensors for electronic noses and their application to food analysis. *Sensors* 10(4): 3882–3910.
Cook A (2011) When it comes to sniffing out graffiti, this man has a nose for trouble. *The Sydney Morning Herald*, 25 August. Available at: https://www.smh.com.au/technology/when-it-comes-to-sniffing-out-graffiti-this-man-has-a-nose-for-trouble-20110824-1jabz.html (accessed 27 June 2025).
Cramp AP, Sohn JH and James PJ (2009) Detection of cutaneous myiasis in sheep using an 'electronic nose'. *Veterinary Parasitology* 166(3–4): 293–298.
Cynkar W, Dambergs R, Smith P, et al. (2010) Classification of Tempranillo wines according to geographic origin: Combination of mass spectrometry based electronic nose and chemometrics. *Analytica Chimica Acta* 660(1–2): 227–231.
Del Valle M (2021) Sensors as green tools in analytical chemistry. *Current Opinion in Green and Sustainable Chemistry* 31: 100501.
Dent AG, Sutedja TG and Zimmerman PV (2013) Exhaled breath analysis for lung cancer. *Journal of Thoracic Disease* 5(Suppl 5): S540–S550.
Di Benedetto LT, Alexander PW and Hibbert BD (1996) Portable battery-powered flow injection analyser for volatile alcohols using semiconductor gas sensors. *Analytica Chimica Acta* 321(1): 61–67.
Feng H, Gonzalez Viejo C, Vaghefi N, et al. (2022) Early detection of *Fusarium oxysporum* infection in processing tomatoes (*Solanum lycopersicum*) and pathogen-soil interactions using a low-cost portable electronic nose and machine learning modeling. *Sensors* 22(22): 8645.
Figaro Engineering Inc. (2018) Gas Sensors & Modules. Available at: https://www.figaro.co.jp/en/product/sensor/ (accessed 21 April 2025).
Fuentes S, Summerson V, Gonzalez Viejo C, et al. (2020) Assessment of smoke contamination in grapevine berries and taint in wines due to bushfires using a low-cost E-nose and an artificial intelligence approach. *Sensors* 20(18): 5108.
Fuentes S, Tongson E, Unnithan RR, et al. (2021) Early detection of aphid infestation and insect-plant interaction assessment in wheat using a low-cost electronic nose (E-nose), near-infrared spectroscopy and machine learning modeling. *Sensors* 21(17): 5948.
Gardner JW (1988) Pattern recognition in the Warwick electronic nose. In: *Proc. of the 8th Int. Congress of European Chemoreception Res. Organisation*, Coventry, UK, July 1988.
Gardner JW and Bartlett PN (1994) A brief history of electronic noses. *Sensors and Actuators B: Chemical* 18(1–3): 210–211.
Gonzalez Viejo C and Fuentes S (2022) Digital assessment and classification of wine faults using a low-cost electronic nose, near-infrared spectroscopy and machine learning modelling. *Sensors* 22(6): 2303.

Gonzalez Viejo C, Fuentes S, Godbole A, et al. (2020) Development of a low-cost e-nose to assess aroma profiles: An artificial intelligence application to assess beer quality. *Sensors and Actuators B: Chemical* 308: 127688.

Herman-Saffar O, Boger Z, Libson S, et al. (2018) Early non-invasive detection of breast cancer using exhaled breath and urine analysis. *Computers in Biology and Medicine* 96: 227–232.

Hibbert B (1999) Electronic noses for sensing and analysing industrial chemicals. In: Bell GA and Watson AJ (eds) *Tastes & Aromas: The Chemical Senses in Science and Industry*. Sydney, Australia: UNSW Press/Blackwell Science, p. 220.

Hibbert B and Bell GA (2007) A method of predicting the source of data sampled from and unknown source. Australian patent 2007291928. Available at: https://patents.google.com/patent/AU2007291928A1/en (accessed 27 June 2025).

Hibbert DB (2024) Bayesian approaches to assigning the source of an odour detected by an electronic nose. *Australian Journal of Chemistry* 77(10): CH24053.

Hong SJ, Yoon S, Lee J, et al. (2022) A comprehensive study for taste and odor characteristics using electronic sensors in broccoli floret with different methods of thermal processing. *Journal of Food Processing and Preservation* 46(4): e16435.

Jinman R (1992) Uni sensor sniffs out air culprits. *The Australian*, 5 September.

John AT, Murugappan K, Nisbet DR, et al. (2021) An outlook of recent advances in chemiresistive sensor-based electronic nose systems for food quality and environmental monitoring. *Sensors* 21(7): 2271.

Khorramifar A, Karami H, Lvova L, et al. (2023) Environmental engineering applications of electronic nose systems based on MOX gas sensors. *Sensors* 23(12): 5716.

LeCun Y, Bengio Y and Hinton G (2015) Deep learning. *Nature* 521(7553). Nature Publishing Group: 436–444.

Muñoz R, Sivret EC, Parcsi G, et al. (2010) Monitoring techniques for odour abatement assessment. *Water Research* 44(18): 5129–5149.

Ollé EP, Farré-Lladós J and Casals-Terré J (2020) Advancements in microfabricated gas sensors and microanalytical tools for the sensitive and selective detection of odors. *Sensors* 20(19): 5478.

Pearce TC, Gardner JW and Friel S (1993) Machine olfaction: intelligent sensing of odours. In: *Proceedings of IEEE Systems Man and Cybernetics Conference — SMC*, October 1993, pp. 165–170 vol.5. Available at: https://ieeexplore.ieee.org/document/390843 (accessed 27 June 2025).

Rastogi S, Dennler N, Schmuker M, et al. (2023) Spike-time encoding of gas concentrations using neuromorphic analog sensory front-end. In: *2023 IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Toronto, ON, Canada, 19 October 2023, pp. 1–5. IEEE. Available at: https://ieeexplore.ieee.org/document/10388752/ (accessed 27 June 2025).

Summerson V, Gonzalez Viejo C, Pang A, et al. (2021) Assessment of volatile aromatic compounds in smoke tainted cabernet sauvignon wines using a low-cost e-nose and machine learning modelling. *Molecules* 26(16): 5108.

Taguchi N (1962) A metal oxide gas sensor. Japanese Patent Application Number 45–38200.

The University of Melbourne (2024) Find an Expert: A/Prof Sigfredo Fuentes. Available at: https://findanexpert.unimelb.edu.au/profile/551189-sigfredo-augusto-fuentes-jara (accessed 27 June 2025).

Tran VH, Hiang Ping Chan, Thurston M, et al. (2010) Breath analysis of lung cancer patients using an electronic nose detection system. *IEEE Sensors Journal* 10(9): 1514–1518.

Tung TT, Losic D, Park SJ, et al. (2015) Core-shell nanostructured hybrid composites for volatile organic compound detection. *International Journal of Nanomedicine*: 203–214.

University of Warwick (2016) Electronic noses. Available at: https://warwick.ac.uk/fac/sci/eng/research/impact/electronicnose/ (accessed 5 June 2025).

Wang X, Zhou Y, Zhao Z, et al. (2023) Advanced algorithms for low dimensional

metal oxides-based electronic nose application: a review. *Crystals* 13(4): 615.
Wilkens WF and Hartman JD (1964) An electronic analog for the olfactory processes. *Journal of Food Science* 29(3): 372–378.
Wilson AD, Oberle CS and Oberle DF (2013) Detection of off-flavor in catfish using a conducting polymer electronic-nose technology. *Sensors* 13(12). 12. Multidisciplinary Digital Publishing Institute: 15968–15984.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 32–49. ISSN 0035-9173/25/01032-18

The UNSW Cadets: pioneers at the birth of a new university

Michael Barber AO

Emeritus Professor, Flinders University and the University of Western Australia
Email: mnjkbarb@yahoo.com.au

Abstract

The UNSW Cadets was an initiative of the University of New South Wales between 1958 and 1966. Its primary objective was to attract high-performing students, particularly in mathematics and physics, to the new university. This article describes the program's genesis, briefly describes the careers of some of the most successful Cadets, and assesses the scheme overall.

Introduction

In the late 1950s and early 1960s, the University of New South Wales (UNSW) was a very different institution from the research powerhouse it is today. Established in 1949 as the New South Wales University of Technology, it became the University of New South Wales in 1958 following the Murray Committee Report of 1957 and the establishment of schools of medicine and law, see, e.g. (O'Farrell 1999).

The new comprehensive university faced significant challenges compared to the established University of Sydney. Little research was conducted, and what was performed tended to be applied. Few staff had PhDs, so they could not supervise PhD students. By the end of 1959, only 49 PhDs had been awarded on predominantly applied topics. The situation was particularly dire in the Schools of Physics and Mathematics. In 1958, physics had only two staff members with PhDs (out of sixteen) and mathematics only one (and one with a DSc) out of eighteen.[1]

Under a dynamic but controversial vice-chancellor, Phillip Baxter[2] (later Sir Phillip), the University began to rebuild its staff and attract a broader range of students. In the decade from 1958 to 1968, the professoriate quadrupled from 21 to 80, with many of the new professors established researchers. Among the first new professors was Professor John Markus Blatt, the foundation professor of applied mathematics.

John Blatt (Franklin 2001) was born in Vienna in 1921 and fled to the US in 1938 with his family to escape the Nazis. He completed a baccalaureate in physics at the University of Cincinnati, followed by PhDs from Cornell and Princeton. In 1953, with the rise of McCarthy, in which John saw parallels with Europe in the 1930s, he left the US and accepted a position at the University of Sydney, moving to UNSW in 1958. Together with George Szekeres (Cowling et al 2019), the foundation professor of pure mathematics, recruited in 1963, they built a school of mathematics that would, in time, match, if not surpass, Sydney University's.

1 Data is from University Calendars, archived and available at https://legacy.handbook.unsw.edu.au/general/2016/SSAPO/OlderCalendars.html#top

2 *Encyclopaedia of Australian Science and Innovation* https://www.eoas.info/biogs/P000211b.htm; see also Angyal (1991).

Another challenge was attracting students, particularly the best. Derided as "Kenso Tech," UNSW had little penetration into many schools and suburbs from which the best students came. This was particularly acute in mathematics and physics.

UNSW Cadets was an initiative to improve this. The scheme's objectives were threefold: to raise the image of UNSW, to attract bright students who would not usually have thought of the university, and to help build the university's research and teaching staff. To this end, the Cadets were expected to complete an honours degree. They would then be employed as teaching fellows during which they would complete a PhD while teaching undergraduate classes (lectures, tutorials, laboratory sessions). The Cadets were bonded to this effect and were paid a living allowance of £400 to £550 pa on top of tuition fees. While called "cadets," the only selection criterion was academic merit. The difference from conventional academic scholarship schemes, was the (guaranteed) pathway to a PhD via a Teaching Fellowship.

The scheme appears to have commenced in the School of Mathematics, probably at Blatt's initiative, with the first two cadets enrolling in 1958. On 13 July 1959, the UNSW Council approved the formal Cadetship scheme to commence in 1960.[3] Initially restricted to Mathematics, the Council extended it to Physics and Commerce/Economics in 1960.[4] The scheme was discontinued on 11 October 1966, and no new Cadetships were offered after the 1966 intake.

The program does not appear to have ever been formally assessed, and no comprehensive list of Cadets exists. However, from material in the UNSW Archives and the memories of Cadets I could contact, I have found 25 Math Cadets, 16 Physics Cadets, and 5 in Economics/Commerce. Economics/Commerce made little use of the program. Of their five, two graduated with BAs, one with first-class honours in history! The following analysis is based on the forty-one Physics and Maths cadets listed in Appendix B.

The UNSW Cadets

So, who were these intrepid trailblazers prepared to take a risk on a new university? They were predominantly men; only seven were women (2 in physics, 5 in mathematics.) Only one was from outside NSW. All did exceptionally well in their final year at school, particularly in mathematics and physics. They could have gone to Sydney. UNSW was a conscious choice. They reflected the emerging Australia of the 1960s. Some were immigrants arriving in Australia as children, often with little English. Many were the first in their immediate family to attend university.

Not all succeeded at UNSW. Six graduated with a pass degree, and no record exists of graduation for three. The remaining thirty-two graduated with BSc (Hons) degrees, nine of whom were awarded University Medals — four in Physics and five in Mathematics.

Of the 32 Honours graduates, 23 are listed in University Calendars as Teaching Fellows for at least one year; fifteen completed PhDs at UNSW, five at overseas universities, and two completed MScs at UNSW, one

3 UNSW Council resolution, July 1959, UNSW Archives: file 00016438

4 UNSW Council resolution, May 1960, UNSW Archives: file 00016438

of whom later completed a PhD at another Australian university. One is known to have withdrawn and not completed a UNSW PhD. There are no records of postgraduate qualifications for the rest.

Unfortunately, I have discovered something about the subsequent careers of only twenty-three Cadets (10 in Maths, 13 in Physics).[5] Five were appointed as lecturers, senior lecturers or associate professors at UNSW at some stage. Jaan Oitmaa became a full professor at UNSW.[6] Nine (Thompson, van der Poorten, Billard, Hutchinson, McKenzie, Cahill, Barber, Hudson and Stacey (née Vale)) became full professors elsewhere. Ted Kraegen, John Grant and Jim Sinclair spent most of their careers in research institutes, reaching the equivalent of professorial appointments. Ted became a clinical professor at UNSW. Of the others, six had academic careers (without reaching professorial rank), and four had substantial careers outside academia. Three Cadets (Barber, Thompson and Hutchinson) were elected Fellows of the Australian Academy of Science, and two (Kraegen and Barber) became officers in the Order of Australia. Six are known to have died. The following are some of their stories.

The First Cadets

Colin Thompson[7] was recruited as a Cadet by the School of Mathematics before the formal scheme commenced with the 1960 intake. He attended Sydney Technical High School, placing 84th in the 1957 Leaving Certificate, winning both a Commonwealth Scholarship and a bursary to the then NSW University of Technology. He was not only the first in his family to attend university but also the first to complete high school. Wanting to do something practical, he opted for the bursary, enrolling in a Bachelor of Applied Science degree in 1958.

When the university became UNSW later in 1958, that degree was abolished, and he transferred to a BSc. Somehow, he came to the attention of the new professor of applied mathematics, John Blatt, who was looking for talented students. Blatt arranged for his bursary to be converted to a Cadetship with a living allowance and the promise of a Teaching Fellowship.

In 1962, Colin graduated with First-Class Honours and the first University Medal in Applied Mathematics. Taking up the Teaching Fellowship, he completed a PhD under Blatt's supervision on the theory of superconductivity (Thompson 1964).

After two years as a postdoc in the US, he returned to UNSW as a Queen Elizabeth II Fellow. From 1968 to 1972, Colin was again in the US before accepting the chair of mathematics at the University of Melbourne, the first cadet to become a full professor in Australia. In 1995, Colin was elected a Fellow of the Australian Academy of Science for his research in statistical mechanics, dynamical systems, and chaos.[8] He retired in 1999.

A second cadet, **Neville Smythe**, joined Colin in 1958. Neville attended Sydney Boys High and ranked 14th in the 1957 Leaving Certificate. Like Colin, Neville graduated

5 There are traces of some of the others in the literature and on the Web. Perhaps someone reading this account can add further details.

6 Promotion to full professor at UNSW was only introduced in 1992.

7 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P003621b.htm

8 https://www.science.org.au/profile/colin-thompson

with First-Class Honours in 1962 and was awarded the University Medal in Pure Mathematics. He then became a Teaching Fellow but appears to have been given leave to attend Princeton for his PhD, returning to UNSW in 1965 as a lecturer.

He moved to the ANU in 1968 and taught there until his retirement. In the mid-1970s, he and a colleague, Martin Ward, became interested in using the newly released Apple Macintosh computers to teach mathematics. He and Ward developed ANUGraph, one of the first graphing packages for the Mac 128.

Following the establishment of the formal Cadetship scheme in 1959, the School of Mathematics awarded two cadetships for entry in 1960, including the first woman, **Patricia Cox (née Wadsworth)**, to be awarded a cadetship.[9] Both completed honours degrees and spent time as teaching fellows, but neither appears to have completed a higher degree.

The 1961 Cadets

Jaan Oitmaa was in the inaugural cohort of Physics Cadets who enrolled at UNSW in 1961. He had arrived in Australia from Estonia with his parents in 1949. He attended Liverpool Boys High, where he was dux. He achieved exemplary results in the 1960 Leaving Certificate: 6th in Maths 1, 13th in Physics, and 7th overall. In 1965, he graduated with First Class Honours in Physics and the University Medal and became a Teaching Fellow in the School of Physics. He completed a PhD in 1967 (Oitmaa 1967).

After postdocs at UC Irvine and the University of Alberta and eighteen months as a QE II Fellow at Monash, he returned to UNSW as a lecturer in 1972. From there, he rose steadily through the academic ranks, becoming a full professor in 1992 and serving as Head of the School of Physics from 1993 to 1999. He retired in 2003 but retains an honorary position.

Jaan's PhD thesis was on lattice dynamics, but his postdoc in Alberta introduced him to the statistical mechanics of phase transitions, which became the primary focus of his research. As a result, in the 1970s and early 1980s, when I was at UNSW, we collaborated, authoring five papers and jointly supervising PhD students.

Like Jaan Oitmaa, **Alf van der Poorten**[10] was an immigrant who arrived in Australia at the age of nine from Holland. He gained a place at Sydney Boys High School and completed the Leaving Certificate in 1960, ranking in the top three in the State. He originally intended to attend Sydney University, but after a year in Israel, he accepted a Cadetship and enrolled at UNSW in 1961.

In 1965, he graduated with fist honours and the University Medal in Pure Mathematics. Alf spent the next fourteen years at UNSW as a Teaching Fellow and then as an academic, rising from lecturer to associate professor. In 1979 he moved to Macquarie University as a professor of mathematics. He retired in 2002. Sadly, he died of lung cancer in 2010, aged 68.

Alf's PhD was in number theory (Van Der Poorten 1968), and while number theory remained the primary focus of his research, he also touched on many areas of pure mathematics. He also made significant

9 Mentioned in *A Brief History of the Department of Statistics, the University of New South Wales, 1948–1983*; https://www.unsw.edu.au/content/dam/pdfs/unsw-adobe-websites/science/maths/2022-01-a_brief_history_-_dept_of_statistics_unsw.pdf

10 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P001450b.htm

contributions to administration, particularly at Macquarie and to the mathematics profession (Hunt 2013a). He was a gifted lecturer and tutor with "not only a natural feel for maths but also knowing where to pitch his explanations" as Dave Wheeler recalled.[11]

After completing the Leaving Certificate at North Sydney Boys High, **Edwards (Ted) Kraegen** was enticed to UNSW by a cadetship in the initial cohort of Physics cadets in 1961. However, the lure of the recently opened Round House proved too much, and he did not perform well and lost his cadetship at the end of first year.[12]

He recovered academically and graduated with a BSc (Hons) in 1965. He was the first UNSW honours graduate in biophysics, which was established when Paul George[13] was appointed a professor in 1964. Ted moved to the Garvan Institute of Medical Research while completing a PhD (Kraegen 1970) with George as his supervisor.

He remained at the Garvan for the rest of his career, becoming an NHMRC Senior Principal Research Fellow and, in 1990, head of the Garvan's Diabetes Research Group. Together with Garvan colleagues, Ted is recognised as the developer of an "artificial pancreas" (Kraegen et al 1977) that led to significant improvements in the monitoring of blood glucose levels in the management of diabetes.[14]

Since the Garvan Institute is affiliated with UNSW, Ted remained involved with the University, supervising research students and honours projects. From 1987 to 2006, he was a (clinical) associate professor and then a clinical professor in the School of Medicine.

In 2019, he was awarded an AO "for distinguished service to medicine and medical education in the areas of diabetes, obesity, and glucose metabolism research." Ted feels his remarkable story would have been unlikely without his Cadetship.[15]

The 1962 Physics Cadets

In 1962, two cadets, **Gilbert Vella** and **Paul Bryce**, were recruited from school, and two existing UNSW students, **John Grant** and **Geoffrey Gould**, were made cadets to replace Ted Kraegen and a second 1961 Physics cadet, who also lost his cadetship[16] again, presumably on academic grounds. All graduated with Honours degrees, took up Teaching Fellowships and completed PhDs.

This was the only occasion that cadetships were offered to existing UNSW students. A similar request by the School of Mathematics in 1964 was, after consultation with the then Vice-Chancellor, Rupert Myers, refused by the Dean of the Faculty of Science, who emphasised that "the most important role and value of the cadetship lies in the

11 Email to MNB, 14 September 2024.

12 Phone conversation with MNB, 5 September 2024.

13 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P002010b.htm

14 https://www.nhmrc.gov.au/about-us/resources/impact-case-studies/improving-insulin-delivery

15 Email to MNB, 15 September 2024.

16 Like Ted, that cadet still graduated with honours but there is no evidence of him being appointed a teaching fellow or completing any higher degree at UNSW.

attraction of school pupils … and it would be unwise to dilute these functions."[17]

John Grant's family had moved to Miranda from Glen Innes in 1956 so he and his older brother could attend high school at De La Salle College in Cronulla. There, they were mentored by Brother Vincent Cotter, who encouraged them to attend UNSW rather than the University of Sydney. John heeded his advice and enrolled in the Common First Year to major in chemistry. He and his older brother[18] were the first in their immediate family to attend university. After completing the first year, during which he had a Commonwealth Scholarship, John decided to switch to physics and applied for and was awarded a University Cadetship in Physics.

When he taught and mentored John, Brother Vincent didn't have a university degree but later attended UNSW and graduated with a BSc in physics. In a delightful reversal of roles, John, then a Teaching Fellow, taught him in one of his laboratory classes. In 1999, in appreciation of Brother Vincent Cotter's teaching and guidance, John established the Brother Vincent Cotter Endowed Honours Award for Honour's Year physics students at UNSW.

After completing his PhD (Grant 1968), John became the first Cadet to spend their subsequent career overseas. Two years as a visiting scientist at the Aerospace Research Laboratories of the US Air Force in Dayton, Ohio, was followed by two years at the Philips National Lab in Eindhoven, The Netherlands. In 1972, he immigrated to the United States. Since then, he has worked as a contractor in materials-related laboratories for the US Air Force, the last thirty-five of which were through Air Force contracts with the University of Dayton Research Institute, where he was a Distinguished Research Scientist.

His contributions to surface science were recognised by the Albert Nerken Award of the American Vacuum Society (2000) and the IUVSTA Prize for Technology of the International Union of Vacuum Science and Technology in 2013. He retired in 2014 but remains active in surface science as a consultant and short-course instructor.

John and his wife live in Florida. Tragically, Hurricane Helene flooded their home in October 2024, destroying many of his records, including those pertaining to his Cadetship, which he credits with laying the foundations of his career. John's successful transition to the United States indicates that by 1970, UNSW graduates were already globally competitive with world-class skills.

The other three 1962 Physics cadets had careers in Australia. After his PhD (Gould 1970), **Geoff Gould** spent 2½ years in Chile as a postdoc at the Universidad de Chile in Santiago. Returning to Australia in 1972, he could not find a position in physics, so he switched to computing and developed a career in that field.[19]

Paul Bryce and Gilbert Vella had academic careers that involved some departure from pure physics. After his PhD (Bryce 1971), **Paul Bryce** moved to the School of Engineering at the University of Technology, Sydney (UTS), where he eventually became an associate professor. He published

17 Letter from Professor Bernard Ralph (Dean, Faculty of Science) to Professor G Bosson (School of Mathematics), 23 November 1964; UNSW Archives, Ref: 63/u120/16438.

18 John's brother, Robert Charles Grant, graduated from UNSW with a BSc (Hons) and PhD (in Chemistry).

19 Phone conversation with MNB, 5 September 2024.

extensively on renewable energy and electrification in development. He also advised various aid programs and served for several years as president of APACE (Appropriate Technology for Community and the Environment), a non-governmental aid agency.[20]

After his PhD (Vella 1971), **Gilbert Vella** switched to medical physics. He became a senior lecturer in the School of Bioscience at the University of Sydney, where he also developed a research interest in higher education.[21] In 2023, the Pope awarded Gilbert a *Croce pro Ecclesia et Pontifice* in recognition of his lay service, particularly his extensive work with the St Vincent de Paul Society (Rodrigues 2023).

The 1962 Maths Cohort

Only seven women appear among the Cadets. Nothing was done to increase that number, except in 1962, when a little affirmative action was applied. Lynne Billard, one of the 1962 Maths Cadets, tells the story (Mukhopadhyay 2017):

> In America, I once was speaking with a faculty person who told me that he had been one of the people who was selecting candidates for a cadetship. He told me how, one year, Professor Blatt wanted to select a woman. Blatt … was pushing this idea very hard. The faculty person telling me the story said he himself was opposed to the idea of including a woman. Eventually, although selection committee members did not want to change the policy of 3 cadetships going to 3 men, out of respect to Professor Blatt, such was his enormous stature, they added 3 cadetships for 3 women for that year. But they were not going to forgo the 3 men!
>
> This faculty person went on "And darn it if those women did not do better than the men!" He was flabbergasted when I said, "I know, I was one of them."

"Better than the men" is an understatement! The three women all obtained honours degrees and became Teaching Fellows. Two of the women, Billard and Reeves, completed PhDs. Of the men? One completed honours and became a Teaching Fellow but does not appear to have completed a PhD. A second graduated with a pass degree, and there is no record of the third graduating from UNSW.

Lynne Billard's career[22] is one of the most successful of all Cadets. She was the dux of her high school in Queensland and topped the state in mathematics. That performance overcame any bias against Queenslanders and made her the only non-NSW Cadet.

After completing her teaching fellowship and PhD (Billard 1968), Lynne held short-term appointments in the UK, the US, and Canada before joining Florida State University in 1975. In 1980, she was promoted to full professor — the first cadet to reach full professorial status — but later that year, she moved to the University of Georgia as professor and Head of the Department of Computer Science and Statistics.

Lynne is renowned for her research on the incubation period of AIDS which had a significant influence on public health policy and education. She was the third person to be president of the American Statistical

20 See http://tiempo.sei-international.org/portal/archive/issue3637/t3637a5.htm

21 https://www.researchgate.net/profile/Gilbert-Vella

22 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P004173b.htm

Association and the International Biometric Society. Lynne remains active at the University of Georgia and frequently visits Australia. In 1999, she received an Alumni Award from UNSW. Recognising the role UNSW and the Cadetship had played in her career, in 2024, she pledged $2.5 million to fund scholarships for female students, with a focus on mathematics.[23]

Like Lynne, **Jane Reeves** left Australia for the UK after completing her PhD (Reeves 1970). She became a senior lecturer at Coventry University. **Susan Ahrens (née Lean)** also went to the UK and may have become involved in local politics.

The 1963 and 1964 Physics

The 1963 cohort of Physics Cadets included the first woman selected as a Physics cadet. Unfortunately, for some reason, she gave up the cadetship, graduating in 1968 with a pass degree.

Aside from her, the other Physics cadets selected in 1963 and 1964 performed well. All graduated with Honours degrees, two (Cahill and Sinclair) being awarded University Medals. All completed PhDs at UNSW except **David Heron** (a 1963 cadet), who "with only a chapter of his PhD thesis to complete, … abandoned academia and moved to Adelaide."[24] He developed a successful career in computing and communications, including work on the first computer network (SAENT) linking university campuses and on Jindalee, Australia's over-horizon radar system. (Heron and Rusbridge 2020). He died in 2010.[25]

Although a 1963 Physics cadet and University Medallist in Physics, **Reg Cahill** took up his Teaching Fellowship in the Department of Applied Mathematics. Under Blatt's leadership, Applied Mathematics in the 1960s and 1970s was essentially UNSW's theoretical physics department. It attracted those physics students who were inclined to study theoretical physics. Reg was the first Physics Cadet to make the change and completed a PhD (Cahill 1970) under the supervision of Ian Sloan.[26] After his PhD, Reg accepted a lectureship at Flinders University, where he rose through the academic ranks to become a professor. His early research was in nuclear physics, but later, he focused on special and general relativity. He died in 2021 or 2022.[27]

Reg's later career is marked by controversy. He worked extensively on the theoretical foundations and potential applications of Process Physics, a controversial alternative to the conventional approach (based on quantum mechanics and general relativity) to understanding the nature of reality. In particular, Process Physics challenges the conventional ideas of space and time, suggesting that these are emergent structures rather than being fundamental themselves (Cahill 2005; Hunt 2013b). While an attempt at combining physics, computation and philosophy, Process Physics remains a fringe theory in physics, with Reg's more specific

23 https://www.inside.unsw.edu.au/innovation-and-engagement/unsw-driving-progress-through-philanthropy

24 David Wheeler in email to MNB.

25 *The High Bulletin*, Vol 55, Nov 2010, 21–22, https://www.yumpu.com/en/document/read/38603910/the-high-bulletin-sydney-high-school-old-boys-union

26 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P003707b.htm

27 Email from David Lewis to MNB, 4 November 2024.

predictions either refuted or unable to be replicated (Seaver 2016). He died in 2022.

A year after Cahill, **John Aarons** (a 1964 Physics cadet) also opted for a Teaching Fellowship in Applied Mathematics and completed a PhD (Aarons 1972) under Sloan's supervision. Little is known of his subsequent career, except that he died in January 2025 after many years of ill health and other problems.[28] The other 1964 Physics cadets had successful but different careers, one in Australia, the other in the UK.

After completing his PhD (McKenzie 1972), **David McKenzie** moved to the University of Sydney, where he became a professor of materials physics. There, he built a research group that significantly contributed to biomaterials, medical devices, and energy materials. He remains active as an emeritus professor and a member of the University of Sydney Nano Institute and the Charles Perkins Centre.

James (Jim) Sinclair was one of the few cadets whose parents were university-educated. His father was a research scientist at the Defence Standards Laboratory (DSL), the predecessor to the Defence Science & Technology Organisation (DSTO). While his mother never worked after her marriage, she had a degree from Adelaide and had worked as a personal assistant to Daisy Bates, the famous anthropologist who studied Aboriginal cultures.

Jim attended North Sydney Technical High School and gained first place in Physics and third place in Maths I in the 1963 Leaving Certificate. He did well at UNSW, graduating with first-class honours and the University Medal in Physics in 1968, followed by a PhD (Sinclair 1971).

Jim's immediate plans after UNSW involved a short-service RAAF commission to avoid being drafted and potentially sent to Vietnam. His birthday had been selected in the national ballot of 20-year-olds. However, he was judged short-sighted at the medical.

With the timing of this unexpected "freedom," opportunities were scarce. He finally found a postdoc in the UK, nominally with Sussex University, but working in the Theoretical Physics Division of the Atomic Energy Research Establishment (AERE) at Harwell. Apart from a six-month postdoc in the US, following his Sussex one, he would stay at Harwell for his career. Jim's career at AERE illustrates (and was directly affected by) significant changes in Britain's approach to government R&D institutions.

AERE was established in 1946 on an old RAF airfield in Oxfordshire to undertake fundamental and applied research in nuclear science and engineering. It supported the development of the UK's nuclear energy program. The first research reactors were commissioned in the late 1940s (Cottrell 1998). (AERE was essentially the UK equivalent of Australia's Lucas Heights establishment.)

The early days of the UK nuclear program involved significant computation in addition to experimental nuclear physics. Thus, AERE operated some of Britain's most powerful computers. Jim's PhD project involved computer modelling of the atomic structure of dislocations. While he continued in that field during his initial years at Harwell, he increasingly became involved in more diverse applications of computer simulation, from the simulation of transition metals

28 Ian Sloan in a phone conversation with MNB March 2025.

(Finnis and Sinclair 1984)[29] to probabilistic forecasting pertinent to nuclear waste storage (Sinclair and Hickford 1998).

When Jim joined AERE and until the 1990s, AERE's mission included basic research that broadly contributed to nuclear energy. It was a publicly-funded research agency similar to CSIRO. That changed dramatically in the 1990s. Under the Thatcher government's privatisation policies, many national research facilities and institutes were privatised. AERA and Jim did not escape these changes. Many of the technical staff of AERE, including Jim, moved into a company, AEA Technology.

AEA Technology was expected to conduct R&D for paying clients. One of its major contracts was with NIREX[30], and Jim became an internationally recognised expert on probabilistic safety assessments of nuclear waste disposal. However, NIREX's activities were severely curtailed when a controversial proposal to trial waste disposal at the old Sellafield nuclear reactor site was refused. AEA Technology sold the group of which Jim was a member to Serco Corporation, from which Jim retired in 2006. He and his wife continue to live in Harwell Village.

The 1963, 1964 and 1965 Maths Cadets

For some reason, the attrition of Maths cadets selected in the three intakes of 1963–65 was high. Of the nine recruited in the three years, two did not graduate, and three graduated with pass degrees. **John Hutchinson** and **Peter Wark** were the only two to complete postgraduate qualifications. The remaining two graduated with BSc (Hons) degrees, but no records show them completing postgraduate degrees. One of them is believed to have died in 2004.

The most successful (and one of the most successful of all Cadets) was **John Hutchinson** (a 1963 Cadet). John was awarded a cadetship after completing the Leaving Certificate in 1962 at Marist Brothers High School, Eastwood, ranking 12th in the state with first places in both mathematics honours level papers (Maths I and Maths II). He shared the BHP science medal for best performance in physics, chemistry and mathematics.

At UNSW, he opted to major in pure mathematics graduating with a BSc (Hons) and the University Medal, the first Maths Cadet since Thompson and Smythe to be awarded a University Medal. The university waived his bond conditions and allowed him to complete a PhD at Stanford. John recalls the waiving as a mixed blessing since no academic jobs were available on his return to Australia in 1972!

He finally found a temporary position as a research assistant in pure mathematics at the ANU. When an existing staff member resigned, John won the ensuing vacancy. He remained at the ANU, where he is now an emeritus professor. In 2002, he was elected a Fellow of the Australian Academy of Science for "fundamental contributions in an unusually broad array of mathematical areas, ranging from logic through analysis and geometry to computational methods

29 See also Ackland et al. (2009).

30 Nirex was set up in 1982 to examine the feasibility of geological disposal of nuclear wastes; see https://en.wikipedia.org/wiki/Nirex

(and) … fractals, which has impacted many applied areas."[31]

Peter Wark was in the same cohort as Hutchinson, but his graduation with honours was delayed a year by ill health. He then became a tutor while completing an MSc (Wark 1971) under George Szekeres's supervision. What he did immediately after UNSW is unknown, but from 2000 to 2005, he was a senior lecturer in the Department of Mathematics and Computing at the University of Southern Queensland.[32] He had switched to operations research, completing a PhD at the University of Queensland in 2005. He died in 2020.

The 1965 Physics Cadets

The 1965 cohort of Physics Cadets is interesting for several reasons (other than because I was a member!) It included the second woman to be a Physics Cadet and the first to graduate with a BSc (Hons). We had divergently different careers after UNSW. Here are our stories.

Mine **(Michael Barber's)** was a successful academic career.[33] I grew up in Tasmania, but we moved to Sydney in 1963 when my father, HN Barber[34], was appointed professor of botany at UNSW (Darlington 1972). Like John Grant, my mother was also university-educated and had worked at Sydney University until her marriage.

I completed the Leaving Certificate at Normanhurst Boys High School in 1964. While a Physics Cadet, I completed Honours in Applied Mathematics, graduating with a University Medal. I was then released from my bond to accept a CSIRO pre-doctoral fellowship at Cornell University for my PhD. My thesis concerned the statistical mechanics of phase transitions, which remained a major focus of my subsequent research career.

I returned to Australia in 1972, and after a QE II Fellowship at the ANU, I became a lecturer in the Department of Applied Mathematics at UNSW in 1974. There, I advanced to associate professor before moving back to the ANU as a professor of mathematics in 1984. At the ANU, I was head of the Department of Mathematics in the Faculty of Science, which at that time included two other former Cadets: John Hutchinson and Neville Smythe.

From 1994 to 2002, I was Pro-Vice-Chancellor (Research) at the University of Western Australia, followed by five years as a senior executive in CSIRO before finishing my career as Vice-Chancellor of Flinders from 2008 to 2014. I was the first Cadet to be elected a Fellow of the Australian Academy of Science and the only Cadet elected a Fellow of the Australian Academy of Technological Science and Engineering. In 2018, I was appointed an Officer of the Order of Australia (AO) for "distinguished service to higher education administration, and in mathematical physics, particularly statistical mechanics, as an academic and

31 https://www.science.org.au/profile/john-hutchinson; see also https://maths-people.anu.edu.au/~john/Assets/Research%20Publications.pdf

32 USQ staff lists are archived on the Wayback Machine of the Internet Archive, https://web.archive.org/web/20001009154819/http://www.usq.edu.au/handbook/2000/index.htm

33 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P004595b.htm

34 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P000038b.htm; see also Darlington (1972).

researcher, and through contributions to science policy reform."

I would have attended UNSW without the cadetship, but, as with many of the Cadets, that choice shaped my career in ways that would have been unlikely if I had chosen differently. In my case, a former Cadet, Colin Thompson, was particularly influential. In my Honours year, Colin taught a unit on the statistical mechanics of phase transitions. Colin had recently returned from the US to UNSW as a QE II Fellow. His course was at the cutting edge of current research, and I was fascinated: there were more questions than answers. As a result, I chose Cornell University for my subsequent graduate work, which led to the research for which I am most noted. While in the late 1960s, the theory of phase transitions was a major focus of research in theoretical physics overseas, there was little expertise or interest in Australia. Thus, I suspect my research career would have been very different if I had been an undergraduate anywhere else in Australia.

Valerie Rendle was the second woman to be a Physics Cadet and the only one to graduate with first-class honours. Arriving from the UK with her parents in 1962, she attended Hornsby Girls High School. In the 1964 Leaving Certificate, she placed 29th on the Order of Merit list, the second-highest girl. In Physics, she was 13th. (Wheeler was 26th while I was a lowly 57th and second last on the Maths I Hons list!)

After graduating with first-class honours in physics, she became a Teaching Fellow in the School of Physics in 1969. However, she became disillusioned with physics, partly because she was the lone woman, and after completing an MSc (Rendle 1974), she left for the finance industry. Later, she retrained as a psychologist and established a successful practice in Sydney. As she said[35] recently: "Once one has mastered physics, anything else is easy!" A sentiment that applies to several of the Cadets!

Like many Cadets, **Dave Wheeler** was the first in his family to attend university. He completed the 1964 Leaving Certificate at St Patrick's College, Sutherland, and only went to UNSW because of the cadetship. Graduating with first-class honours, he fulfilled his obligation as a teaching fellow while completing a PhD (Wheeler 1973).

He then specialised in teaching physics at the first-year university/senior high school level. From 1974 to 1988, Dave was, in his words, "a surfer by day, a Physics TAFE teacher by night." From 1989 to 1992, he developed, managed and taught the physics component of UNSW's Foundation Program (now renamed UNSW College). He spent the next decade in Asia, ultimately becoming Head of Physics at Mahanakorn University of Technology, a major engineering university in Bangkok.

He said his career goal was "to make physics fun again." However, riding a Wall of Death to explore its physics (Charoenkul et al 1999) doesn't sound fun!

The last cadets: the 1966 Maths Cadets

Only the School of Mathematics offered cadetships for entry in 1966.[36] The scheme was officially terminated in October 1966.

35 Phone conversation with MNB, 13 March 2024.

36 Surprisingly, there seems to be no record in UNSW Archives of the 1966 cohort. Thanks are due to Professor Jim Williams (BSc (Hons), 1970), who when I told him of my project, confirmed that there weren't any Cadets in his Physics Honours year but that his sister-in-law was one in Maths. His sister-in-law is Kaye Stacey (née Vale)!

This final cohort proved to be the most successful. All graduated with Honours, with two sharing the University Medal in pure mathematics. While the University exempted them from their bond obligations, all completed PhDs, one at UNSW and two overseas. Two went on to professorships in Australian universities, while the third, after a PhD, became a successful software entrepreneur. Here are their stories.

Malcolm Hudson completed the Leaving Certificate in 1965 at the Church of England Grammar School in North Sydney. He then accepted a Cadetship and graduated with first-class honours in pure mathematics. With the support of a CSIRO fellowship, he switched to statistics and completed a PhD in statistics at Stanford in 1974.

After an appointment as an associate professor at the University of California, Berkeley, he returned to Australia in 1977, becoming a statistics professor at Macquarie University, where he remains active as an emeritus professor. His research has ranged widely from statistical applications in health and medicine to algorithms for image reconstruction. His work in the latter field was recognised in 2014 by the *Institute of Electrical and Electronics Engineers' Marie Sklodowska-Curie Award*.

Kaye Stacey (née Vale) attended Heathcote High, where she says a mathematics teacher encouraged her to enter a mathematics competition at UNSW. At the prize-giving ceremony, she heard of the Cadetships.

She was awarded one on completing the Leaving Certificate in 1965 (ranking 7th in the State). Four years later, she graduated with first-class honours and shared the University Medal in Pure Mathematics with Geoffrey Lewis.

Freed of the cadetship bond, she entered Oxford, completing a DPhil in pure mathematics in 1973 and marrying Peter Stacey, another mathematician. They returned to Australia, but Kaye found few academic posts available in Melbourne (particularly for women), so she took a lectureship at Burwood State College (a teachers' college).

That move initiated an interest in mathematics education and how children learn mathematics, which became the focus of an influential career in teacher education and research. In 1992, she became the foundation professor of mathematics education in the Faculty of Education at Melbourne University. She retired in 2012 but continues her research and advocacy in mathematics education.[37] In July 2024, the International Commission of Mathematical Instruction recognised her contributions with the *Emma Castelnuovo Award for Excellence in the Practice of Mathematics Education*.

And then there is **Geoffrey Lewis** — mathematician, entrepreneur, and polymath! Geoffrey completed the Leaving Certificate at Sydney Boys High in 1965, ranking second in the State and first in mathematics. His Leaving Certificate performance was the best of any Cadet. At UNSW, he graduated with First Class Honours in Pure mathematics, sharing the University Medal with Kaye Vale. While, as with the other 1966 Cadets, the University waived his bond condition, Geoff stayed at UNSW and completed a PhD in pure mathematics (Lewis 1974).

He then embarked upon a remarkable career. After a stint teaching economics at the University of Sydney, he worked

37 See, e.g. Burkhardt et al. (2024).

for computer companies for several years before establishing his own company, Custom-Made Software Pty Ltd, in 1983. The company continues to operate successfully.

Outside business, he is a Fellow of the Royal Philatelic Society London with five large gold medals and the co-author of a book on the postal history of the Spanish Philippines (Petterson and Lewis 2000). His interests in history extend beyond stamps, with a book (Lewis 2006) on the French explorer La Pérouse. At 63, he took up powerlifting and represented Australia.[38]

Assessment and conclusion

So, how should we assess the Cadetship scheme? The scheme certainly brought high-achieving students to UNSW. Thirty-eight of the Maths and Physics cadets were selected on their results in the NSW Leaving Certificate; 27 ranked in the top 100 in the state in their year — six in the top 10. They came from some of the most prestigious schools in Sydney. Sydney Boys High supplied four, and Hornsby Girls High three. The scheme also gave opportunities to high-achieving students from public schools in newer suburbs, such as Liverpool and Heathcote. Considering the success of the 1962 cohort of Mathematics Cadets, it is disappointing that similar affirmative action to attract women wasn't taken in other years of the scheme. However, this would have been an idea ahead of its time.

The award of a cadetship certainly changed preferences. Several cadets commented that they planned to go to Sydney until they were offered a cadetship. Alf van der Poorten was quoted in the *Sydney Morning Herald*'s column[39] on the high achievers in the 1959 Leaving Certificate as planning to "study science at the University of Sydney and hopes to become an atomic scientist." Cahill planned to be an engineer before being awarded the Cadetship (Hunt 2013b).

The cadetship allowance was an attractive incentive. Jaan Oitmaa, one of the inaugural Physics Cadets, recalls: "We were not well off, so the living allowance was very attractive." Neville Smythe, Dave Wheeler and Kaye Stacey, at opposite ends of the period of the scheme, all said that without the Cadetship, they would have accepted (bonded) NSW Education Department Teaching Scholarships, which would have delayed if not diverted them from PhDs and academic careers.

While only two Cadets (Oitmaa and Kraegen) spent most of their careers at UNSW or an affiliated research institute, the University benefited from a ready pool of graduates to fill teaching fellowships when academic staff were in short supply.

The University was generous in releasing students from their bonds, allowing those wishing to pursue PhDs overseas to do so. Indeed, I am unaware of the bonds being enforced on any student, even those not progressing, for academic reasons.

On the other hand, little was done to help Cadets who fell by the wayside for one reason or another. In the 1960s, university was "sink or swim" without today's support services. This attrition was particularly severe in Mathematics, where eight (of 25) did not complete honours degrees, including some Cadets who had entered with

38 *The Senior*, 28 June 1981 https://www.thesenior.com.au/story/5417588/for-geoffrey-its-mind-over-matter/

39 *Sydney Morning Herald* Archives, January 5, 1960.

extremely high scores in their Leaving Certificates.

Surprisingly, the University did not use the Cadets to attract other students to UNSW. I recall no profiling or other publicity. The only student I know who was directly influenced by a Cadet to enrol at UNSW is Professor Jim Williams[40], who graduated with Honours in Physics in 1970. Jim had an illustrious career, becoming a Fellow of the Australian Academy of Science and Director of the Research School of Physical Sciences at the ANU. He was a year behind Dave Wheeler at St Patrick's College, Sutherland. In a history of the school, Jim wrote, "I looked up to David Wheeler, the dux[41] of the year ahead and followed him off to university (UNSW) ... I think I disappointed Br Mac when I chose to major in physics at university, but, by that stage, his influence had waned, and Dave Wheeler's had gained in importance." (Levins 2016).

Since he initiated the scheme, giving the last word to John Blatt seems appropriate. In a letter to the Dean of the Faculty of Science (Professor Bernard Ralph) in October 1963 (urging more cadetships for Mathematics), John wrote, "These superior students, in the long run, will contribute very greatly towards the reputation of this University for scholarship and research."

The rise of UNSW over the past sixty years is due to the efforts and success of many staff and students. The Cadets constitute a small sample of the students involved. They came from diverse backgrounds, took risks and seized opportunities. Not all succeeded but those that did both in and out of academia fulfilled John's prediction and helped the rise of UNSW.

Added in proof

Recently I have become aware of some additional documents that pertain to the initiation of the Cadetship scheme. While Blatt appears responsible for recruiting the first Cadet, Colin Thompson, there is considerable ambiguity around the initiator of the formal scheme. In his book on the development of Australian mathematics, *Counting Australia In*, Graeme Cohen (2006) records that Jim Douglas claimed, in an interview in 2003, that he initiated the scheme. Douglas was an associate professor of statistics at the time and is recognised for developing an honours course in statistics. I am unaware, however, of any other evidence supporting his claim. Douglas does not mention the scheme in his oral history[42] in the UNSW Archives. More credibly, the initiator may have been Geoffrey Bosson, as he claims in his oral history.[43] Bosson was Head of School and would have steered the scheme through the formal processes of the University. Whether the original seed of the idea was his or John Blatt's is lost in the mists of time.

Acknowledgements

I wish to thank Jaan Oitmaa, David Wheeler, Valerie Rendle, Colin Thompson, John Hutchinson, Lynne Billard, Ted Kraegen, Geoff Gould, Jim Sinclair, John Grant, Kaye Stacey and Geoffrey Lewis for their

40 *Encyclopaedia of Australian Science and Innovation*, https://www.eoas.info/biogs/P006591b.htm

41 To be technically correct, Wheeler topped the school in the Leaving Certificate but was not the formal dux. (Email from DW to MNB, 30 September 2024.)

42 University of New South Wales Archives, Reference 98A95/18

43 University of New South Wales Archives; Reference OH25

recollections and comments. Pleasingly, the project became an opportunity to renew old friendships and make new ones. I want to thank Robin Perry of UNSW Archives and Geoff Lewis for their assistance in searching the University's archives.

References

Aarons JC (1972) *Polarization phenomena in neutron-deuteron scattering*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/60919 (accessed 1 June 2025).

Ackland G, Sutton A and Vitek V (2009) Twenty five years of Finnis–Sinclair potentials. *Philosophical Magazine* 89(34–36): 3111–3116.

Angyal SJ (1991) John Philip Baxter 1905–1989. Available at: https://www.science.org.au/fellowship/fellows/biographical-memoirs/john-philip-baxter-1905-1989 (accessed 1 June 2025).

Billard L (1968) *Sequential tests for two-sided alternative hypotheses*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/62121 (accessed 1 June 2025).

Bryce P (1971) *Energy distributions of sputtered metal particles*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/61393 (accessed 1 June 2025).

Burkhardt H, Pead D and Stacey K (2024) *Learning and Teaching for Mathematical Literacy: Making Mathematics Useful for Everyone*. IMPACT: interweaving mathematics pedagogy and content for teaching. Abingdon, Oxon; New York, NY: Routledge, Taylor & Francis Group.

Cahill RT (1970) *Theoretical investigation of neutron-deuteron breakup.* UNSW Sydney. Available at: http://hdl.handle.net/1959.4/58642 (accessed 1 June 2025).

Cahill RT (2005) *Process Physics: From Information Theory to Quantum Space and Matter*. Contemporary fundamental physics. New York, NY: Nova Science Publ.

Charoenkul N, Wheeler D and Dejasvanong C (1999) The wall of death: Newtons, nerves, and nausea. *The Physics Teacher* 37(9): 533–535.

Cottrell A (1998) Harwell — the first 50 years. *Interdisciplinary Science Reviews* 23(2): 139–145.

Cowling MG, Hunt DC and Steele JD (2019) George Szekeres 1911–2005. *Historical Records of Australian Science* 30(1): 49–57.

Darlington CD (1972) Horace Newton Barber, 1914–1971. *Biographical Memoirs of Fellows of the Royal Society* 18: 21–33.

Finnis MW and Sinclair JE (1984) A simple empirical *N*-body potential for transition metals. *Philosophical Magazine A* 50(1): 45–55.

Franklin J (2001) Profile of a mathematician: John Blatt. *Parabola* 37(2): 15–17.

Gould GN (1970) *Atomic beam measurements of some sodium excitation functions*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/62512 (accessed 1 June 2025).

Grant JTP (1968) *Properties of vacuum mated surfaces of semiconductors*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/62514 (accessed 1 June 2025).

Heron D and Rusbridge C (2020) Network development: some achievements and possibilities (1978/79, unpublished). In: *Unsustainable Ideas*. Available at: https://unsustainableideas.wordpress.com/2020/11/26/network-development-some-achievements-and-possibilities-1978-79/ (accessed 1 June 2025).

Hunt D (2013) Life and Mathematics of Alfred Jacobus van der Poorten (1942–2010). In: Borwein JM, Shparlinski I, and Zudilin W (eds) *Number Theory and Related Fields*. Springer Proceedings in Mathematics & Statistics. New York, NY: Springer New York, pp. 1–53. Available at: https://link.springer.com/10.1007/978-1-4614-6642-0_1 (accessed 1 June 2025).

Hunt T (2013) Alternative cosmologies, part I: a conversation with Reg Cahill about process physics. *The Santa Barbara Independent*, 17 February. Available at: https://www.independent.com/2013/02/17/alternative-cosmologies-part-i/ (accessed 1 June 2025).

Kraegen EW (1970) *The blood glucose feedback control system*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/59596 (accessed 1 June 2025).

Kraegen EW, Campbell LV, Chia YO, et al. (1977) Control of Blood Glucose in Diabetics using an Artificial Pancreas. *Australian and New Zealand Journal of Medicine* 7(3): 280–286.

Levins DM (ed.) (2016) *The Hannigan Era: The Early Years of St Patrick's College, Sutherland, 1956–1961*. Cronulla, N.S.W.: Desmond Michael Levins.
Lewis G (1974) *Coherence for a closed functor*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/63475 (accessed 1 June 2025).
Lewis G (2006) *La Perouse: Why He Came to the Pacific*. Randwick, N.S.W.: Randwick & District Historical Society.
McKenzie DR (1972) *Ferroelectricity in thiourea*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/62136 (accessed 1 June 2025).
Mukhopadhyay N (2017) A Conversation with Lynne Billard. *Statistical Science* 32(1).
O'Farrell PJ (1999) *UNSW, a Portrait: The University of New South Wales, 1949–1999*. Sydney, Australia: UNSW Press.
Oitmaa J (1967) *The lattice theory of dielectric saturation in simple ionic solids*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/66230 (accessed 1 June 2025).
Petterson D and Lewis G (2000) *Postal History of the Spanish Philippines 1565–1898*.
Reeves JE (1970) *Bayesian estimation in the first-order auto-regressive series*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/65635 (accessed 1 June 2025).
Rendle VA (1974) *Biophysical aspects of excitation*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/59587 (accessed 1 June 2025).
Rodrigues M (2023) Varieties of service, but the same Lord. *The Catholic Weekly*, 13 December. Available at: https://catholicweekly.com.au/varieties-of-service-but-the-same-lord/.
Seaver JR (2016) Attempt to replicate Cahill's quantum gravity experiment to measure absolute velocity. *Progress in Physics* 12(4): 362–365.
Sinclair JE (1971) *Computer simulation of dislocations and cracks in crystals*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/69472 (accessed 1 June 2025).
Sinclair JE and Hickford GE (1998) Experience of safety assessment for the deep disposal of intermediate-level waste in the U.K. In: Stenhouse MJ and Kirko VI (eds) *Defence Nuclear Waste Disposal in Russia: International Perspective*. Dordrecht: Springer Netherlands, pp. 187–197. Available at: http://link.springer.com/10.1007/978-94-011-5112-2_17 (accessed 1 June 2025).
Thompson CJ (1964) *Investigations in the theory of superconductivity*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/65083 (accessed 1 June 2025).
Van Der Poorten AJ (1968) *Simultaneous algebraic approximation of functions*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/65150 (accessed 1 June 2025).
Vella GJ (1971) *The Pockels effect and electrical conductivity of ADP and KDP crystals above 20 degrees C*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/67334 (accessed 1 June 2025).
Wark P (1971) *Representations of commutative rings with two generators*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/65235 (accessed 1 June 2025).
Wheeler DJ (1973) *Recombination radiation from surface barriers in II-VI compounds*. UNSW Sydney. Available at: http://hdl.handle.net/1959.4/62414 (accessed 1 June 2025).

Appendix A — Sources

UNSW Archives has a file with two lists of "existing cadets," dated late 1962 and late 1965. The former lists appointment dates, while the latter lists graduation dates. These appear slightly inaccurate since they list the same date (1968) for the 1965 and 1966 physics cohorts. Actual graduation dates up to 1969 are available in Volume 2 of the 1970 Calendar. The 1970 graduations are available in the (archived) Order of Graduation. PhD theses are available (online) through the UNSW Library. Teaching Fellowship appointments were sourced from archived (online) copies of the University Calendars.

Unless otherwise referenced, biographical information was derived from interviews or correspondence with the Cadet involved.

Appendix B: The UNSW Cadets in Mathematics and Physics, 1958–1966

Appointed	Mathematics	Physics
1958	Colin John Thompson	
1958	Neville Smythe	
1960	Pamela Cox (née Wadsworth)	
1960	James Underwood	
1961	Robert John Farrell	David Thomas Edwards
1961	Edward Alan Mann	Edward William Kraegen
1961	Alfred Jacopus van der Poorten*	Jaan Oitmaa
1962	Susan Ahrens (née Lean)	Paul Bryce
1962	Lynne Billard	Geoffrey Nevile Gould
1962	Grahame King	John Thomas Peter Grant
1962	Michael Mullins	Gilbert John Vella
1962	Richard Telfer Mullins	
1962	Jane Elisabeth Reeves	
1963	John Edward Hutchinson	Reg Thomas Cahill*
1963	Gregor Lesnie	David Longridge Heron*
1963	Peter de Carteret Wark*	Helen Margaret Smith
1964	Michael John Butler	John Christopher Aarons*
1964	Terrence John Roberts	David Robert McKenzie
1964	John Alexander Woodward	James Everhard Sinclair
1965	G Moulds	Michael Newton Barber
1965	Howard Thomas McElnea	Valerie Ann Rendle
1965	Geoffrey Ian Whyte*	David Wheeler
1966	Harold Malcolm Hudson	
1966	Kaye Christine Stacey (née Vale)	
1966	Geoffrey Bernard Lewis	

* Known to be deceased

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 50–58. ISSN 0035-9173/25/01050-09

Political ideology and economics

Erik W. Aslaksen

Allambie Heights, NSW 2100

erik.aslaksen@bigpond.com

Introduction

At election time politics is sometimes reduced to "It's the economy, stupid," and it is certainly true that politics and economics are inextricably related. But it can be difficult to identify the relationship between them, as politicians try to appeal to an ideological base at the same time as they promote economic measures that respond to an immediate popular need or a tactical opportunity that is at odds with the ideology. The purpose of this paper is to present a high-level normative definition of that relationship which identifies a politician's ideology by his or her actions in the economy, and it can be seen as an adjunct to an earlier work on the correlation between economic variables and features of social evolution (Aslaksen, 2021). The approach taken here is to first develop views of both ideology and economics in a top-down fashion, starting with the simplest descriptions and then developing them to suit our purpose.

There is nothing new in the material presented; both economics and political science are, on the individual level involved here, extensively treated in textbooks and journal articles. For example, two articles of relevance to the present paper are Douglass North's 1988 paper and that of Christian Bjørnskov from 2005. Both papers investigate the influence of society's political ideology on its economic performance, but they consider this ideology from different perspectives; North through the perspective of transaction costs, Bjørnskov through the perspective of the political orientation of the governing political party. What is original and hopefully useful in the present paper is the identification of a particular connection between the economic actions of a government and its true political ideology, no matter how it likes to present itself to the voters.

Political ideology

A political grouping, such as a political party, is identified by its policies in response to perceived problems and inadequacies in society and by its promotion of these policies at all levels of government. These policies are developed through a process involving discussions, research, analysis, and evaluation within and between groups of party members at all levels, and the inputs to this development process are the assumed or actual values of parameters characterising the state of the society, such as the *per capita* GDP, Gini coefficient, employment data, net immigration rate, indigenous incarceration rates, consumer confidence, and so on, just to mention a few of the vast number of such parameters being collected and handled through electronic data acquisition and processing. But in addition to these data, the process of formulating corresponding policies is not a mathematical process in the sense of a one-to-one correspondence between the set of parameter values and

the resulting policies. The process involves an *evaluation* of the data, an evaluation based on a *belief* in the relative importance of the parameters and in their normative values. Any belief is personal, but when it is expressed as a consensus among a group of people it can be considered as the *political ideology* of that group.

To develop our understanding of political ideologies we need to first take a step back and agree on a high-level understanding of the environment in which a political party operates, which is a *society*. As a point of departure, a society may be defined as a group of interacting humans, and as the human has not changed significantly over the last 10,000 years, the evolution of society is the evolution of the interaction. That is, the *essence* of a society — what at the highest level of abstraction distinguishes two societies — is not its members but their interaction. Or, conversely, for a society the greatest value of its members is their ability to interact, which, at the level of simplicity of this presentation, we may consider to be the same for every member. The evolution of that interaction has been one of increasing intensity and complexity so that today this interaction and its consequences constitute a very complex subject matter, encompassed essentially by the social sciences. We approach this complex subject matter by asserting that, at the highest level of abstraction, a society is characterised by a measure of the individuals' perception of the concept of society and of their relationship to it. At the one end of the scale the individuals consider themselves to be a collection of individuals like themselves interacting to form an environment in which they can pursue their individual activities based on their evaluation of the resulting benefit to themselves. Essentially rejecting the concept of a society as having its own reality, as was the case with Margaret Thatcher (Thatcher, 1989). At the other end of the scale individuals see themselves as integrated elements of society; there is no individual existence outside of society. They are like the cells of an organism, and individuals that break out of this framework and act only for their own benefit and growth, without considering the implications for the whole, are like cancer cells.

Closely related to the two extremes of this characterisation, the interaction between society's members may be considered to be of two types: One type is where an interaction is defined by its associated activity or task: a particular *transaction*. The interaction is in the form of a temporary cooperation of the members of the group participating in the transaction, and enables extensive and complex activities, well beyond the capability of an individual, to be performed. But once the transaction is completed nothing remains as a change in the participants' understanding of society, the interaction itself has no purpose beyond facilitating the transaction: an instrumental value. And, correspondingly, the value of the members to each other is defined solely in terms of such transactions. This type of the interaction between society's members as transactions and with it the assessment of the value of the individual as defined by its ability to participate in and benefit from transactions can, for obvious reasons, be characterised as *materialistic*. The evolution of this type of interaction in terms of the cost of transaction is treated in North (1988).

The other type of interaction is one that is intended to have a lasting effect on the par-

ticipants in the interaction; it is an exchange of ideas or information that influences the participants' beliefs and their understanding and evaluation of their fellow members. The interaction leaves an imprint in the minds of the participants: it forms a *social bond* between them. This bond is formed by the alignment of two ideas (or beliefs), one in each participant, and thereby creating a new idea shared by both. Such a shared idea is different to an idea particular to a single individual due to the knowledge, by both participants, that it is shared and that this implies an intention to preserve it. The type of interaction may be characterised as *idealistic*.

In any society the interactions between its members will reflect both of these types; this is obvious from the fact that transactional interactions rely on some form of common understanding, the most immediate one being language and the meaning of words. What is significant in the following discussion of ideology is the relative importance of the two types.

A different, but related, aspect of the interaction arises from the observation that our actions are determined by our physical circumstances and the information available to us at the time of action — information stored in our memory and the information provided by our senses at the time of action. Accordingly, humans can be characterised in three ways: in terms of what they are (biology), in terms of what they do (production), and in terms of what they think (information). The first of these is not directly relevant to our purpose (not least because of our assumption of identical interaction capabilities), but the other two constitute the characterisation of the individual as an actor (*Homo faber*) and as a processor of information (*Homo cogitans*), respectively, and the complementarity to the previous characterisation is obvious. As action is preceded by information it is possible to consider the information domain as the primary, as the driver of action, and hence an ideology, although consisting of information (beliefs, ideas, understanding), must also be seen as a *process* that results (or should result) in action.

As defined in Wikipedia, a *political ideology* is "a certain set of ethical ideals, principles, doctrines, myths or symbols of a social movement, institution, class or large group that explains how society should work and offers some political and cultural blueprint for a certain social order," but it then goes on to say that "political ideologies have two dimensions: (1) goals: how society should be organised; and (2) methods: the most appropriate way to achieve this goal," and it is comparing these two statements that will provide the kernel of this current essay. The second statement focuses on the organisation of society; the ideology must define what society should be like, what it should look like. It implies a materialistic view of society, with the interaction as transactions and the individuals as actors and production elements that can be organised in a certain structure. And any statement about *why* it should have this particular form will also be in materialistic terms: a better life as measured by disposable income, attained level of education, life expectancy, and so on.

The last part of the first statement is quite similar to the second statement, but the first part is formulated in terms of ideas and beliefs, and this is where the basic differences between political ideologies lie. Any political ideology will purport to promote the well-being of society's members, the dif-

ference between ideologies is best described by how the members see themselves in terms of their activities and capabilities and with the interaction between individuals as transactions enabling these features, or as the interaction producing shared beliefs as the defining factor. These shared beliefs and the commitment to them become a characteristic of the society as *public commitments* and are realised in the form of *public services*. The concept of a public service needs to be clearly understood as a service that is defined by government and made available to all members of society, but that is not necessarily free. For example, education might be free, but transportation might require the user to pay. The considerations that determine the size and structure of the payment are, in principle, no different to those that enter into determining the taxation system, and we shall, in the next section, consider payments for public services to be a form of tax. Free or not, a public service is a government obligation and responsibility.

Every society contains both types of interactions, as transactions within a society require a framework based on a public commitment to shared ideas of behaviour and the realisation of these ideas in the form of a legal system provided as a public service. And in most nations defence is provided as a public service (although private forces and the use of mercenaries have a long history). Which activities should be provided as a public service and which should be subject to transactional interactions is one of the major coordinates used to distinguish between the two ideological poles of *neoliberalism* and *socialism*, and two main areas of contention are education and health care. But even if a service is considered to be a public service, such as transportation and energy, there is the issue of how it is to be *delivered* — by private industry or by public bodies, providing a second coordinate, as shown in Fig. 1. Although the two coordinates are not quite orthogonal, as indicated by the location of the ideologies on the diagonal, it might be useful to view an ideology as being located within this two-dimensional space. As it stands, no scales are provided to give a quantitative meaning to a location within this space, that will be provided in Section 4.

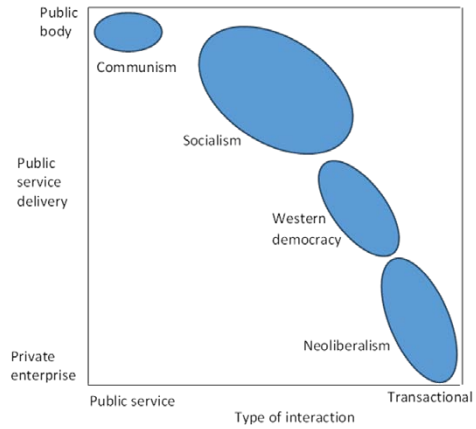


Figure 1: A two-dimensional space for characterising political ideologies in terms of the type of interactions between its members. The horizontal axis defines the extent to which the interactions are in the form of transactions or as public services; the vertical axis defines the extent to which public services are delivered by public bodies or by private industry.

The economy

While politics and economics are closely linked, they are, of course, quite different in many ways. And while economics is sometimes described as a "black art" with a crystal ball as its main tool, the fact is that economics, as an intellectual discipline, is far better defined and developed than political science. In particular, the economy of a

society is structured on many levels, from the simplest to a very detailed structure, as documented e.g., by the National Accounts, and in this section we take advantage of this in what might be called a top-down fashion. The result is an idealised and highly simplified model of the economy.

The starting point is to view the economy as consisting of only two components — production and consumption, as illustrated in Fig. 2.

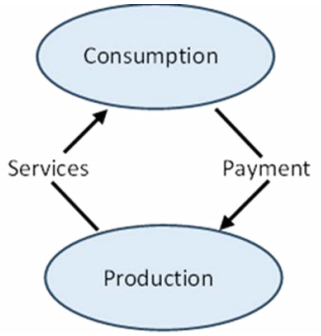


Figure 2: The economy represented by two components — production and consumption. Throughout this paper, "services" are to be understood as "goods and services."

Figure 2 presents a highly simplified view of the economy, and a first simplification is that it is a static view, a snapshot, it ignores the dynamics of the economy in the form of growth and transformation. A second, and related, simplification is, obviously, that it neglects the concepts of profit and the accumulation of capital, which is the driver of growth. The dynamics of the economy and its relation to capital formation, as well as the significance of the Dual Economy (see below) in this regard is treated in detail in an often-cited book by Thomas Piketty (2014). A third simplification is that it hides the internal structures of the two components — consumption is performed by an unstructured entity which we shall think of as "Population", and the services are end-products that reveal nothing of the complex structure and processes within production that determines the price of those products, represented by the Payment; they are simply produced by entities we shall call "Enterprises".

According to the picture of society presented in Section 2 the services are of two types, public services and transaction services, so that we can now structure "Production" into two components: Public Enterprises and Private Enterprises. To this we must add a third component — Government — for the management of the interfaces between Public and Private Enterprises and of the interface between them and the Population, resulting in the particular structure of the economy shown in Fig. 3 which, for obvious reason, is identified as The Dual Economy.

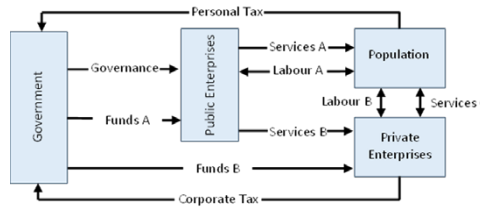


Figure 3: The Dual Economy. Here, Tax includes duties, levies, etc. on all levels (federal, state, local) as well as any payments for public services, as discussed in Section 2. Personal Tax includes income tax, death duties, inheritance tax, wealth tax, capital gains tax, etc. and Corporate Tax includes GST, duties, resource taxes, etc. As before, Services include products and commodities. The double-headed arrows on Labour A, Labour B, and Services C indicate that payments flow in return for labour and these services.

The Public Enterprises are normal corporations wholly owned by the State as the only shareholder and their employees are not public servants (they are located only in Government). For an assessment of Public Enterprises, see e.g., Hanna (2013) and Detter and Fölster (2015). Trade, as an activity of Private Enterprises, is not shown explicitly in Fig. 3. In this model, what in Australia are Government departments (such as the Department of Education) are contained within the respective Public Enterprises, providing a separation of politics and business. The political system, operated by the Government and including such functions as the Electoral Commission, is effectively a process with two interfaces. In the interface with the Population, it needs to negotiate a balance between the Population's desire for public services and its willingness to pay for them; in the interface with the Public Enterprises the process needs to find a balance between available funds and the abilities of the Public Enterprises as a function of funding. The Government process is a back-and-forth between these two interfaces: the art of the political compromise.

For Public Enterprises, the purpose is to provide public services defined by legislation at the lowest cost; for Private Enterprises the purpose is to maximise the return on equity by meeting real or induced market demands. Private Enterprises may compete under normal commercial contract conditions for Government funds for the provision of certain public services (outsourcing). These are provided to the public as part of Services C, and their economic value is simply the funds provided by the Government, indicated in Fig. 3 as Funds B. Moreover, in this simplified model, NGOs are included in Private Enterprises.

In an ideal Dual Economy the public services agreed by the people through the democratic process are delivered entirely by Public Enterprises, and Funds B = 0. Private Enterprises are not prevented from offering similar services, perhaps to differing standards or for the purpose of social differentiation, but they shall receive no public funds for such activities.

The cost of operating the Government process appears as an overhead on Public Enterprises, so that the value of the services produced by them is the sum of the two taxes minus Funds B. Society's GDP is the sum of Services A + Services B + Services C.

The model of the economy presented in Fig. 3 is a static model; it is a simplified picture of the state of the economy at one point in time. For a model that does identify factors influencing economic progress (e.g., the expectation of future reward) and the influence of political ideology on these, see (Bjørnskov, 2005).

The relationship

We are now in a position to relate our characterisation of the society's ideology in Fig. 1 to the model of the economy in Fig. 3 by assigning a quantitative scale to each of the axes in Fig. 1. Let the variable expressing a position on the horizontal axis be x, $0 \le x \le 1$, and the variable expressing a position on the vertical axis be y, $0 \le y \le 1$. If we then introduce the following two new variables:

Tax = Personal Tax + Corporate Tax; and

β = Funds B/Tax;

then the two coordinate variables are given by

$x = 1 - \text{Tax/GDP}$; and

$y = 1 - \beta$.

This is shown in Figure 4, which now provides a high-level correlation between a

society's political ideology and the structure of its economy, and for a typical Western democracy a Government Expenditure (i.e., Tax) as a proportion of GDP in the range of 18–24 % is what is observed (Aslaksen, 2021). As a function of time the evolution of a society would be described by a trajectory in this plane, and at the very earliest formation of a society it would have to have been located in the lower right-hand corner, x = 1 and y = 0. As the society evolved and became increasingly structured it would move upward on the arc indicated in Fig. 4, but at a decreasing rate.

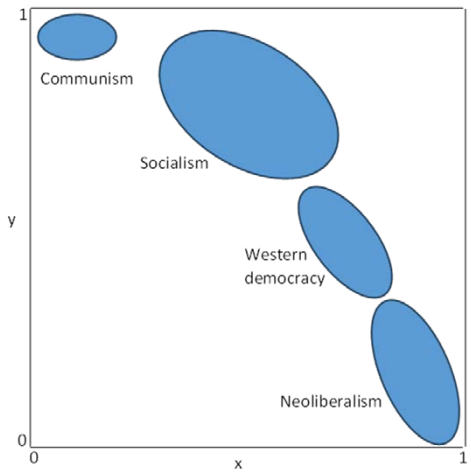


Figure 4: The relationship between political ideology and economics illustrated by assigning quantitative values determined by economics to the two axes defined in Fig. 1. Here x is the proportion of GDP delivered by Private Enterprises and y is the proportion of public services delivered by Public Enterprises.

The two economic variables used as coordinates in Fig. 4 are ratios of absolute variables, so that the relationship expressed is applicable to any size society and economy. And, furthermore, this relationship does not present any value judgement, such as that stated by North: "even in the modern world successful economies, as measured by per capita income, are still in the minority" (North, 1988: 18). On that subject, it might be noted that we should be careful with such a measure, as the success of these Western societies is to a significant extent due to their initial brutal exploitation of the rest of the world. It is analogous to ignoring the role of the initial investment (venture capital) in a successful start-up.

In Fig. 4, both extreme neoliberalism and communism are utopian states of society. Neoliberalism a longing for the supremacy of the individual in an idealised past, communism a vision of a perfect future collective, both unobtainable when a realistic description of human nature is taken into account.

Acknowledgement

The author is grateful for the corrections and helpful comments provided by the two anonymous referees, which led to significant improvement of the paper.

References

Aslaksen EW (2021) *Measures of Social Evolution: Macroeconomic Indicators of Social Stability*. SpringerBriefs in Sociology. Singapore: Springer Singapore. Available at: https://link.springer.com/10.1007/978-981-16-1800-0 (accessed 13 June 2025).

Bjørnskov C (2005) Does political ideology affect economic growth? *Public Choice* 123(1–2): 133–146.

Detter D and Fölster S (2015) *The Public Wealth of Nations*. London: Palgrave Macmillan UK. Available at: http://link.springer.com/10.1057/9781137519863 (accessed 13 June 2025).

Hanna TM (2013) Challenging corporate domination: the public ownership approach. *The Good Society* 22(1): 26–43.

North DC (1988) Ideology and political/economic institutions. *Cato Journal* 8(1): 15–28.
Piketty T (2014) *Capital in the Twenty-First Century* (tran. A Goldhammer). Cambridge: Belknap.
Thatcher M (1987) "There is no such thing as society; there are individual men and women, and there are families." As quoted by Douglas Keay in interview on 23 September 1987. *Woman's Own* 31: 8–10.

Personal notes on Aslaksen's paper[1]

Christopher M. Adam

Emeritus Professor, UNSW

Having spent my professional career learning and expositing techniques of considerable detail within the economics discipline, I have found much of that work has ill-prepared me in recent times for the (what seems to me) rising tide of "cross-discipline" analyses being quoted ostensibly to support economics research. For example, I observe applications of "complexity," "network theory" and "quantum" being borrowed from mathematics and physics to explain how separate agents in markets may interact with each other (Der Derian and Wendt, 2022; Farmer, 2024; Khanna, 2016). As another example, I have noted the growth of linguistics research intended to answer economics questions such as "How many languages do we need?" (Ginsburgh and Weber, 2011) or to define a new cross-discipline of "Linguanomics" (Hogan-Brun, 2017).

In addition, running in the seemingly opposite direction to building on existing analytical structures, is research arguing that the foundations of our economic understanding are better based on a novel fundamental construct drawn from history. This is captured, under the title of "zone" analysis, as the recent historical emergence of small non-democratic geographically focused "zones" of economic activity like Hong Kong or Singapore, rather than widespread national entities such as countries like the US or China, or collectives of nations such as the European Union (Slobodian, 2024). Zones are considered more robust as the key elements for human interaction than are global intercontinental entities. Pursuit of the zone approach supports the development of gated communities within existing nation states or the separation of industrial production sites from major residential cities. The novelty of the zone structure is that it does not, in the view of its supporters, require broad-range democratic institutions to control and manage a given zone: in fact, a zone would best operate under its own rules, which tend to create administrative regimes without democracy.

When confronted with this large range of suggested and potentially overlapping alternative methods of analysis, it is not clear what the direction is for the next step. A guide for next step(s) would seem beneficial.

What struck me about the paper submitted to the Royal Society was its useful clarity

1 Chris Adam was one of the two referees for this paper. At the Editor's request, this is a note on Aslaksen's paper. [Ed.]

in identifying a particular set of linkages between economics and political ideology that could be adopted in short compass. The paper does not attempt to provide all possible connections between the two disciplines, nor does it offer to exposit a complete range of underlying analytical or historical techniques which may be adopted and adapted to exploring the linkages proposed.

The paper instead provides a valuable summary in two dimensions, both verbally and graphically, how we may trace useful connections between economics and political analysis. In reading the paper we are not overwhelmed by exposure to separate and independent advanced analytical tools, nor are we required to embrace an extended range of political philosophy in order to underpin the explanation of how political ideology can drive economic analysis in real countries. The paper explains some analytical tools, and some political ideology, helpfully brought together through a two-dimensional diagram.

Obviously, a short paper cannot encompass all possible analyses of the interactions between the content of economics and that of political ideology. Indeed, it is doubtful that any finite publication might cover all aspects of the interactions. The true value of this paper is that it presents an original summary which provides a useful foundation for taking further steps of a more detailed discussion, both pro and con, on the topic.

References

Der Derian J and Wendt A (2022) *Quantum International Relations: A Human Science for World Politics*. Oxford: Oxford University Press USA - OSO.

Farmer JD (2024) *Making Sense of Chaos: A Better Economics for a Better World*. Dublin: Allen Lane, an imprint of Penguin Books.

Ginsburgh V and Weber S (2011) *How Many Languages Do We Need? The Economics of Linguistic Diversity*. Princeton (N.J.): Princeton university press.

Hogan-Brun G (2017) *Linguanomics: What Is the Market Potential of Multilingualism?* London, England: Bloomsbury Publishing.

Khanna P (2016) *Connectography: Mapping the Future of Global Civilization*. Westminster: Random House Publishing Group.

Slobodian Q (2024) *Crack-up Capitalism: Market Radicals and the Dream of a World Without Democracy*. Dublin: Penguin Books.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 59–78. ISSN 0035-9173/25/01059-20

2024 Royal Society of New South Wales and Learned Academies Forum: "Threats to Democracy"

Thursday, 14 November 2024
Government House, Sydney

Her Excellency the Honourable Margaret Beazley AC KC, Governor of New South Wales

Susan Pond AM FRSN FTSE FAHMS, President, Royal Society of NSW

Emeritus Professor Christina Slade FRSA FRSN, Chair, Forum & Program Committees

Professor Philip Pettit AC FASSA FAHA FAAAS FBA, Distinguished Professor ANU, L S Rockefeller University Professor of Human Values, Princeton University

Opening Addresses

Her Excellency the Honourable Margaret Beazley AC KC

Bujari gamarruwa, Diyn Babana, Gamarada Gadigal Ngura

I greet you in the language of the Gadigal people, the Traditional Owners of the land on which Government House stands. I pay my respects to their Elders past, present and emerging. To everyone in the room, and those watching online, I welcome you all to Government House this morning for the 2024 Royal Society of NSW and Learned Academics Forum, "Threats to Democracy."

This year's Forum could not have been more aptly named or timed. 2024 has been described as the "ultimate election year."[1] By year's end, there will have been elections in more than 70 countries, representing almost half the world's population (49%).[2] And yet, less than 8% of the world's population lives in what might be described as a "full democracy."[3]

Taking as a premise, at least in the Western world, that representative democracy provides the best form of government, there is nonetheless significant dissatisfaction with how democracies are working. The Pew Research Center, since 2017,[4] has recorded an overall decline in levels of satisfaction with democracy. Despite a brief bounce back in 2021, where a median of 49% of those surveyed were satisfied with the way their democracy was working, today the number is 36%.[5]

Accepting that there will be differing reasons for this low level of satisfaction in

1 https://time.com/6550920/world-elections-2024/

2 https://time.com/6550920/world-elections-2024/; see also: https://edition.cnn.com/2024/07/08/world/global-elections-2024-maps-charts-dg/index.html

3 EIU Report, *Democracy Index 2023*: https://www.eiu.com/n/campaigns/democracy-index-2023/?utm_source=eiu-website&utm_medium=blog&utm_campaign=democracy-index-2023

4 It looked in detail at "12 economically advanced democracies." The 12 nations are: Canada, France, Germany, Greece, Italy, Japan, the Netherlands, South Korea, Spain, Sweden, the UK and the USA. But, overall, respondents in 31 countries were surveyed. See: https://www.pewresearch.org/short-reads/2024/06/18/satisfaction-with-democracy-has-declined-in-recent-years-in-high-income-nations/

5 https://www.pewresearch.org/short-reads/2024/06/18/satisfaction-with-democracy-has-declined-in-recent-years-in-high-income-nations/

different countries, a number of common factors emerge. Three are of particular relevance. The first is the economy. How people feel about the way their democracy is working is "strongly related to how they believe *their economy* is working." Second, how people feel about the governing party — "are they doing enough for me; do they understand me?" Third is the level of education: the lower a person's level of education, the less satisfied they are with the way democracy is working compared to those who are better educated.[6]

When people are asked what they think would improve democracy, simply put, the answer is: *politicians*. People want "politicians who are more responsive to their needs (which is why the economy features so signficantly) and who are more competent and honest."[7] Wider representation among politicians was also cited: in particular the narrow "white wealthy male" category came in for criticism by respondents from different democracies across the globe — but that doesn't explain democracy in the United States, and I don't only refer to the President-elect. The President could equally be so described. The difference there of course was in political outlook.

In Australia, 60% of those surveyed were found to be satisfied with our democracy. That, in in my view, is not a high level of satisfaction, given that a candidate with over 50% of the vote determined on preferences is elected. One might ask whether, overall, these statistics indicate merely complacency about our political system, or should it be seen as a Red Flag — a warning that our democracy cannot be taken for granted?

Perhaps, unsurprisingly, some of the starkest statistics come from the US, where the latest survey found that 68% were *dis*satisfied with their democracy. Also unsurprisingly, according to *The Economist*'s Democracy Index, the United States is a "flawed democracy."[8] The position in Greece, the home of democracy, is even more marked with the *dissatisfaction* level at 78%.[9]

I do not know whether the respondents to the surveys on which these statistics are based are part of the voting constituency in any of the countries (except Australia which has enforced compulsory voting). We do know, however, that with a population of 345,426,571, and not having compulsory voting, the 2020 US Presidential election saw the largest voter turnout for any national election since 1900, but still with only around two-thirds (66%) of the eligible population having cast a vote.[10] That was an increase of 17 million votes from 2016.[11]

6 This level of education was found to be a relevant factor in 8 countries surveyed: Argentina, Chile, France, Germany, the Netherlands, Poland, Spain and the USA. However, in other countries, the level of education was not found to be an influencing factor. See: https://www.pewresearch.org/short-reads/2024/06/18/satisfaction-with-democracy-has-declined-in-recent-years-in-high-income-nations/

7 https://www.pewresearch.org/global/2024/03/13/what-can-improve-democracy/

8 https://worldpopulationreview.com/country-rankings/democracy-index-by-country

9 https://www.pewresearch.org/short-reads/2024/06/18/satisfaction-with-democracy-has-declined-in-recent-years-in-high-income-nations/

10 https://www.pewresearch.org/politics/2023/07/12/voter-turnout-2018-2022/

11 137.5 million votes cast in 2016 to 154.6 million cast in 2020 (https://www.census.gov/newsroom/press-releases/2022/2020-presidential-election-voting-report.html). The context of the time was certainly unique, it being in the midst of a global pandemic, but the combination of an aging population and the insurgence

Last week's election saw nearly 5 million fewer votes cast than in 2020, coming in at 149.9 million.[12]

Australia is one of only 23 countries in the world that has compulsory voting.[13] Australia is marking the centenary of its introduction this year[14] which was a reaction to low voter turnout over a number of election cycles, where, at the Commonwealth level, it had been as low as 58%.[15] Critics at the time argued that compulsion was "wrong in principle" and that "it 'is not the democratic norm'."[16] Arguments in favour included "compulsion would enforce political education." In the first state and Commonwealth elections that took place after compulsory voting was implemented, turnout increased by an average of 23.2%[17] and has never dropped below 90%.[18] In the United States in 2015, President Obama raised the question of compulsory voting, and the *Harvard Law Review* published a Note on the topic which said, "[t]his nascent debate marks an exciting effort to make the actual electorate more representative of the eligible electorate and potentially shift political power."[19]

When I first started thinking about my remarks for this morning, the election in the US was ahead of us. The pall of disappointment, if not disbelief, that hung over the Democrats on the evening of 5 November was palpable for all to see on our television screens. And, as might be expected, the commentators, including in Australia, have had an "I told you so" field day ever since.

Indeed, last weekend reading a variety of articles would make one think that's how we should all have been thinking, all along. Let me provide you with a few quotes:

- "As millions struggled with life and death cost of living pressures, Harris was babbling word salads about joy".[20]
- One Democrat Senator observed that "Harris and Biden made the case to voters that the administration's agenda had benefited Americans and should be extended for another four years," "But [the popu-

of the youth vote had a big impact on the numbers (https://www.pewresearch.org/politics/2021/06/30/behind-bidens-2020-victory/).

12 As at 13 November 2024: https://www.nytimes.com/interactive/2024/11/05/us/elections/results-president.html

13 https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Completed_Inquiries/em/elect04/appendixg

14 See the *Commonwealth Electoral Act 1924* (Cth), "It shall be the duty of every elector to record his vote at each election."

15 M Mackerras and I McAllister, 'Compulsory voting, party stability and electoral advantage in Australia' (1999) 18 *Electoral Studies* 217, 220.

16 ibid, 222.

17 ibid, 220. Literature on the impact in other countries seems to suggest an increase of between 3.5–10%. See: M Hoffman, G Leon and M Lombardi, 'Compulsory voting, turnout, and government spending: Evidence from Austria' (2017) 145 *Journal of Public Economics* 103 and S Gaebler, N Potrafke and F Roesel, 'Compulsory Voting and political participation: Empirical evidence from Austria' (2020) 81 *Regional Science and Urban Economics* 103499.

18 https://www.aec.gov.au/about_aec/publications/voting/

19 'Compulsory Voting's American History', (2024) 137 *Harv. L. Rev.* 1138: https://harvardlawreview.org/print/vol-137/compulsory-votings-american-history/

20 Joe Hildebrand, *Saturday Telegraph*, 9 November 2024.

lace] didn't feel it — and 'the American public' didn't give us credit for it."[21]

- As to the strong Trump vote amongst Latino men, another commentator observed that "this time around it appears that the economy was the key to Trump's success," citing amongst other things that Latino men are working class and, overall, not educated.[22]

Henry Ergas, writing his weekly opinion piece in *The Australian* summed up the position in these terms: "… the Americans who voted for Trump didn't think they were electing a saint. They thought in a system, replete with constitutional safeguards, that they were electing a President who could make their lives at least a little bit better, a little bit easier."

Which brings me back to the Pew Research Centre's survey: 2 of the 3 factors they mentioned — living standards and education — were key factors in determining satisfaction levels with democracy. The consensus seems to be that it is the same with voter choice. Indeed, President Bill Clinton's political strategist James Carville, in the election against George H W Bush, put it quite pointedly: "It's the economy, stupid."

So, with those reflections, do I maintain what I consider an important and principled view of democracy and in particular compulsory voting? Absolutely. In my own view, to not vote is to disenfranchise yourself. Would compulsory voting have changed the outcome of the US election? We can, of course, only speculate. But of one thing we can be certain, the next 4 years will be interesting, and not only in the US.

I only add this: one thing that cannot be left out of the equation in discussions such as we are having today is that politics is the tin tacks of democracy. Democracy is at naught if the politics aren't right.

Today's Forum will give us a lot to think about. I offer the warmest of thanks, as always, to the Royal Society and the Learned Academies for continuing this important tradition of facilitating informed and enlightening discourse, and the opportunities for enrichment it promotes. I also give special thanks to all the contributors to today's sessions. Your insights, considerations, and generosity in sharing your knowledge and time is invaluable.

It is my privilege that I now open the 2024 Royal Society of NSW and Learned Academies Forum, "Threats to Democracy."

Thank you.

Susan Pond, President, Royal Society of NSW

I am Susan Pond and I've got a small role today to play as President of the Royal Society of New South Wales. I thank Her Excellency for her opening remarks that do set the stage for what she calls, and is truly, an important discussion about the wide range of forces that are challenging democracies around the world, including here in Australia. I add my welcome to Her Excellency's and thank her most sincerely for hosting yet again the annual Forum which has been held here since 2015.

21 Michael D. Shear and Zolan Kanno-Youngs, *New York Times* in the *Sydney Morning Herald*, 8 November 2024.

22 Matthew Knott, *Sydney Morning Herald*, 8 November 2024.

The Royal Society of New South Wales upholds the principles of liberal democracy. We pride ourselves on being a trusted institution that provides credible information and on being part of a society that is connected and respectful, with a common purpose and shared identity. Today's Forum and today's topic, "Threats to Democracy," are fine exemplars of how the Society lives up to these ideals.

My main role this morning is to welcome and thank all of our speakers for participating in the programme, and to thank everyone for joining the audience today, either here in Government House in person or online from across Australia and beyond. Our speakers, and you the audience, represent a very wide spectrum of interests and expertise. You span academia, industry, government, public administration, culture and civil society. You include, but are not limited to, Members and Fellows of the Society itself, Fellows of the five learned academies — Health and Medical Sciences, Humanities, Social Sciences, Science, Technology and Engineering — Fellows of the Royal Society of Arts in London, early career researchers from universities across New South Wales, leaders in civil society, government, and businesses small, medium and large. I especially acknowledge the representatives here today from the office of the New South Wales Chief Scientist and Engineer, and thank Hugh Durrant-Whyte, our New South Wales Chief Scientist and Engineer, and the New South Wales Government for their continued engagement with the Society and their much appreciated sponsorship of this Forum.

The Royal Society of New South Wales is purposely cross-disciplinary and welcoming to members from all walks of life. We are only going to be able to examine complex topics like threats to democracy by combining all of the perspectives from the sciences and humanities in order to make progress.

I now turn to thanking on behalf of the Society the chair of this year's Forum planning committee — Christina Slade — and committee members Elizabeth Dean, Vince di Pietro, Peter Shergold, Robert Marks, Graham Town and Lindsay Botten. Today would not have been possible without them. Today of course is only one day, but the Society will be preserving the proceedings for years to come in written form in the Society's *Journal & Proceedings* and in the video recordings on the Society's YouTube channel.

I invite Emeritus Professor Christina Slade to the stage. Christina is a Council member of the Society and chair of this year's Forum planning committee. Christina is an international academic leader in the areas of the impact of globalism on citizenship, media, and education. She has served as a senior academic and administrator in Australia, Europe, the US, and Mexico. Christina, welcome to the lectern to begin our collective consideration of threats to democracy.

Christina Slade, Chair, Forum & Program Committees

Thank you very much, Susan. I too want to acknowledge the Traditional Owners of this land, past, present, and future, and I want to make a special thanks to the current occupants of this House and in particular the Governor and the household for their huge support. It's been a long process.

When I mooted the idea of "Threats to Democracy" as the topic of this year's Forum, it was March or April, and we knew that there were going to be a lot of issues coming up, and we knew the American election would be decided just before we had the Forum. It has proved a rather more turbulent year than we expected. I think we're particularly lucky to have Philip Pettit joining us from close to the epicentre — he's at Princeton in the United States — to deliver the keynote address on the big question we're all facing. His title is "Democracy — the What, the Why, and the How." Philip is a highly distinguished philosopher with an extraordinary range. He jointly holds positions as Distinguished Professor of Philosophy at ANU and as the Laurence Rockefeller University Professor of Human Values at Princeton. He has fellowships in Australia, France, the UK, the US, and Ireland. He comes from the analytic tradition. I first knew him when he came to ANU in the 1980s, where he proved this extraordinary ability to collaborate. He led and worked with a cross-disciplinary team of economists and social theorists — very well-known names: Geoff Brennan, John Braithwaite, Frank Jackson, Michael Smith — in an extraordinarily powerful period for ANU's philosophy.

He explained then that, having studied philosophy in Ireland, he had read widely across French and European philosophy. He takes French and European philosophy seriously. Perhaps that's not always true of analytic philosophers.

For Philip, issues in political philosophy and ethics in decision theory are tied to a genuine search for how we as a society live the best life possible. His book, *Republicanism: A Theory of Freedom and Government* from 1997, is not addressed to the issue of the Republic which might be relevant here. It's a discussion centring on what freedom means for a citizen. He explains that while classical republicans depicted freedom as a negative quality — freedom from interference — he equates freedom with a positive — freedom from arbitrary domination — and he goes on to argue that freedom as non-domination is embedded in a vision of human agents as fundamentally social, communicative beings.

Aristotle taught Alexander the Great, but few modern analytic philosophers have direct influence on politicians or leaders. That is not true of Philip. His republicanism provided the underlying justification for political reforms in Spain under José Luis Rodríguez Zapatero, and he wrote with José Luis Martí *A Political Philosophy in Public Life: Civic Republicanism in Zapatero's Spain*.

We are all in uncharted times right now for democracy. I am very, very honoured to welcome Philip Pettit.

Keynote

Democracy: the What, the Why and the How[23]

Philip Pettit

Distinguished Professor, ANU; LS Rockefeller University Professor of Human Values, Princeton University

philip.pettit@anu.edu.au

Thank you very much indeed, Christina. It's a real pleasure and a great honour to be invited by you all. My great thanks to Your Excellency, Madame President, and ladies and gentlemen. I'm going to talk around the general themes. I hope it may be of some use as a background to the more detailed and I suspect incisive discussions that you're going to have later in the day. Unfortunately, as you can see, I'm in night-time America at the moment. You can see in the windows behind me that night has fallen, maybe in more senses than one. In any case I want to talk about these three themes: the What of democracy, the Why of democracy, and the How of democracy. So let's begin with the what of democracy.

The What of democracy: not by election alone

The characterisation of democracy that is almost standard in political science textbooks is "a system in which rulers are selected by competitive elections." That's a quote from Adam Przeworski, a well-known political scientist from NYU, more or less on the left of the political spectrum.[24] It echoes what is really orthodoxy in political science, and that orthodoxy at least goes back to Joseph Schumpeter, writing in the 1940s. So the idea is that you equate democracy simply with electoral control over those who are in government.[25]

One initial comment about that is that it's really quite a recent development. For example, if you look at the authors of *The Federalist Papers*, written in support of the US Constitution in 1787, they certainly defend what they would describe as a representative system — and basically an electoral representative system — but they do not call it democracy. In fact they distinguish it from democracy. Similarly, to pick another source, in 1819 in a rather famous piece on government, James Mill, father of John Stuart Mill, talks about the representative or electoral system as the grand invention of modern times, but he distinguishes it from democracy.[26]

So I think it's worth noting that the equation between competitive election and democracy is really of fairly recent origin. It

23 This is an edited transcript of Professor Pettit's keynote address. See the video at https://www.youtube.com/watch?v=Uwf1Zw-58Ng&t=888s

24 Przeworski A (2019) *Crises of Democracy*. C.U.P.

25 Schumpeter J (1942) *Capitalism, Socialism and Democracy*. NY: Harper Bros.

26 Mill J (1820) Government, from *The Encyclopedia Britannica*. http://studymore.org.uk/xmilgov.htm

only became standard in the mid-19th century after the 1830s and 1840s. I think it's an unfortunate equation, actually, suggesting that the be-all and end-all of democracy is competitive elections. Just to explain why I believe that, let me describe two takes on this equation. One is the construction that is standard among political scientists — for example, very well known in the work of William Riker — which basically says democracy is about electoral control, majoritarian control, of who's in government. Those attached to this approach admit that that could create all sorts of problems, in particular the tyranny of the majority. So it's always said that, apart from the element of electoral control of government, we need anti-majoritarian constraints that will put a brake, so to speak, on what majoritarian rule might lead to. Now that's really very unfortunate because it equates democracy with electoral control, but then says democracy is actually not all that worthwhile.[27]

Of course, that immediately invites the comment: "Well, who's at the source of these anti-majoritarian constraints?" The traditional line has been, "Well, that's the work of elites." Now you get a competition between the people ruling in the majoritarian election and the elite ruling in imposing these anti-majoritarian constraints. That's a very unfortunate mix and I suspect it may actually be at the source of the sort of discontent you find in populist circles with the way our democratic systems are working; the line is that there are too many of these anti-majoritarian constraints, so let's go with real democracy, that is to say, majoritarian control. That's a very unfortunate consequence of the equation of electoral control with democracy.

But the other equally unfortunate construal of that equation is that which is commonly defended by such populists, which goes back to a theme from Jean-Jacques Rousseau. Populists tend to vulgarise Rousseau , however, drawing on him in support of the claim that electoral control by the majority is terrific because it imposes the will of the people on government. Competitive election on this approach is sacralised, or romanticised, as the way in which the people speak: the way in which the will of the people is expressed.

The notion that there is a will that the people as a whole — the collective people — might form and impose on government appears with Rousseau in the 1760s in the idea of the general will. Rousseau took the idea of a general will from a 17th-century theological tradition of thinking that God rules the world by a Divine will and that individuals are allowed to do things according to their particular wills under the general constraint of God's will for the universe. Rousseau secularised that idea, arguing that the people might rule by a general will, imposing it on government. But he did not think that the majoritarian election of government would secure the presence of the general will, holding that it would be very difficult to ensure its presence. He thought it would require at least a participatory democracy on the model that he found in his native Geneva.

This romanticisation of electoral competitive control of government is just as unfortunate as the other approach I've mentioned, which would limit electoral

27 Riker WH (1987) *Liberalism Against Populism: A Confrontation Between the Theory of Democracy and the Theory of Social Choice*. Waveland Press.

control by anti-majoritarian checks. For one thing, it's metaphysically obscure. It's very unclear what the will of the people is, for if you have different districting rules or different electoral rules, it turns out that a different will is expressed in the voting. Given that there is no such thing as the will of the people independently of the particular voting system you use to express that will, the idea llooks like a chimera, really — an illusion.

Apart from that unfortunate aspect of romanticising majoritarian competitive control of government, there's the fact that it simply licenses the tyranny of the majority. We know that the people in any democracy like ours in Australia — or in any advanced democracy today — are going to be of various backgrounds, interests, opinions, religions and ethnicities. They are extremely unlikely to have a single will that they might be happy to rally behind. If you allow majority will to rule in that way, you're going to deprive many individuals of their status as members of the people.

How should we think about democracy if we are unhappy with the simple equation between democracy and competitive electoral control? In order to address the issue of how democracy might be conceptualised if it's not just about competitive electoral control, I think, as indeed Her Excellency mentioned, that we should go back to the Greeks, who after all were the ones who used the word *dēmokratia* that we translate as democracy. What's very striking — and I'm really not a producer in this area, more a consumer of the scholarship — is that the scholarship makes quite clear that what the Greeks meant by *dēmokratia* was a system of any kind in which ordinary people had a good deal of power — in particular, had a good deal of push-back power against those in government.

Thus, on the Greek approach, Athens was an exemplar of democracy, although, interestingly, in Athens almost no officials were elected; it was a system in which most authorities were appointed by lot — by a chance mechanism. The population was divided into ten tribes and then most bodies in government were filled by a statistical sample from each of those tribes. The Greek notion of democracy was focused not on any method, electoral or otherwise, whereby the people might control government , but just on the requirement that they have considerable power, no matter by what means, over their governing authorities.

Her Excellency, the Governor, mentioned the Economist Intelligence Index of democracy. It's very striking that it and other indices of democracy go away from the political science orthodoxy. For example, *The Economist* has 60 indicators of democracy. I'm all for this because that approach — thinking of democracy as having many different aspects or facets — presupposes that, as the Greeks would have it, the point or the goal of democracy is simply to ensure that ordinary people have a good deal of control over how they are governed, no matter by what means that control is achieved.

The Why of democracy: back to the Greeks (and Romans)

This answer to the question of what democracy is directs to an answer to the why question too. Assume that democracy is a system in which ordinary people are required to have a good deal of power over governing authorities. If democracy is attractive, then, that must be because it

enables people to exercise their power effectively. It ensures that the authorities will be unable to frame or impose the law, interpret or apply it, just as they wish, regardless of the judgments and values of the people; it puts popularly sourced constraints in place on how the authorities can use their power.

I can't resist introducing some history at this point, focusing on that fact that ancient Rome is a good example (in fact Athens itself was too) of a system where ordinary people had a great deal of control over how they were governed. The Romans didn't use the word democracy or *dēmokratia*, though they would have understood it — they described their system as a *res publica*, which essentially meant a conception of the system of government as a public affair. That's what *res publica* means, and of course gives us the word "republic." The Romans thought of the Republic as precisely a system in which ordinary people had a great deal of control and power: a capacity for push-back against those who ruled over them.

It's worth thinking about just the bare elements of the Roman Republican system, which was there for hundreds of years, down to the beginning of the Empire. Election did play a role in that system, unlike in Athens, because those who occupied official roles or bodies had to be elected to those bodies, indeed had to be elected by ordinary people. Maybe I should say "ordinary citizens," because of course in Rome at that time, as in Athens and almost everywhere else until very recent times, the citizenry were not inclusive of everybody; in particular, they were not inclusive of women. Still, in Rome those ordinary citizens had a great deal of power, and one aspect of that power was that the authorities had to be elected by the ordinary people.

But there were also many other aspects to the way in which ordinary people had control over how they were governed in Rome. A second was that while only those in authoritative positions could propose a law or a major initiative, no law could be enacted, unless it was ratified by one or another popular assembly, and there were many of these in Rome at the time.

A third way in which ordinary people could control government in Rome was that the courts were basically selected from among certain classes of ordinary people, case by case. The courts were very different from our courts, of course, because the members voted on both guilt and sentence: they weren't just a jury, they were judge and jury, as you might say. The important point for us, however, is that they were not controlled in applying the law by the elites, so that the courts represented a form of power on the part of ordinary people which was quite independent of the electoral control they had in selecting the authorities or indeed even in ratifying the laws.

But in other ways too, the ordinary people enjoyed considerable control over governing authorities. So, for example, if you as an ordinary person objected to how a particular official ruled in your case, you could appeal to special, elected officials, the tribunes of the plebs, and make your case to them; the tribunes were like powerful ombudsmen and if they took up your case, could even block any action against you. But apart from that, people in Rome had the right not just to appeal to a tribune but to appeal against an authority to a popular assembly: "Look how they've treated me," you might say. It was called a right of *provocatio*, from which we get provocation. Again, that was a means of control that ordinary

people had over how they were governed, how they were treated by those in government.

Nor is that all. Those of you who have visited Rome may remember that the Forum of ancient Rome is just in front of the Senate building; the Senate was a body of the elite officials or ex-officials who decided on policy, although not on law. People would assemble before the Senate and often protest against various measures that were being proposed or decisions that had been made. And that was yet another form of control — contestatory control — that the people had over the authorities in government.

Finally, ordinary people had a certain indirect power over officials of a kind that I think we still enjoy a vestige of, or a descendant of, today. This is that at every level of officialdom, at every level of authority, there were a number of competing officials. Thus, there were always two consuls at the top level, while at one of the bottom levels in the later Republic there were 40 quaestors. Such officials had to align with one another in order to agree on any policy. Since they often found it hard to align, they were seriously checked by this measure and were thereby made more controllable by ordinary people.

So much for the ways in which in Rome, the people had a great deal of democratic control in the Greek sense over how they were governed. I'd like to describe their system as *polycentric* in character. As there were many different centres of power in Rome, many different authorities, each with their own area domain of expertise and power, so there were many different channels of control over how those authorities did their business. Rome was a polycentric system in the sense that there were many centres of power, and many channels of popular control. It really contrasts with the electoral image of democracy, which is monocentric: the power of the people is limited to their electoral power. Rome represents a polycentric model in which election plays a role but only alongside a variety of other measures.

The How of democracy I: updating the polycentric model

Moving on to the *how* of democracy, I now want to suggest that we should think of our democracy, and that of many advanced democracies today, as a polycentric system. This means a democracy with multiple centres of power within the government, and with various channels of control over those powers. What democracy involves, on this view, is an amalgamation of these control channels, through which we, as ordinary citizens, can push back against those in government. We have the power to ensure that those who rule us — who establish the laws, enact the laws, and apply the laws — do not do so at their own discretion. They are not our masters, for ideally it is we who set the terms under which they govern us.

I think this polycentric perspective is essential if we are to address the various threats that democracy faces today. There is no doubt that the electoral channel of control is under threat — though I would argue that this is more acute in the United States than in Australia. But the threats to democracy arise at many different points in the polycentric model of democracy that I'm proposing. I believe that many of the institutions in a polycentric democracy have Roman origins. But I will set aside a further discussion of Rome.

The role of government

Before we proceed, let's think about government. I've been discussing how ordinary people in a polycentric system can gain control over those who govern them. But we need to be clear about who exactly is included in the category of "those who govern."

What does government actually encompass? We often use the term to refer simply to the executive in our system — the administration, as it is called in the United States — or, especially in parliamentary systems like ours, to the executive as the controlling faction or party in the legislature. This is a perfectly reasonable use of the term, but I would like to invite you to consider that government involves far more than just the legislature that enacts laws, or by the administration that enforces them.

The legislature and executive enjoy domain-general power, since the laws they enact and enforce apply across many areas of social life, and they are rightly placed at the centre of democracy. But a democracy like ours also includes many other official individuals and bodies, which, for lack of a better term, I will refer to as domain-specific authorities. For example, the courts — the judiciary — represent a domain-specific authority. Unlike the legislature or the executive, the judiciary's power is not general but restricted to applying and interpreting the law in individual cases. This requires both impartiality and expertise in interpreting the requirements of law within the framework of overarching constitutional principles.

There are many other domain-specific authorities in any democracy, however, and certainly in a democracy like ours. The Electoral Commission, for instance, has a very specific role in determining the rules and conduct of elections, under the eventual control of Parliament, but functioning as a relatively independent body. This is why I regard it as an authority in its own right. Similarly, the Central Bank operates with domain-specific authority, requiring impartiality and expertise. The Bureau of Statistics, which provides vital economic data, is another example.[28] These authorities are all part of the broader government system that shapes the lives of ordinary citizens. It is crucial that the system of control over these powers is polycentric — addressing different points of power and offering diverse channels of control over the exercise of that power.

The Constitution as the framework for control

How should we think about the overall picture of a polycentric democracy? The first thing I would emphasise — and I won't dwell on this — is that if the people are to have control over how they are governed, they must have control over the Constitution. The Constitution serves as the framework for governance — the settlement, if you like — and it includes not only the written Constitution but also all the conventions and traditions that surround it. People must have some degree of control over the Constitution if the governance system is to be responsive to them.

In Australia, people have control over the Constitution through referenda, although

28 There are many many examples, of course, such as the promised Commonwealth Centre for Disease Control. [Ed.]

these referenda are at the government's discretion. I would prefer to see citizen-initiated referenda, subject to strict campaign finance laws. Nonetheless, there must always be the possibility of public control over the Constitution. It should be difficult to change the Constitution, but not so difficult that popular discontent cannot spark the kind of debate that leads to a referendum. If the Constitution stands as it is, it should reflect the fact that the people freely acquiesce in it — that there is no widespread discontent sufficient to call for a referendum.

Control over the Constitution is essential because it often imposes constraints on government — constraints such as the rule of law. These constraints can be seen as originating from the people. They are not anti-majoritarian impositions by an elite but are grounded in the Constitution, which is ultimately the people's Constitution. This is one of the key reasons why control of the Constitution is so important.

The Constitution also licenses ordinary citizens to take initiatives in determining how government conducts itself. I think it's here that we see many of the centres and the channels of power that are so important to our enjoying democratic control over how we are governed.

The How of democracy II: polycentric control devices

I think of the various kinds of control licensed under the Constitution in a polycentric democracy like ours as falling into three broad categories. This may sound somewhat academic, but it provides a helpful mnemonic for understanding the range of mechanisms by which we, as ordinary citizens, exercise democratic control. These controls may not be surprising in themselves, but grouping them this way helps us appreciate just how many channels of influence we do, in fact, possess. I'm going to refer to these control mechanisms — or devices — as Disciplinary devices, Contestatory devices, and Selectional devices.

It's important to recognise all three as avenues through which ordinary people can monitor and constrain government power. Ideally, these controls ensure that when those in authority govern us, they do so on terms that we have imposed — or at least endorsed. Let me briefly outline these three categories. I'll only cite familiar examples, but I hope doing so will help stimulate our imaginations about how these devices might be expanded, consolidated, or strengthened.

Standard Disciplinary devices

The first type of control we enjoy is disciplinary in nature. Let me begin with some examples.

A classic disciplinary device is *the system of checks and balances* that we, the people, embed in the structure of government. Take bicameralism, for instance: the requirement that both houses of Parliament must agree on legislation before it can pass. This constrains those in power because it forces different perspectives to be reconciled. The people, through their Constitution, impose this structure. It echoes the Roman system in which one consul could veto another — a model of mutual constraint. Rome is often described as a system of checks and balances, and we carry that legacy forward.

Another check derives from *the independence of the judiciary*, which plays a vital disciplinary role. Those in power can only introduce laws that withstand judicial scrutiny — judges (impartial and expert, we hope) must determine whether those laws

are consistent with the Constitution and existing legal frameworks. This is a powerful constraint, rooted in the rule of law, and one that originates in the people.

Other checks in the system of checks and balances are linked with relatively independent domain-specific authorities such as the Central Bank, the Electoral Commission, or the Bureau of Statistics. These bodies, like the judiciary, constrain domain-general authorities such as the executive or legislature by limiting their discretion. At the same time, these bodies can be checked by one another. This intricate web of institutional counterbalances helps secure democratic governance.

A second disciplinary device in addition to the system of checks and balances is found in the *rule of law* itself. This principle requires that laws be public, intelligible, and reasonably clear, so that citizens can actually comply with them. Laws must not be excessively burdensome, must avoid retrospective application, and should apply broadly and consistently across government institutions. These standards place substantial constraints on government power.

A third disciplinary device is *the requirement for reason-giving*. The executive must justify its decisions; legislatures must respond to interrogation in the chamber; judges must provide written opinions explaining their rulings. This public expectation — that those in authority account for their actions — is another powerful constraint sourced from the people.

Then there are *individual rights* entrenched in the Constitution. These establish clear boundaries that government must not cross, particularly when it comes to how domain-general authorities exercise power.

Finally — and I think this is especially important — is the disciplinary role of *a professional public service*. A capable, well-informed public service brings institutional memory, policy continuity, and independent advice grounded in good governance. This is in sharp contrast to political staffers, whose focus is often on what good politics requires, not necessarily what good government demands. The weakening of the public service's role is deeply troubling.[29] A strong, expert bureaucracy is a vital constraint on arbitrary power.

Standard Contestatory devices

The second category of control consists of Contestatory rather than Disciplinary devices. These rely on core freedoms: freedom of speech, freedom of the press, freedom of association, and freedom of information. Such freedoms must be firmly secured — "copper-fastened," so to speak — if contestatory mechanisms are to function properly in a democracy.

One form of contestatory control is *direct public protest*. Citizens or media actors who challenge government decisions — through demonstrations, legal actions, or journalistic exposés — are exercising contestatory power. These challenges are crucial to democratic oversight.

But contestation doesn't always take such active forms. There is also standby contestation — the implicit constraint created by the *possibility* of public backlash. Governments often refrain from certain actions not because they are prohibited outright, but because they anticipate strong public

29 As perhaps seen in the Robodebt debacle (2016–2020.) [Ed.]

resistance. This latent capacity for protest is itself a meaningful form of control.

Beyond these direct forms, there are *arm's-length mechanisms* of contestation. Civil society groups — such as NGOs with popular legitimacy — can protest and monitor government on our behalf. In the Roman Republican tradition, every citizen was expected to be vigilant in overseeing government. Today, we distribute that responsibility across civil society. Different NGOs perform the role of public invigilators, offering a form of indirect contestation.

We also rely on *independent bodies* established by government, such as inspectorates or commissions of inquiry, which can investigate and speak in the people's name. Although created by the state, these bodies operate with relative independence and can serve as institutional platforms for public contestation.

Standard Selectional devices

The third and final category of control mechanisms is what I refer to as Selectional devices. These concern the ways in which ordinary citizens participate in choosing who holds office and who exercises power on our behalf. In a functioning democracy, this category is absolutely central.

The most obvious selectional device is *the electoral system* itself. Through regular elections, we, the people, choose our representatives — those who sit in Parliament, form governments, and implement policy. This process of selecting, re-selecting, or de-selecting our leaders is fundamental. It gives ordinary people control over the *personnel* of government, even if not over every policy outcome. Of course, elections alone are not sufficient for democracy, but they are indispensable.

A related selectional mechanism is *the recall mechanism*, used in some systems, which allows voters to remove an elected representative before the end of their term. While Australia does not have this at the federal level, it's an example of how democratic systems can give people more direct say in who represents them, and for how long.

In addition to formal elections, selectional control can take the form *of public appointments processes*. For example, while we may not vote directly for judges, central bank governors, or heads of statutory agencies, democratic systems typically require these appointments to follow certain procedures — sometimes including parliamentary scrutiny or independent vetting — to ensure that those chosen reflect public standards of merit, impartiality, and integrity.

Where election is the salient selectional mechanism with domain-general authorities in the legislature and executive, it is inappropriate with officials in these domain-specific roles. Why? Because those in such roles have an incentive inherent in the tasks they are assigned to discharge them by standards assumed on all sides to be relevant. For example, judges are supposed to interpret the law based on the best understanding of that law. If we elected them, we would introduce an independent motive — the incentive to be re-elected — which might well distort their decisions. It's far better that such appointments be made under public procedures — but made transparently, of course, subject to contestation through appropriate review bodies, and based on relevant criteria of expertise and good-faith tests of impartiality.

Finally, to introduce a mechanism of popular control that has recently come

into prominence, there are *citizens' assemblies and deliberative forums*, which allow for the temporary selection of ordinary citizens to deliberate on public policy. These processes give citizens a direct role — not just in selecting representatives, but in shaping laws and policy outcomes. When properly structured, they can complement electoral selection and formal procedural appointment, deepening people's control over government.

What all these mechanisms have in common is that they empower citizens to shape the composition of government, either directly or indirectly. Through these devices, we have the capacity to *renew* the personnel of government, ensuring that those who govern do not become entrenched or unaccountable. Selectional controls are, in that sense, a safeguard against the degeneration of democracy into oligarchy or rule by an unresponsive elite.

Takeaway

Disciplinary, Contestatory, and Selectional devices form the polycentric framework of democratic control. They reflect the multiple centres of power in a complex modern democracy and the multiple avenues through which citizens can exert influence over those centres. The more robust each set of mechanisms is — and the more they are supported by constitutional structures, cultural norms, and civic habits — the healthier a democracy will be.

Thus, in a polycentric democracy like ours, the people should have control not only over the Constitution, but also — through disciplinary, contestatory, and selectional means — over the conduct of government. If there's a takeaway from all this, it's that any serious review of the threats to democracy must look at threats to each of these control points within a polycentric, networked model of democratic governance — the kind we're fortunate to enjoy in Australia.

Questions and Closing

Christina Slade: Thank you very much, Philip, for a wide-ranging and timely reconfiguration of how we think about our democracy. That was fascinating. I'm now going to open the floor to questions. Please keep them as questions — not long statements. But I'll start us off.

As Her Excellency the Governor mentioned, we've been flooded here in Australia with analysis of what happened in the US election. The piece I want to refer to appeared last weekend in the *Financial Times*, by Francis Fukuyama.[30] He argued two things: first, that classical liberalism had been undermined both by neoliberalism and by identity politics — what he called "woke liberalism." More importantly, he said — and many commentators have agreed — that in Trump's first term, the system constrained him: the bureaucracy and your so-called polycentric system worked. But Fukuyama warns that in a second term, those constraints may be undermined. We've already seen appointments that suggest this. My question: how can those constraints be reinforced in a possible second Trump presidency?

30 Fukuyama F (2024) What Trump unleashed means for America. *Financial Times*, 8 November.

Philip Pettit: Thank you, Christie. I remember doing an interview in Europe just after the 2016 election, and I was quite confident then that the American system would constrain Trump — that he wouldn't, as many feared, run amok. I think that turned out to be largely right, as Fukuyama says.

But I'm far more concerned now. Many of the guardrails — the institutional bars that might keep him in check — seem less visible than before.

One particularly striking feature of the American system is the politicization of the judiciary. There are deep reasons for that, including the Constitutional requirement that Senate approval is needed for federal judicial appointments. That sounds like a check on the President — and in theory it is — but in practice, it means Presidents can appoint judges who just scrape over the required threshold, and who are on their side politically. This politicization is a real weakening of the system.

That said, I do hope that judges — even those politically appointed — are still influenced by their interest in maintaining their reputation. That "economy of esteem," as I call it, may help keep the judiciary honest, even when partisanship intrudes.

But the most worrying development in the last election was Trump — and indeed J.D. Vance — refusing to commit to accepting the result if it went against them. That's absolutely terrifying. I hope, if the Democrats win in later years, that any challenge to the results would be so shameless that it wouldn't gain traction. But the fact that such a scenario is even plausible is deeply concerning.

Another risk lies in the Justice Department. Traditionally, it has had some independence from the executive, but that's based more on convention than constitutional requirement. With the new Attorney General, it's not at all clear that this independence will be honoured. If it's lost, it could create a kind of internal rot — a slow unravelling of the polycentric democracy that the U.S. has long represented.

Question: I'd like to build on the previous question, because I think it's important to examine the motivations behind the erosion of different centres of power. We've seen this trend globally — Hungary under Orbán being a standout example of so-called illiberal democracy.

It seems that in recent years, we're seeing a convergence of government with the interests of particular business elites. We saw it under Thaksin in Thailand, Berlusconi in Italy, and now Orbán in Hungary. I'd be interested to hear your thoughts on whether this convergence between business and government represents a new kind of threat to democracy.

PP: Let me comment first on the Hungary case, which illustrates what we've seen in many countries where democracy has drifted toward autocracy. The typical strategy taken by elected but increasingly autocratic governments — "autocratic democrats," so to say — is to systematically silence institutional checks and balances. This includes disempowering domain-general bodies like parliaments and domain-specific ones like courts or regulatory agencies. In Hungary, Russia, Türkiye, and to an extent India, the pattern is clear: weaken or control the judiciary, and simultaneously marginalise or discredit non-governmental organisations.

NGOs are often labelled as "foreign agents," as we've seen in all those examples. It's a way of suppressing a vital part of

polycentric democracy — shifting toward a monocentric, top-down form of governance.

As for the connection with business — I think you're right to highlight it, and it's an important observation. I don't have a fully worked-out theory, but I would say this: when a government consolidates monocentric power, it gains the ability to favour certain corporations. In return, those corporations provide support — political, financial, or even ideological. So yes, autocratic or semi-autocratic governments can enter into mutually beneficial arrangements with selected business interests.

But it's never all business. It's always a subset — those firms that are seen as politically useful or aligned with the regime's priorities. So it's not a general pro-business stance. It's cronyism. And it's dangerous.

Ros Croucher: I'm the former president of the Australian Human Rights Commission, and in that role I advocated for the introduction of a statutory human rights framework in Australia. Our current system of rights protection relies heavily on tradition — and while those traditions are important, there remains a clear gap in formal legislative safeguards.[31]

Philip, I was heartened to hear you speak out against the risks of an elected judiciary. One challenge we've faced in advocating for statutory rights is a rather mischievous critique: the claim that it would put "too much power in the hands of unelected judges."

This criticism often distracts from the real conversation. After all, the statute would still be designed and passed by elected representatives. So I'd welcome your reflections on that trope — that unelected judges are somehow a democratic threat.

PP: That's music to my ears, Ros — and I appreciate your advocacy on this front. This idea that unelected judges are inherently undemocratic stems from a narrow view of democracy — one that sees electoral competition as the sole source of democratic legitimacy and popular control. If we define democracy purely by reference to elections, then yes, it seems troubling that judges — key decision-makers — aren't chosen by popular vote.

But that's a serious misunderstanding of how democratic control operates in a polycentric system. As we've discussed, judges aren't supposed to be delegates of public opinion. They're appointed to perform a domain-specific function: to interpret and apply the law in line with constitutional principles and established conventions. And insofar as they do that — insofar as they act in good faith, with expertise and impartiality — they *are* acting under the people's control. They're doing what we collectively have authorised them to do.

Introducing elections into this process adds a second, and often competing, motive: the incentive to please voters in order to be re-elected. That can lead to distortion — judges tailoring decisions to popular sentiment or political ideology, rather than to legal principle. We've seen this in the U.S., where elected judges sometimes issue harsher criminal sentences as election dates approach. That's not accountability. That's vulnerability to political pressure.

You asked about the controls on judges — and they do exist. In Australia,

31 Ros Croucher 'Making rights a reality — the need for a Human Rights Act for Australia'. The 1313th OGM and Open Lecture of the RSNSW, 7 June 2023. https://www.youtube.com/watch?v=dgB22sneAfw

judges aren't appointed for life as in the U.S., which already offers a measure of temporal limitation. But beyond that, I believe reputation plays a crucial role. Judges care deeply — as they should — about how they're viewed by their peers, by the broader legal community, and by the public. There's a culture of professionalism and integrity, and that's a powerful constraint.

So, to your broader point about statutory rights: I wouldn't be worried about judges interpreting those rights, provided that appointments are merit-based, transparent, and insulated from political manipulation. In the U.S., interpretation of rights — take the Second Amendment,[32] for example — has often been driven by contemporary political agendas, which undermines both judicial independence and public confidence. Australia is in a far better position to design a framework that avoids that fate.

That said, if we are to introduce statutory rights, we should also think carefully about how to protect judicial impartiality. Otherwise, we risk building a framework that, over time, erodes the very protections we set out to establish.

John G., UNSW: My question parallels the previous one, and in many ways you've already answered it. But I'd still like to ask: to what extent can it really be said that citizens control judges in systems where the judiciary is elected? We know — especially from the United States — that elected judges often have one eye on their re-election, particularly in criminal sentencing. That introduces distortions. So, if election distorts judgment, how can we meaningfully claim that the public "controls" judges in such systems?

PP: Thank you, John. That goes right to the heart of the issue. It's a mistake, I think, to equate democratic control purely with electoral control. As I've argued, we should understand democracy in a *polycentric* way — where power is exercised through different institutions, each subject to distinct but meaningful forms of constraint.

In the case of the judiciary, citizens exercise control not through the ballot box, but through the culture, expectations, and normative constraints that define the judicial role. These are part of what we might call the *informal constitution* of the country — a constitution that includes the conventions that shape the appointment process, the norms judges internalise, and the standards to which they hold one another.

This is what I've elsewhere called an *economy of esteem*. Judges care deeply about their standing — among peers, within the legal community, and in the eyes of the public. That reputational economy exerts real pressure. It helps ensure that judges behave in accordance with the values and expectations that we, as a public, have broadly endorsed.

And crucially, judges in systems like Australia are not politicised in the way U.S. federal judges often are. They're appointed, not elected, and they're not granted life tenure. That, too, creates space for accountability without politicisation.

You're absolutely right that elected judges often distort their rulings under political pressure — especially in high-salience areas like criminal justice. That's a serious danger. In those cases, the motive to seek public favour can overpower the imperative

32 "The Right to Keep and Bear Arms." [Ed.]

to follow the law impartially. In my view, that's not a feature of democracy — it's a pathology of a poorly designed system.

What we need is a clearer articulation — and perhaps greater public awareness — of how appointed judges remain accountable. If we can *make visible* the checks and expectations that shape judicial behaviour, then we reaffirm public control in a deeper, more robust way than the crude mechanism of the vote ever could.

That's why I've argued that in a polycentric democracy, we should focus not just on expanding electoral channels of control, but on nurturing the *disciplinary* and *contestatory* channels — the invisible yet powerful ways in which citizens shape institutional behaviour. The judiciary is a perfect case in point.

CS: Phillip, I think we had better finish there. Thank you so much. Since I first heard you speak, I've been in awe of your capacity for clarity and argument and this great commitment to reason. I think we've seen that again today. I also think that's been the basis of our thinking slightly more positively about how we can manage what has looked to us like a fairly difficult time for democracy. I think we have a real concern about what's going to happen to these structures. and so I'm very grateful to you for that, and look forward to the rest of the day.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 79–108. ISSN 0035-9173/25/01079-30

2024 Royal Society of New South Wales and Learned Academies Forum: "Threats to Democracy"

Panel Session 1: Global challenges to democracy[1]

Mr Peter Varghese AO, Chancellor, Univ of Qld
chancellor@uq.edu.au

Emeritus Prof Hugh White AO FASSA, Sch. of International, Political and Strategic Studies, ANU
hugh.white@anu.edu.au

Prof. Deborah Cobb-Clark AO FASSA, School of Economics, Univ. of Sydney
deborah.cobb-clark@sydney.edu.au

Prof. Quentin Grafton FASSA, Crawford School of Public Policy, ANU
quentin.grafton@anu.edu.au

Peter Varghese

Good morning to all and welcome to our first panel session of the Forum. my name is Peter Varghese. I'm the Chancellor of the University of Queensland. This morning we've had two very thought-provoking presentations: a contemporary analysis from the Governor and then a very erudite scene-setter from Professor Philip Pettit on the what, the why, and the how of democracy. You could well ask, between the two of them what more is there to discuss about democracy?

In this session we want to take the broad framing that our two speakers this morning provided and apply it to the global challenges to democracy. We have a very eminent panel to help us do that. Their biographies are in the program notes. Let me briefly introduce them. First is Professor Hugh White, who's the Emeritus Professor of Strategic Studies at the Australian National University, a former senior Defence Department official, prime ministerial advisor, and an old friend and colleague. Next is Professor Deborah Cobb-Clark, who is Professor of Economics at the University of Sydney. Finally, Professor Quentin Grafton who's Professor of Economics and an ARC Laureate Fellow at ANU.

The discussion in this panel will focus on three broad topics: Hugh will address the geopolitical big picture, including, I hope, whether we face a contest between an alliance of democracies and an axis of autocracy, about which we're hearing more and more; Deborah will explore democracy and inequality, including inequality and intergenerational fairness; and Quentin will focus on democracy, the environment, and sustainability. All of them, I hope, will not just admire the problem but also canvas some steps that we can take to strengthen democracy.

In locating democracy in a global context, I think it is humbling to note, as the Governor did and as our program notes do, that less than 8% of the world's population live in

1 This is an edited transcript of the session, which can be viewed at https://www.youtube.com/watch?v=FSSsCYfZdqQ

what could be described as full democracies. And I think it's also the case that, while most people in this room think of democracy in terms of secular liberal democratic tradition, which has essentially shaped the Australian experience and the anglosphere experience as well, globally, democracy comes in many guises, including illiberal democracies and elected autocracies. As we've seen in many countries there's no guarantee that, once established, liberal democracies stay that way.

The format of our discussion will be that each of our panel members will speak sequentially for no more than ten minutes, and then we will open it up for questions, and wrap up just short of one hour. so I'm going to ask Hugh to kick off our discussion.

Global challenges to democracy
Hugh White

Donald Trump's remarkable victory in the US election last week compels attention in any conversation about the threats to democracy around the world. But today it might be helpful to take a wider view, and explore how the current crisis in global order affects the future of democracy globally, and here at home. It is widely accepted now that there is a crisis in global order, reflected in acute challenges to what is called the "Rules-Based Order," by which people mean the US-led order that evolved in the West after 1945 and appeared, for a time, set to take over the world after the Cold War ended with the collapse of the Soviet Union in 1991. This crisis of global order is seen as a crisis for democracy too, because it is generally seen as arising from a contest between the democratic ideals that underpin the old US-led order and the authoritarian ideology espoused by the powers that challenge it.

This perception is understandable, and it is far from entirely wrong. Since democracies first emerged — even as far back as Fifth Century Athens — there has always been a sense that democratic political institutions are inherently fragile and hence vulnerable to subversion or destruction by authoritarian forces. There was thus always a concern about whether democracy can flourish anywhere if it does not flourish everywhere. Hence the perceived need for democracies to dominate the international system (in Woodrow Wilson's famous phrase), "to make the world safe for democracy."

This goal seemed at last to have been achieved at the end of the Cold War when we looked forward to a new global order framed by liberal democracy, accepted by all the world's major powers, led by America and upheld by America's seemingly unchallengeable power. And it wasn't all an illusion: democracy did indeed make great strides for a while — in Indonesia, South Korea, Taiwan, and of course throughout Eastern Europe. The future of democracy seemed safer and more certain than it had ever been before. "The End of History" indeed.

Of course these hopes have now been dashed because the "Rules-Based" post-Cold War global order is in deep trouble. It is clear that many powerful countries do not after all embrace democratic values, nor do they accept their subordination to global US leadership. Two of the world's strongest states — China and Russia — now overtly challenge the post-Cold War status quo, aiming to replace it with a new and very different global order. Many other rising

powers — India, Indonesia, South Africa among them — seem tacitly to support this challenge, or at least appear reluctant to oppose it.

As a result the old post-Cold War order faces a major challenge, creating the biggest general crisis of global order since the dawn of the Cold War in the late 1940s. History, in the form of old-fashioned great power rivalry, is back. We in the West fear that if this challenge is not defeated the Rules-Based Order will be replaced by a global authoritarian order. Such an order, we believe, would promote and impose authoritarian values around the world, including in our own countries. Not so long ago we expected that our global democratic order would promote and impose democracy around the world, and now we fear the tables will be turned on us. That fear drives the determination among governments and policy elites in the West to defeat the authoritarian challenge and preserve the Rules-Based Order at almost any cost — including, if necessary, by going to war. Comparisons with the 1930s abound, and any suggestion that we might take a different approach is dismissed as Chamberlainesque appeasement.

Is this right? It is an important question. Let's start by acknowledging that the challenge to the post-Cold War order really is very serious, and it is important to understand why. It is because it springs from profound shifts in the global distribution of wealth and power, which constitutes the deepest foundation of global order. In the 1990s the post-Cold War vision of a US-led global order seemed credible because America appeared set to enjoy for decades to come an overwhelming unchallengeable superiority in ever dimension of national power — economic, technological, military and ideological. But that is not the way things have turned out. The rise of China and India, especially, constitutes the biggest and fastest shift in the global distribution of wealth in history. Technological and military power have shifted too. America remains an immensely powerful country, but today it faces in China a "peer competitor" which is economically more powerful relative to America itself than the Soviet Union ever was in the Cold War.

There is another factor, too. In the 1990s it seemed that people around the world were happy to accept US global leadership, not just because they were embracing the ideals of liberal democracy, but also because they believed that their own countries and societies could flourish and fulfil their destinies under America's benevolent and protective wing. In particular, it seemed that strong states around the world would, like the former great powers of Western Europe, be content to forgo their aspirations to great power status and accept US leadership. That meant they had no reason to bear the costs and risks of challenging the US-led order. Again, this is not how things have turned out. China and Russia — and India too — are determined to assert their place as great powers, not subordinate to America but equal to it. Their resolve is strong and they are willing to accept high costs and risks to achieve their goals.

Together, these factors mean that the costs and risk to America of upholding the Rules-Based Order against determined and powerful challengers is very high. It has become increasingly clear that, in order to do so, Washington must convincingly threaten to go to war against the challengers to preserve its post-Cold War global leadership, because only such a threat will deter their

challenge. Ukraine has shown how hard that is to achieve. Against nuclear-armed rivals, that means being able to convince them that America is willing to fight a nuclear war, and there is scant evidence so far that it can or will do this.

Ultimately that is because the stakes for America (and its allies like Australia) in perpetuating the post-Cold War order are not high enough to justify the appalling costs of nuclear war. And that in turn is because the new order that would take its place would not be as bad as most in the West now assume. There is very little danger that the unipolar US-led order would be replaced by a unipolar authoritarian-led order, for the simple reason that there are too many powerful states eager to assert their own place as great powers. We are much more likely to see the emergence of a multipolar global order in which a number of great powers would successfully assert equal places at the "top table." As things stand, the likely candidates for this status include America, Europe, Russia, India and China. None of these powers would be strong enough to impose their ideologies on one another or on the world at large, so the world would remain ideologically diverse. That means we in the West have no compelling reason to fear that the passing of the post-Cold War unipolar order would make the world "unsafe for democracy," which in turn means that we would not be justified on going to war to preserve it — especially as we have every reason to believe that a major war to defend the Rules-Based Order would end up destroying it anyway. Democracy did after all survive and flourish in the ideologically-diverse multipolar global orders of the 19th and 20th Centuries, and this conception of global order is precisely what was envisaged at the foundation of the UN in 1945.

Of course a new multipolar global order would be more difficult and more dangerous for countries like Australia to navigate than the near-to-ideal situation that seemed to be offered by the post-Cold War order. It would create immense new challenges for us, because the emergence of a new multipolar global order would have profound implications for the regional order in Asia. The rise of China and India mean that America will not remain our region's leading power, and it is most likely that it will cease to play any significant strategic role in Asia at all. Instead, China and India will dominate Asia strategically, probably dividing the region into respective spheres of influence. For the first time since European settlement, Australia will have to make it in an Asia that is not dominated and made safe for us by preponderant British or American power. This will be among the biggest, if not the biggest, transformation in our international circumstances since European settlement, and navigating it successfully will be an immense challenge — perhaps the most demanding foreign policy challenge in our history so far.

In the process we should expect our society to change, as it has changed before in response to new circumstances — such as when we welcomed non-English-speaking migrants in the 1950s, and later when we abandoned White Australia. But we have no reason to fear for the future of our democracy in navigating a new global and regional order. On the contrary, the bigger threat to our democracy would arise from the mistaken conviction that we should be willing to go to war to preserve US global leadership and perpetuate US strategic primacy

in Asia — which is the implicit policy that underlies all the talk of "deterrence" from both sides of politics today.

As we reflect on the health of our democracy, it is important to note how utterly inadequate has been the public and political debate about the present crisis in global order and how we should respond to it. For democracy to flourish and even survive it has to work, and to work it has to deliver both good leaders and good policies. The fact that both sides of politics, and most of the commentariat, believe that we need go no further in our analysis of the biggest shift in our international circumstances than to express our determination to support whatever Washington decides to do suggests that on this vital issue, at least, democracy in Australia today is not working. That should give us pause.

Inequality, intergenerational fairness, and the social contract

Deborah Cobb-Clark

Introduction

Moral philosophers and social scientists have debated the implications of inequality for the way societies govern themselves for centuries. The concern is that inequality — particularly when it is extreme or seen as unfair — threatens democracy by undermining support for the social contract.

In this paper I will begin by discussing the conceptual links between economic inequality and the support for democracy, focusing on four key issues: i) economic opportunity; ii) notions of fairness; iii) support for redistribution; and iv) the generational divide in social cohesion. I then focus on a particularly salient issue in the current Australian debate — housing security — and consider the potential for better policy to reduce inequality and enhance social cohesion.

Economic opportunity

There is a direct link between inequality and economic opportunity. Rising inequality pulls the rungs of the socioeconomic ladder further apart, reducing social mobility by making it harder for poor children to avoid becoming poor adults. A lack of social and economic mobility is, in turn, costly for society. Constraints on mobility at the bottom of the distribution mean that many people's talents are squandered, undermining productivity and economic growth (OECD, 2017). At the same time, limited mobility at the top of the distribution "may translate into persistent rents for a few at the expense of many, due to unequal access to educational, economic or financial opportunities" also resulting in inefficiencies (OECD, 2018, p.13).

Perceptions also matter. Some studies suggest that people's beliefs about inequality and where they fit in the distribution are more important for individual wellbeing than are objective measures of how resources are distributed (Buttrick et al., 2017). The prospects for upward mobility have been linked to greater life satisfaction and improved wellbeing, while pessimism about social mobility can undermine social cohesion and the democratic process (OECD, 2018). Research has found, for example, that economic inequality, measured by the Gini coefficient, drives down people's support for democracy (see Huang, 2023 for a review). Currently, 68 per cent of people worldwide believe that economic inequality is the big-

gest threat to democracy at home (Alliance of Democracies, 2024).

It's little wonder that US President Barack Obama has called restoring economic opportunity "the defining challenge of our time" (Obama, 2013).

What's fair?

Inequality is also linked to the social contract and democratic support through societal perceptions of what is fair inequality and what is not. Martinez et al. (2017, p. 380) describe the distinction in the following way:

> Fair inequality emerges as a result of meritocratic societies rewarding people who are skilled and work harder while unfair inequality is driven by differences in the lottery of birth where the choices available to people are already constrained by the circumstances that they were born into. In the economic literature, the fair kind is called inequality of outcomes, while the unfair type is known as inequality of opportunities.

Promoting equality of opportunity can be thought of as reducing unfair inequality — that is, "seeking to offset differences in outcomes attributable to luck, but not those differences in outcomes for which individuals are responsible" (Roemer and Trannoy, 2016, p. 1289).

Greater economic inequality tends to foster democratic beliefs in autocracies and erode democratic support in democratic regimes (Reutzel, 2024). Much of this overall association appears to be the result of what is perceived to be unfair inequality, i.e. contexts in which economic opportunity is not shared equally, and inequality is driven by poor governance (Saxton, 2021) or other factors beyond people's control (Reutzel 2024). Importantly, there is also evidence that unfair inequality deters economic growth, while fair equality enhances growth (e.g. Marrero and Rodríguez, 2013, 2023; Bradbury and Triest, 2016; Aiyar and Ebeke, 2020), raising the possibility that the fairness — or not — of inequality is linked to democratic support through overall living standards.

Support for redistribution

Social and political theorists often argue that that the poor will be relatively more supportive of redistribution policies (e.g. Romer, 1975; Meltzer and Richard, 1981; Benabou and Ok, 2001; Piketty, 1995). Empirical evidence, however, indicates that income is a surprisingly poor predictor of beliefs about redistribution. Those at the bottom of the distribution can be reluctant to support redistribution despite benefiting more from such policies (e.g. Fong, 2001; Hoy and Mager, 2021; Cavaillé, 2023). This apparent incongruence is sometimes hypothesised to be the result of the poor being overly optimistic about their own — or their children's — prospects for upward economic mobility (see Benabou and Ok, 2001). Hoy and Mager (2021) also note that this is consistent with the poor using their own situations as a benchmark for what is acceptable for others. Either way, support for redistribution is difficult to understand using a simple socio-economic status lens.

The evidence is clear, in contrast, that people's support for redistribution is closely related to their beliefs about the relative importance of luck vs. effort in getting ahead — the same yardstick people use when deciding whether inequality is fair. Those who believe that getting ahead in life is

largely influenced by hard work and merit are less supportive of redistribution, while those who believe opportunities are unequal are more supportive (Alesina and Angeletos, 2005; Alesina and La Ferrara, 2005; Alesina and Giuliana, 2011; Almås et al., 2020). Researchers have demonstrated that this holds not only in observational data across a number of countries, but also in controlled laboratory experiments designed to uncover causal mechanisms (see Cappelen et al., 2022; Mengel and Weidenholzer, 2022; and Lobeck, 2023 for comprehensive reviews).

This makes it important to understand how societal views of the importance of luck vs. effort in getting ahead are formed. Researchers studying the issue have found, for example, that people often exhibit attribution bias — attributing their own successes to effort and their failures to luck. Moreover, these beliefs about the relative importance of luck and effort may be "motivated" in the sense that people may distort their beliefs about the true relationship between effort and success so that they can achieve a specific goal or justify a certain behaviour. Studying this issue in an experimental setting, Lobeck (2023) concludes that people's luck-effort beliefs depend on the past or current events that tell them about the true relationship between the two, but also the reward structure they expect to face in the future.

The consequence is that, in many countries, rising inequality does not result in egalitarian policy responses (see Cavaillé, 2023 for a review). One explanation for why this might be the case is provided by Alesina and Angelotos (2005, p. 960):

> Different beliefs about the fairness of social competition and what determines income inequality influence the redistributive policy chosen in a society. But the composition of income in equilibrium depends on tax policies. … If a society believes that individual effort determines income, and that all have a right to enjoy the fruits of their effort, it will choose low redistribution and low taxes. In equilibrium, effort will be high and the role of luck will be limited, in which case market outcomes will be relatively fair and social beliefs will be self-fulfilled. If, instead, a society believes that luck, birth, connections, and/or corruption determine wealth, it will levy high taxes, thus distorting allocations and making these beliefs self-sustained as well. These insights may help explain the cross-country variation in perceptions about income inequality and choices of redistributive policies.

Australia's generational divide in social cohesion

Globally, the nature of inequality has changed over the past four decades. In 1980, more than half of worldwide inequality (57 per cent) was attributable to disparities between countries; over the next decade this fell to less than a third (32 per cent) (Chancel and Piketty, 2021). Inequality is increasingly being felt within, rather than between societies. What was once a disparity between "us" and "them" is increasingly a disparity between "us" and "us."

It is also the case, that no single measure can capture all aspects of societal inequality. Often the debate centres on economic inequality — as measured by income or wealth inequality — however, disparities in health, life expectancy, social connections, political influence, and future aspirations are equally important in understanding people's well-being. Inequality in one domain can bleed

into other domains, of course. Importantly, "economic inequality translates into political inequality" (Stiglitz, 2014, p. 11) which may directly shape the democratic process.

In Australia, the picture on economic inequality is mixed with estimates of the level of and trend in both income and wealth inequality depending on the data source, measure, and time periods considered. Income inequality today is higher than it was in the 1980s, though there appears to have been little change since the mid-2000s (see ABS, 2019; Whiteford, 2015; Wilkins, 2014, 2015). In the lead-up to the pandemic, income inequality was stable; inequality declined at the start of the COVID-19 pandemic, then subsequently increased as the economy recovered. "It is inconclusive whether post-pandemic income inequality is higher or lower than pre-pandemic levels" (Productivity Commission 2024, p.11).

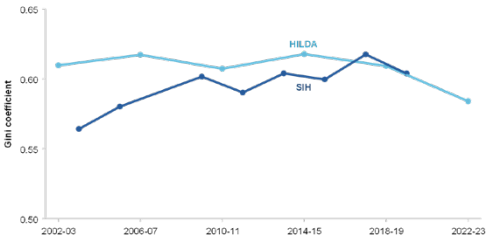


Figure 1: Wealth inequality was stable but declined recently. Gini coefficients for equivalised household wealth, 2002–03 to 2022–23. Source: Productivity Commission (2024)

The Productivity Commission (2024) has also recently concluded that, since the turn of the 21st Century, Australian wealth inequality has been relatively stable, likely declining in the aftermath of the COVID pandemic (see Figure 1). Property and superannuation are the two most important forms of wealth held by Australian households (ABS 2019), but the Productivity Commission estimates that inequality in both superannuation and housing wealth has declined as well (see Figures 2 and 3). On balance, there is little evidence of a major shift in economic inequality in Australia.

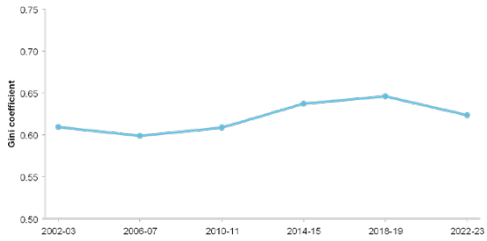


Figure 2: Housing wealth has become more equally distributed in recent years. Gini coefficients for equivalised owner-occupied housing wealth, 2002–03 to 2022–23. Source: Productivity Commission (2024)

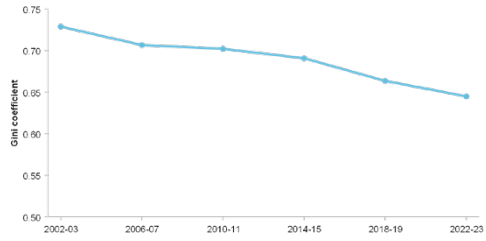


Figure 3: Superannuation inequality has been declining. Gini coefficients for equivalised superannuation wealth, 2002–03 to 2022–23. Source: Productivity Commission (2024)

Despite this, there is a growing perception that intergenerational economic opportunity is lacking. In 2022, 72 per cent of Australians reported being pessimistic about the prospects of future generations, saying that they believe that children born today will be worse off than their parents (Clancy et al., 2022). This represented an extraordinary 14 percentage point increase in the degree of pessimism — the largest amongst all 15 countries surveyed — over the previous year. We can only speculate

about the possible catalyst for the sudden lack of confidence in intergenerational progress — perhaps it is the result of COVID-19 lockdowns or general economic uncertainty — but whatever the cause, it does not seem to be the result of a dramatic shift in economic inequality.

There also is a growing generational divide in social cohesion. Younger cohorts are now less likely than older cohorts to agree that "Australia is a land of economic opportunity where in the long run, hard work brings a better life" — an age disparity that was not evidence in 2013 (O'Donnell, 2023). The sense of belonging in Australia is falling, particularly among young people and those who do not feel financially secure (O'Donnell, 2023).

It is hard to escape the conclusion that many people — specifically, many young people — are increasingly feeling left behind despite the stable trend in income and wealth inequality.

If the apparent unravelling of Australia's social fabric is not the result of a major shift in economic inequality, why is it happening? No doubt, there are many complex, nuanced answers to this question. Here I shine a light on one issue — housing — that is at the heart of the current Australian debate around inequality and intergenerational fairness.

International law has recognised adequate housing as a basic human right for nearly three generations.[2] Australia signed and ratified the various treaties that recognise the right to adequate living standards more than half a century ago. Yet today, 40 per cent of young Australians feel that they might not have a comfortable place to live in the next 12 months (Walsh et al., 2023). Former President of the Australian Human Rights Commission, Rosalind Croucher, has called on governments at all levels to urgently respond to housing vulnerability not only as a social issue, but also as a social justice issue (Croucher, 2022).[3]

Housing is important for many reasons, not the least of which is that housing is a core social determinant of health. Recent research in the UK, for example, indicates that there is a link between housing tenure and biological ageing.[4] Specifically, Clair et al. (2024) conclude that living in a privately rented home is associated with faster biological ageing relative to owning one's home outright. Crucially, despite the enormous wealth disparities and potential stigma associated with social housing, biological ageing for those living in social housing was found to be the same as for those who owned their homes outright — an outcome which the authors posit may result from the additional security provided to those in social housing.

2 Adequate housing was recognised as a component of the right to an adequate standard of living in both the 1948 Universal Declaration of Human Rights and the 1966 International Covenant on Economic, Social and Cultural Rights (UN, 2009). Australia signed the ICESCR in 1973 and ratified it without reservations in 1975 (Croucher, 2022).

3 The Australian Bureau of Statistics has adopted a broad definition of homelessness that corresponds to being without a home, rather than a narrow definition consistent with being without a roof over one's head. In essence, "homelessness" is therefore a lack of one or more of the elements that represent "home" including housing stability (ABS, 2012).

4 Biological ageing — measured through DNA methylation — has been proposed as a way of understanding how environmental conditions, such as socioeconomic status and stress, can have lasting biological impacts that influence outcomes, including health (Neu, 2022).

Addressing the elephant in the room: is policy the problem?

Inequality is shaped not only by economic conditions, including the pace of economic growth, but also by social and economic policy (see Rice et al., 2021). This leaves us with some uncomfortable questions. Does the decline in Australia's social cohesion stem not from a belief that inequality itself is increasing, but rather the growing perception that the public policy is exacerbating inequality? Are the policies adopted by Australian governments fuelling a widening generational divide? What is fair in an intergenerational sense? Openly debating these questions — rather than treating them like the elephant in the room — is crucial because the answers go to people's notions of fairness, support for redistribution, and, ultimately, the willingness to support and participate in the democratic process.

Housing accessibility, stability, and quality, for example, all contribute to the degree of security that people have in their housing. Each is driven by numerous policy decisions at all levels of government and there is ample room for Australia to do better. While the national policy debate has largely focused on strategies to stem the fall in homeownership rates, for many people the more immediate issue is likely to be how to navigate a rental market that is increasingly precarious. One clear policy option would be to increase the availability of social housing. Over the past 20 years, the social housing stock has remained stagnant despite the Australian population growing by a third; the consequence is that between 1991 and 2021 the percentage of social housing in the national housing stock almost halved (Croucher, 2022).

Numerous other policies to provide more stability to renters in the private market should — at the very least — be on the table for discussion. These include long-term leases, rent control, limitations on evictions, rights around pet ownership, as well as "build-to-rent" schemes and other policies that incentivise the development of housing that is both stable and affordable. Not all these ideas will pass the pub test. Nor will all attract the political leadership and bipartisanship necessary to turn good ideas into good public policy. But, surely, they must at least be debated.

More generally, there is a need for serious consideration of reforms to the nation's tax and transfer system. Tax breaks for superannuation and housing investments are at the heart of a gap in wealth that leaves Australians at the top of the distribution owning 90 times the wealth of those at the bottom (Anglicare Australia, 2024). Former Treasury Secretary, Ken Henry, believes that Australia's present tax system "amounts to a conspiracy against future generations" (Henry 2024). Resolving this makes for an excellent starting point.

Looking forward

Nobel Laureate Joseph Stiglitz (2014, p. 1) reminds us:

> Inequality is not inevitable: it is a result of policies and politics. There are policies that would simultaneously reduce inequality, heal some of the divides in our society, and strengthen our economies.

This leaves us with a glass that is at least half full. The good news is that there is a pathway forward. If policy has brought us to where we are today, then surely there are better polices that would reduce inequality, bridge the generational divide,

and mend the social fabric. Completely filling the glass, however, requires that our democratic institutions are robust, inclusive, and civil enough to serve up the political leadership necessary to identify and enact those policies. This, of course, remains to be seen; it is not a matter to be taken for granted. Ben Rhodes — Deputy National Security Adviser under President Barack Obama — writing in the *New York Times* after the 2024 US election puts it this way (Rhodes Nov. 8, 2024):

> Democrats understandably have a hard time fathoming why Americans would put our democracy at risk, but we miss the reality that our democracy is part of what angers them. Many voters have come to associate democracy with globalization, corruption, financial capitalism, migration, forever wars and elites (like me) who talk about it as an end in itself rather than a means to redressing inequality, reining in capitalist systems that *are* rigged, responding to global conflict and fostering a sense of shared national identity.

In the end, the greatest threat to democracy is the possibility that our democratic institutions are failing — or are perceived to be failing — a large share of society. Can democracy really survive if it has left people pessimistic about their children's futures? Or if it has left people feeling that hard work is not the pathway to getting ahead? Or if increasing numbers of people feel they are being excluded and left behind?

Tackling inequality — broadly defined and within as well as across generations — is crucial to righting the ship and strengthening the faith in our democratic institutions.

References

Aiyar S and Ebeke C (2020) Inequality of opportunity, inequality of income and economic growth. *World Development* 136: 105115.

Alesina A and Angeletos G-M (2005) Fairness and redistribution. *American Economic Review* 95(4): 960–980.

Alesina A and Giuliano P (2011) Preferences for Redistribution. In: *Handbook of Social Economics*. Elsevier, pp. 93–131. Available at: https://linkinghub.elsevier.com/retrieve/pii/B9780444531872000048 (accessed 1 June 2025).

Alesina A and La Ferrara E (2005) Preferences for redistribution in the land of opportunities. *Journal of Public Economics* 89(5–6): 897–931.

Almås I, Cappelen AW and Tungodden B (2020) Cutthroat capitalism versus cuddly socialism: are Americans more meritocratic and efficiency-seeking than Scandinavians? *Journal of Political Economy* 128(5): 1753–1788.

Azize M (2024) *Widening the gap: worsening wealth inequality in Australia*. Australia Fair Series 5. Canberra: Anglicare Australia.

Benabou R and Ok EA (2001) Social mobility and the demand for redistribution: the Poum hypothesis. *The Quarterly Journal of Economics* 116(2): 447–487.

Bradbury K and Triest RK (2016) Inequality of opportunity and aggregate economic performance. *RSF: The Russell Sage Foundation Journal of the Social Sciences* 2(2): 178–201.

Buttrick NR, Heintzelman SJ and Oishi S (2017) Inequality and well-being. *Current Opinion in Psychology* 18: 15–20.

Cappelen AW, Mollerstrom J, Reme B-A, et al. (2022) A meritocratic origin of egalitarian behaviour. *The Economic Journal* 132(646): 2101–2117.

Cavaillé C (2023) *Fair Enough? Support for Redistribution in the Age of Inequality*. 1st ed. Cambridge University Press. Available at: https://www.cambridge.org/core/product/identifier/9781009366038/type/book (accessed 1 June 2025).

Chancel L and Piketty T (2021) Global income inequality, 1820–2020: the persistence and mutation of extreme inequality. *Journal*

of the European Economic Association 19(6): 3025–3062.
Clair A, Baker E and Kumari M (2024) Are housing circumstances associated with faster epigenetic ageing? *Journal of Epidemiology and Community Health* 78(1): 40–46.
Clancy L, Gray R and Vu B (2022) Large shares in many countries are pessimistic about the next generation's financial future. In: *Pew Research Center*. Available at: https://www.pewresearch.org/short-reads/2022/08/11/large-shares-in-many-countries-are-pessimistic-about-the-next-generations-financial-future/ (accessed 1 June 2025).
Croucher R (2022) Housing and human rights — rights where it matters. Hobart. Available at: https://humanrights.gov.au/about/news/speeches/housing-and-human-rights-rights-where-it-matters (accessed 1 June 2025).
(CYPEP) MC for YP and EP, Walsh L, Gallo Cordoba B, et al. (2023) *The 2023 Australian youth barometer*. Monash University. Available at: https://bridges.monash.edu/articles/report/The_2023_Australian_Youth_Barometer/24087186 (accessed 1 June 2025).
Fong C (2001) Social preferences, self-interest, and the demand for redistribution. *Journal of Public Economics* 82(2): 225–246.
Henry K (2024) Inequality in Australia. *Journal & Proceedings of the Royal Society of New South Wales* 157(2): 246–265.
Hoy C and Mager F (2021) Why are relatively poor people not more supportive of redistribution? Evidence from a randomized survey experiment across ten countries. *American Economic Journal: Economic Policy* 13(4): 299–328.
Huang K-P (2023) Support for democracy in the age of rising inequality and population aging. *Social Indicators Research* 166(1): 27–51.
Lobeck M (2023) Motivating beliefs in a just world. 4369242, SSRN Scholarly Paper. Rochester, NY: Social Science Research Network. Available at: https://papers.ssrn.com/abstract=4369242 (accessed 1 June 2025).
Marrero GA and Rodríguez JG (2013) Inequality of opportunity and growth. *Journal of Development Economics* 104: 107–122.
Marrero GA and Rodríguez JG (2023) Unfair inequality and growth. *The Scandinavian Journal of Economics* 125(4): 1056–1092.
Martinez A, Rampino T, Western M, et al. (2017) Estimating the contribution of circumstances that reflect inequality of opportunities. *Economic Papers* 36(4): 380–400.
Meltzer AH and Richard SF (1981) A rational theory of the size of government. *Journal of Political Economy* 89(5): 914–927.
Mengel F and Weidenholzer E (2023) Preferences for redistribution. *Journal of Economic Surveys* 37(5): 1660–1677.
Neu W (2022) A role for epigenetics in economic analysis. MPRA Paper 114217. University Library of Munich, Germany. Epub ahead of print 16 August 2022.
O'Donnell J (2023) *Mapping social cohesion 2023*. November. Scanlon Foundation Research Institute. Available at: https://scanloninstitute.org.au/mapping-social-cohesion-2023.
Piketty T (1995) Social mobility and redistributive politics. *The Quarterly Journal of Economics* 110(3): 551–584.
Reutzel F (2024) The grass is always greener on the other side: (unfair) inequality and support for democracy. *European Journal of Political Economy* 85: 102600.
Rice JM, Temple JB and McDonald PF (2021) Intergenerational inequality and the intergenerational state. *Journal of Population Research* 38(4): 367–399.
Roemer JE and Trannoy A (2016) Equality of opportunity: theory and measurement. *Journal of Economic Literature* 54(4): 1288–1332.
Romer T (1975) Individual welfare, majority voting, and the properties of a linear income tax. *Journal of Public Economics* 4(2): 163–185.
Saxton GW (2021) Governance quality, fairness perceptions, and satisfaction with democracy in Latin America. *Latin American Politics and Society* 63(2): 122–145.
Stiglitz JE (2014) The price of inequality: how today's divided society endangers our future. In: *Sustainable Humanity; Sustainable Nature; Our Responsibility*. Vatican City: Pontificia Academia, pp. 1–21. Available at: https://www.pas.va/content/dam/casinapioiv/pas/

pdf-volumi/extra-series/es_41/es41-stiglitz.pdf.
Whiteford P (2015) Inequality and its socioeconomic impacts. *Australian Economic Review* 48(1): 83–92.
Wilkins R (2014) Evaluating the evidence on income inequality in Australia in the 2000s. *Economic Record* 90(288): 63–89.
Wilkins R (2015) Measuring income inequality in Australia. *Australian Economic Review* 48(1): 93–102.

Confronting the "Democracy Deficit" and long-term environmental threats

R. Quentin Grafton

Abstract

The world faces multiple long-term environmental threats that include: i) climate change; ii) biodiversity loss; and iii) water insecurities. Effective responses are hindered by the "democracy deficit;" deficiencies in democracy and the influence of powerful interests that undermine actions favoured by a majority of voters. Confronting the democracy deficit requires more active (deliberative *and* participatory) democracy to redistribute power and influence to citizens from privileged interests — the "push back" triangle of; i) the Climatocracy (climate change), ii) the Biodiversocracy (biodiversity loss) and iii) the Hydrocracy (water insecurity). More active democracy requires but is not limited to: i) high-quality public education that allows most people to engage with complex problems; ii) effective and widely-available civic education; iii) fact-checking of publicly available information; iv) a diverse and free press; v) participatory processes around decisions of key public interest; and vi) transparent mechanisms that hold decision-makers fully accountable for their actions.

Introduction

> The modern representative democracy was the best form of government that mid-18th-century technology could conceive of. The 21st century is a different place scientifically, technically and socially. — B. Schneier (2023)

The World Economic Forum's Global Risks Report 2024 named three key environmental issues as critical threats: extreme weather events, biodiversity loss, and ecosystem collapse (World Economic Forum, 2024). Given the risks of catastrophic climate change, a possible anthropogenic mass extinction event, and severe and irreversible climate tipping points (Tollefson, 2023), a precautionary approach to reducing the drivers (e.g. GHG emissions, habitat loss) is urgently required.

Effective responses to global environmental threats that have local impacts require trust in institutions and cooperation across communities, nationally and globally. Yet more than half of respondents in the EU and North America are *not* "satisfied with democracy." Importantly, dissatisfaction with democracy appears to be increasing at a faster rate among the young and in some of the larger democracies (Nigeria, Spain, the United Kingdom, and the USA) (Foa et al., 2020). The decline in satisfaction with democracy is contemporaneous with declines in democratic performance in almost half of monitored countries in relation to: i) Credible Elections; ii) Effective Parliament; iii) Economic Equality; and iv) Freedom of Expression and Freedom of the Press over the period 2018–2023 (IDEA, 2024).

In Australia, 70% of voters in the 2022 Australian Electoral Study were satisfied with democracy but this proportion has declined from its peak in 2007 (Cameron & McAllister, 2022). Nevertheless, an increasing proportion of voters are not satisfied with democracy characterised as "business as usual," as evidenced by a continuing decline in the proportion of those voting for the two major parties at federal elections (Cameron et al., 2022).

Over the past few decades there has been a decline in trust in governments, media, or trust in other people in several key democracies. For example, in the USA, trust in the national government declined from 73% in the 1950s to 24% in 2021. Across 62 high- and middle-income countries, the proportion of people expressing "Trust in Government" peaked in the early 2000s at one half, and had declined to about one-third by 2019 (United Nations Dept. of Economic and Social Affairs, 2021). By comparison, in Australia only 30% of respondents in the 2022 Australian Electoral Study believed that governments "... can be trusted to the do the right thing nearly all the time" (see Figure 1). Further, 54% of Australians in 2022 believed that "government" is run for "a few big interests," while just 12% believed that government is run for "all the people" (Cameron & McAllister, 2022).

Multiple reasons can be attributed to increasing dissatisfaction with democracy and declining levels of trust in government. In large measure their proximate cause is a perceived (or actual) failure to deliver to citizens what they want (e.g. secure employment, affordable housing, effective climate change mitigation, etc.) and this perspective appears to be held in a greater proportion by younger adults.

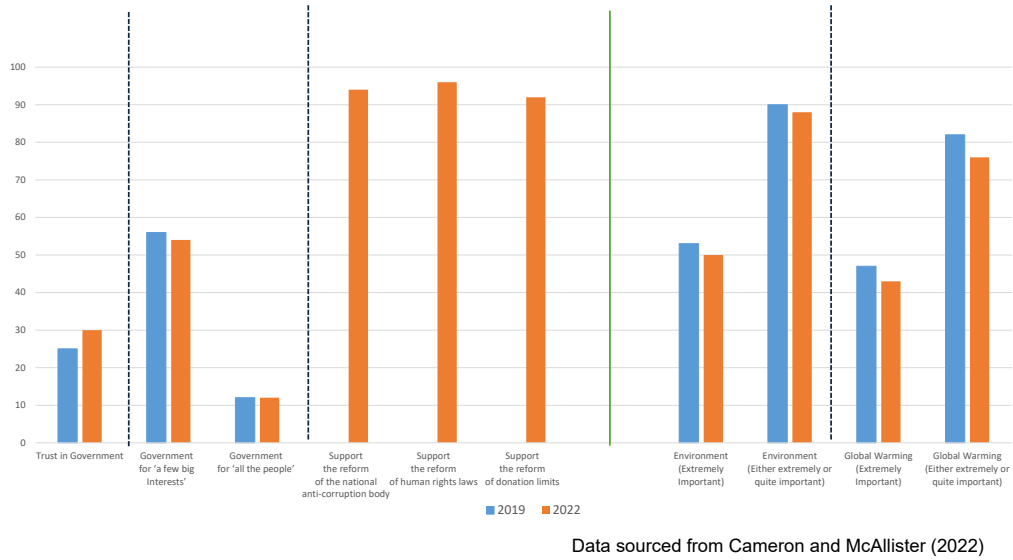


Figure 1: Australian Electoral Study 2022

Global environmental threats

Three key global environmental threats are: climate change, biodiversity loss, and water insecurity. Much of the burden of these threats falls primarily on those with the fewest resources to mitigate their own risks (Gupta et al., 2023). By contrast, those who are the most well-off, typically, have the greatest individual environmental impacts (Alestig et al., 2024).

In 2023, global anthropogenic carbon-dioxide emissions from fossil fuel use and industry (not including land use change) were 38 billion tons, a six-fold increase from 1950, and are currently rising at about 1% per year (IEA, 2024). This has resulted in an atmospheric concentration of carbon dioxide increasing by half from its pre-industrial level to over 420 ppm in 2024. CO_2 concentrations are currently higher than they have been for 800,000 years and this is the primary reason why 2023 was the hottest on recorded: about 1.5°C warmer than the 1850–1900 global average (Berkeley Earth, 2024). Compared to the global average, Australia's temperature has warmed by about 1.6°C (range: 1.4–1.6°C) relative to 1850–1900 (BOM and CSIRO, 2024).

On the current trajectory of greenhouse gas (GHG) emissions, the world is expected to warm by about 2°C by 2050 and by 3.1°C by 2100 (range: 1.9–3.8°C) noting that the chance of limiting warming to 1.5°C is now virtually zero (UNEP, 2024). Global Net Zero by 2050 from 2024 requires, at a minimum, a reduction in global energy-related CO_2 emissions of 34% by 2030 and 84% by 2050 (IEA, 2024). By comparison, global CO_2 emissions fell by 1.4% in 2009, with the global financial crisis (Peters et al., 2011) and fell by 5.8% in 2020 with the COVID-19 pandemic, and then rebounded by 6% in 2021 (IEA, 2021).

In 2023, CO_2 global emissions rose 1.3% relative to 2022 and in 2024 are estimated to have risen 0.8% relative to 2023 (Friedlingstein et al. 2024). Of critical importance is that net-zero policies [at 2050] will *not* keep warming within 1.5°C (Dyke et al., 2024). That is, even if Net Zero were achieved between 2030–2060 globally, because of lagged effects including deep-ocean warming, the *additional* global surface temperature in the coming centuries could be as much as 2.6°C, or more than 4°C warming relative to pre-industrial levels (King et al., 2024).

Biodiversity, if defined as average species abundance, has been in decline for centuries but appears to have accelerated since 1950. One estimate is that, directly or indirectly, humans have been responsible for the extinction of 7.5–13% of the 2 million known species since 1500 (Cowie et al., 2022). In terms of the measured wildlife populations (mammals, birds, amphibians, reptiles and fish), there has been a 69% decline in abundance since 1970 (WWF, 2022). Overlaying species extinction is the loss of ecosystem diversity from deforestation and increasing land use for agriculture and urban areas (Beyer & Manica, 2020). Of critical concern is that three important 2030 global conservation targets to reduce biodiversity loss will almost certainly not be achieved: i) halting deforestation (Chu et al., 2023); ii) ensuring "… at least 30 per cent of terrestrial and inland water areas, and of marine and coastal areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed" (Convention on Biological Diversity, 2022 Target 3); and iii) restoring 350 M ha. of degraded

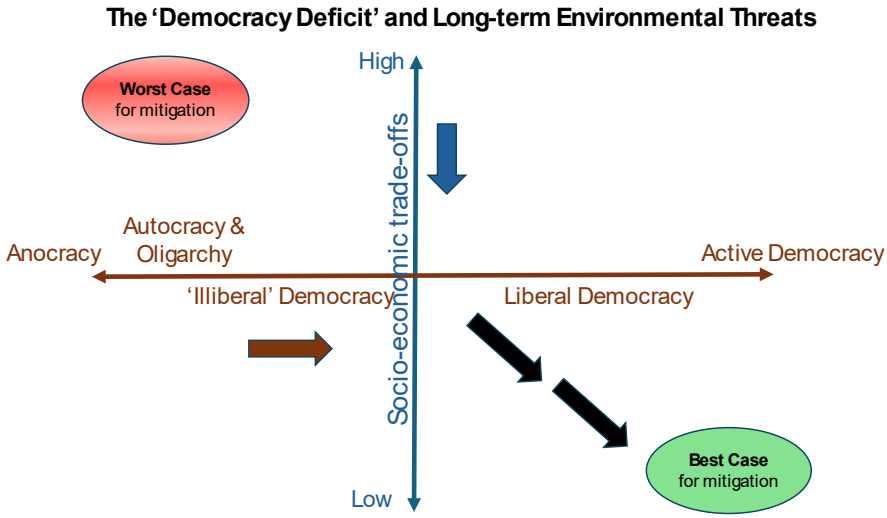


Figure 2: The "Democracy Deficit" and socio-economic trade-offs

and deforested land by 2030 (Palomo et al., 2024).

Water insecurity exists at multiple levels: individual, household, catchment, national and global (Grafton et al., 2024). Despite improvements in the proportion of people with access to safe water and sanitation, unsafe water sources still result in 1.7 million annual deaths worldwide and create disabilities that affect more than 80 million people annually (Grafton & Fanaian, 2023) while as many as 4.4 billion people lack safe drinking water (Greenwood et al., 2024). Importantly, none of the key Sustainable Development Targets for water will be achieved by 2030 (Grafton et al., 2023). Further, the global area in wetlands is in decline (Fluet-Choinard et al., 2023), groundwater is diminishing in many key food-producing regions, and there are projected to be substantial streamflow declines globally (Jasecho et al., 2024).

The "democracy deficit"

In democracies where governments face genuine competition for power there should be incentives to spend on non-exclusive public goods, such as environmental remediation. By contrast, in autocracies and oligarchies key decision-makers are more likely to be incentivised to provide benefits to the most powerful and influential (Deacon, 2009) and there are more constraints on citizens to express their views (Acheampong et al., 2022).

The effectiveness of democracies to respond to environmental threats depends on multiple factors (Figure 2): first, the strength of environmental non-governmental organisations (Binder & Neumayer, 2005), civil society (Lægreid & Povitkina, 2018), and green parties (Bernauer & Koubi, 2009); second, broad indicators of levels of education and income equality (Farzin & Bond, 2007); third, the visibility, ease and the speed of responding to environmental degradation, such as urban air pollution

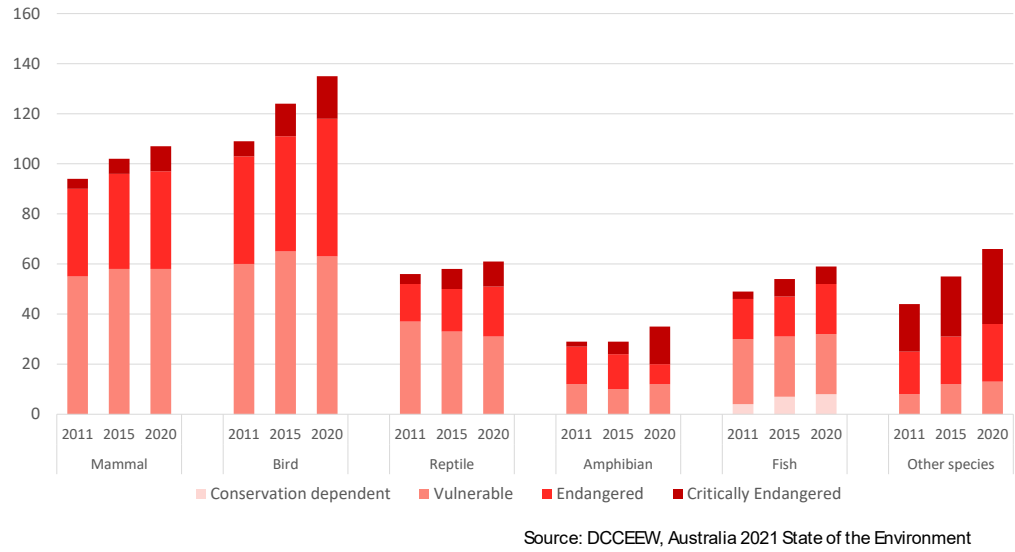


Figure 3: Australian "endangered" species list

(Winslow, 2007) versus climate change; and, fourth, the quality of democratic institutions, such as freedom of the press (Riti et al., 2021), lack of corruption (Wilson & Damania, 2005) and "good government" (Lægreid & Povitkina, 2018; Young, 2013).

The democracy and the environment literature suggests that: i) democracies are not the same (Wolf, 2023) such that countries with liberal democracies (e.g. rule of law respected, protection of individual rights, dispersal of power, independent judiciary) and with elements of active democracy (e.g. well-informed and engaged citizens, participatory, transparent and accountable decision-making) are more effective at responding to environmental degradation or global environmental threats; and ii) environmental degradation and threats that require a long-term focus (e.g. climate change mitigation) do not fit well into a single-election cycle. That is, long-term environmental threats are subject to much greater "push back" from privileged and influential interests (e.g. fossil -uel interests and their lobbyists) (Stoddard et al., 2021) over multiple election cycles (Lindvall, 2022). Together, deficiencies in democracy and powerful interests that undermine environmental actions favoured by voters result in the *democracy deficit*. This deficit impedes, or may even prevent, effective environmental actions even if they are a priority for most voters.

Overlaying the effects of the democracy deficit are social and economic trade-offs of pollution mitigation (Shen et al., 2024), including who are the winners and losers. These trade-offs matter in terms of both their scale — who are affected — and their magnitude. Irrespective of the size of the democracy deficit, the greater the socio-economic trade-offs to long-term environmental threats, the less likely there will be an effective government response, all else equal (Figure 2).

Important issues for Australian voters in the 2022 federal election were the *Environment* (see Figure 1), with 88% considering it either "Extremely Important" or "Quite Important" in their voting decision, and *Climate Change*, with 76% considering it either "Extremely Important" or "Quite Important" in their voting decision (Cameron & McAllister, 2022). In 2024, 95% of Australian respondents wanted a "better budget for Nature." while 63% wanted a mandatory assessment and consideration of carbon emissions on major projects through national environmental law (Biodiversity Council, 2024).

Notwithstanding Australian voter preferences about the environment, the responses by Australian governments are, relative to the scale of the challenges, inadequate. A summary of the key interventions in relation to climate change, biodiversity loss and water insecurity in Australia are: i) Net Zero by 2050 which allows for carbon offsets to compensate for GHG emissions (DCCEEW, 2024a); ii) Nature Positive for which the Australian Government has committed by 2030 to protect 30% of Australia's land and water consistent with the Kunming-Montreal Global Diversity Framework, achieve effective restoration of 30% of Australia's degraded ecosystems, and ensure zero new extinctions; and iii) implementation of the 2004 National Water Initiative that included the commitment by Australian governments "… to ensure the health of river and groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction" (Council of Australian Governments, 2004).

The success of these interventions can be judged in terms of their likelihood of achieving their stated goals. In terms of Net Zero by 2050 target, Australia's CO_2 fuel-related emissions in 2022 of 355 Mt (about 80% of total Australian CO_2 emissions) were 9% lower than their peak in 2010 and 2% lower than their level in 2005 (IEA, 2023); total CO_2 emissions, however, were virtually unchanged between 2022 and 2023 and decreased by only 0.6% from end of March 2023 to end of March 2024 (DCCEEW, 2024b).

In terms of Australia delivering Nature Positive by 2030, the number of mammal, bird, reptile, amphibian, fish and other species listed as endangered (likelihood of extinction is 20% over the next 20 years) or critically endangered (likelihood of extinction is 50% over the next 10 years) increased from the period 2011 to 2015, and again from the period 2015 to 2020 (see Figure 3). Further, many Australian ecosystems, because of cumulative pressures and business as usual environmental policies and regulation, are suffering from important function losses (DCCEEW, 2022).

In terms of water insecurity, for the period ending 2022, most environmental water requirements in the Murray-Darling Basin (MDB) have not been achieved (Sheldon et al., 2024) and 18 of 20 Indigenous, environmental, social and compliance indicator targets in relation to the MDB have not been met (Colloff et al., 2024). This is despite the expenditure to date of A$ 7.7 bn on water recovery for the environment (Wheeler, 2024), a Basin Plan that was legislated in 2012, and a commitment in 2007 by Prime Minister John Howard: "… to confront head on and in a comprehensive way, the over-allocation of water in the Murray-Darling Basin." (Howard, 2007).

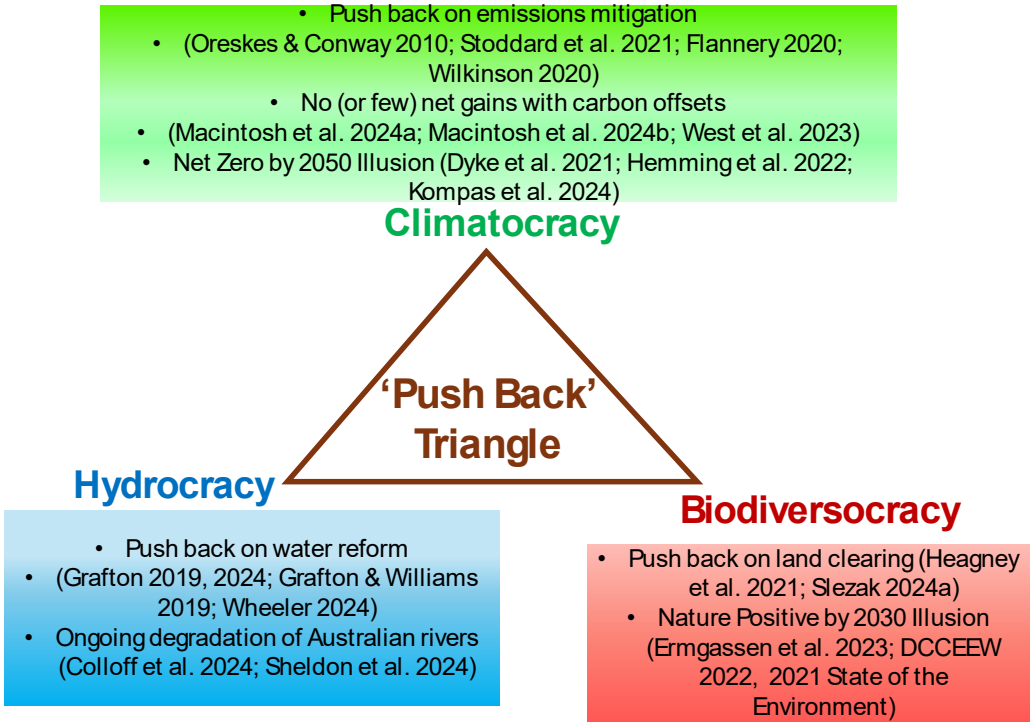


Figure 4: The "Push Back" triangle

Confronting the democracy deficit

Confronting the democracy deficit is based on three inter-linked hypotheses (H1, H2 and H3).

H1: Decline in trust in government and satisfaction with democracy is explained, primarily, by a decline in the ability (or willingness) of democratic governments to deliver what citizens want, including mitigation of long-term environmental problems.

H2: The nature of democracy (e.g. illiberal versus liberal democracy) matters, including the levels of regulatory capture (Grafton & Williams, 2020) by privileged and influential interests (private and public), the degree of political competition (Wilson & Damania, 2005), and the time frame to deliver effective mitigation responses (e.g. whether it requires multiple election cycles or not).

H3: Greater active democracy, especially within liberal democracies (Wolf, 2023), would mitigate the effects of "push back" by privileged interests (Gilens & Page, 2014) to slow or halt effective responses to long-term environmental threats, typically mediated through the political process of party donations (Thompson, 1993). These privileged interests, in the context of climate change, biodiversity loss and water insecurity are, respectively, labelled the "Push Back Triangle" consisting of the *Climatocracy* (Evans & Stevens, 2009), the *Biodiversocracy* and the *Hydrocracy* (Wester et al., 2009) (Figure 4).

The most well-known privileged interests with climate change are those enterprises and organisations that oppose or hinder effective climate change mitigation. Strategies of the Climatocracy include: i) denying anthropogenic climate change; ii) creating doubts and uncertainty around projected climate change (Oreskes & Conway, 2010) and, most recently; iii) highlighting that climate change mitigation is "sorted" with Net Zero targets. All these approaches have the same goal — to slow down or halt meaningful mitigation, or at least mitigation imposed on the Climatocracy. In Australia, the principal focus of privileged interests wanting to slow down or halt effective climate mitigation has been to influence key decisions, especially within governments (Flannery, 2020; Wilkinson, 2020).

As the evidence for global warming has become irrefutable, the fossil fuel producers and their lobbyists have adopted what is called "greenwashing." In the context of climate change, greenwashing is the pretence of, or an exaggerated claim about, effective climate change mitigation. Greenwashing is especially widespread in terms of voluntary mitigation commitments by large emitters and with the verification of carbon offsets (Lowe, 2024).

A 2023 United Nations report[5] identified that "… net zero is entirely incompatible with continued investment in fossil fuels. Similarly, deforestation and other environmentally destructive activities are disqualifying … actors cannot buy cheap credits that often lack integrity instead of immediately cutting their own emissions across their value chain." There also is increasing economic evidence that, at a global scale, Net Zero by 2050 is impossible at current economic growth trajectories (Kompas et al., 2024). The major beneficiary of carbon greenwashing is the Climatocracy, the large emitters of GHG emissions.

Given asymmetries in land and ocean CO_2 uptake, one ton of CO_2 emissions is more effective at raising atmospheric CO_2 concentrations than a one-ton removal of CO_2 from the atmosphere, or what is called a "negative emission." And this difference increases the larger the magnitude of emissions and their removal. Thus, even *if* every ton of CO_2 removed from the atmosphere were fully verifiable and of high integrity (MSCI Carbon Markets, 2024), permanently sequestered (Brunner et al. 2024), and the timescale of emissions and sequestration perfectly matched (Fankhauser et al., 2022; Johannessen & Christian, 2023) — none of which is true — its impact on climate change would still be *less* effective than a ton of emissions reductions (Zickfeld et al., 2021).

West et al. (2023), in an analysis of 26 carbon offsets projects in six countries, concluded that most of the projects had failed to result in "additionality," that is additional carbon sequestration from reduced deforestation. Where additionally was identified, the actual benefits were lower than claimed. Notwithstanding possible co-benefits (e.g. biodiversity, soil health, ecosystem resilience) of carbon offsets (Milne et al., 2024) and the potential of Nature-based solutions to restore ecosystems with Indigenous land practices (Russell-Smith et al., 2024), exaggerated or false claims about the effectiveness of carbon credits used as offsets poses an important challenge for

5 United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of Non-State Entities, 2023: 7.

Australia to genuinely achieve Net Zero by 2050. In Australia, notwithstanding "creative accounting" around base years and land-use changes not attributable to climate mitigation policies (Merzian & Hemming 2021), current reductions in national energy-related CO_2 emissions are grossly inadequate to meet Net Zero, *without* heroically assuming large negative future emissions which includes wide-spread use of carbon credits to offset emissions (Hemming et al., 2022).

One of the key challenges with Net Zero targets, and negative emissions, is that the world's voluntary carbon markets may only generate a small fraction of the claimed real emissions reductions (Probst et al., 2023). In Australia, Macintosh et al. (2024a) found, in an assessment of 143 carbon offset projects (80% of the total projects), that there was either zero or negative change in woody cover, yet they generated 22.9 million carbon credits. In their assessment of 3.4 M ha. of the carbon credited area in Australia, the authors found evidence of increased woody cover in only 28,155 ha (0.8% of the total area). In a related study of Human Induced Regeneration projects that generate Australian Carbon Credit Units (ACCU), MacIntosh et al. (2024b) found that: i) most projects were non-compliant; ii) projects had very limited effect on woody vegetation; and iii) there were major failures with respect to Australia's carbon credit scheme. The major beneficiaries of carbon credits that do not sequester carbon are landowners who receive a payment for credits and large emitters who do not reduce their GHG emissions by the amount of the purchased credits that offset their emissions.

The increased use of biodiversity offsets and other economic instruments are highlighted as a key part of Nature Repair Markets intended to deliver Nature Positive. Nevertheless, there are identified weaknesses with biodiversity offsets in England (Mancini et al., 2024; Rampling et al., 2023), while Ermgassen et al. (2023) investigated the effects of biodiversity offsets under Victoria's Native Vegetation Framework (2002–2013). Ermgassen et al. (2023) concluded that what gains that did occur in Victoria would have happened in the absence of the biodiversity offsets program. In neighbouring New South Wales, its Biodiversity Offsets Scheme has been described by the Wentworth Group of Concerned Scientists (2024a, p. 2) to: "… not align with international best practice for biodiversity offsetting, it provides for significant variation to like-for-like rules which undermines the ability to genuinely offset impacts on affected species and places, the mitigation hierarchy is not consistently or rigorously applied, the scheme allows proponents to make a payment into a fund for impacts that are not offsettable…"

Notwithstanding the problems with biodiversity offsets, and especially the challenge of like-for-like comparisons, there is still potential for Nature Repair in Australia to directly fund Traditional Owners, but not as offsets, for their custodianship of their Country (Russell-Smith et al., 2024). The scale of the Nature Repair payments in Australia has been estimated by the Wentworth Group of Concerned Scientists (2024b, pp. 6-7) at $7.3 billion per annum (in 2022 $) over 30 years. Notably, the Wentworth Group of Concerned Scientists recommends that some of this multibillion-dollar funding be spent on: "… public investment for stewardship programs, Indigenous land managers and threatened species recovery".

Land clearing has a major and negative impact on threatened species. Consequently, the pretence that regulation of land clearing is effective, when it is not, is a form of greenwashing concerning biodiversity and habitat loss. Despite multiple reviews since land clearing regulations first became regulated in New South Wales in 1990, the evidence is that state regulations have "... played only a minor role in limiting land clearing rates" (Heagney et al., 2021: 10). Heagney et al. (2021) show that, in contrast to policy and regulations around land clearing, high commodity prices for agricultural products have had a major impact on land clearing. Nevertheless, when the New South Wales Native Vegetation Act was managed by regional catchment authorities, from 2004-2012, the rate of land clearing (ha/year) halved (Heagney et al., 2021, Fig. 3).

In Northern Australia, there is evidence that much of the land cleared where there is threatened species habitat has been undertaken without the approvals required under the federal Environmental Protection and Conservation (EPBC) Act (Slezak, 2024a). The major beneficiaries of land clearing and ineffective or unenforced regulations are the Biodiversocracy; primarily large dryland and cattle enterprises (Slezak, 2024b).

In the context of water reform, there is substantial evidence that reform has slowed, in some cases even halted needed change and contrary to the stated intentions of decision-makers. For example, Prime Minister John Howard (Howard, 2007) had wanted to: i) spend almost $6 billion in water infrastructure subsidies and grants in the 2007 National Plan for Water Security, to save more than 3,000 billion litres of water, but the actual increases in stream flows might have been as little as 10% of this target ; ii) spend $3 billion on buybacks of tradeable water rights from willing sellers to increase stream flows but the actual amount spent was less because the volume of water allowed to be recovered for the environment was capped by the federal parliament at 1,500 billion litres in 2015; iii) spend $225 million for irrigation water meters to stop water theft, yet in 2017 an independent review of the Northern Murray-Darling Basin found that between half to three-quarters of water diversions were unmetered (Grafton, 2024a).

A consequence of misdirected water reform in Australia has been: "Explicit environmental protections in existing water management legislation are neither enforced nor reflected in current policy and operations." (New South Wales Office of the Chief Scientist and Engineer, 2023: 3). The major beneficiaries of failing water reform (Grafton, 2019) in the public interest (Grafton, 2024b) are the Hydrocracy, primarily irrigators who own most of the water rights in Australia, worth some $26 billion in 2020 (Productivity Commission, 2021), and who were initially allocated these rights gratis.

Towards active democracy

In many countries without compulsory voting, there has been a decline in the proportion of the voting-age population voting. Across 173 countries it fell from, on average, 65% in 2008 to 55% in 2023 (IDEA, 2024). While Australia has compulsory voting, its voters are increasingly shifting their votes from the major political parties towards independents (Cameron et al., 2022). In Australia, voters have also signalled their preference for an alternative to business-as-usual democracy; more than 90% of voters in the 2022 Australian Electoral Survey wanted

a national anti-corruption body, limits on donations, and legal protections for human rights (Cameron et al., 2022).

Democracy reform is about reimagining how democracies operate and what they deliver to citizens to become "government of the people, by the people, and for the people" (Lincoln, 1863). That is, reform is about promoting good governance that ensures people have a genuine voice in decision-making. Such reform should adapt the best practices of deliberation from Athenian democracy some 2,500 years ago (Jones, 1960). For example, in the digital age (Spinney, 2024) citizens can communicate among themselves and with decision-makers at very low cost. This, in turn, allows for the possibility of much greater inputs by citizens into government decision-making than in the person-to-person meetings of the Agora in Ancient Athens (IDEA, 2024).

A shift to greater deliberative democracy involves more citizen engagement in democracy processes that goes well beyond the basic responsibility of voting in elections. The literature on deliberation shows that: i) if well-informed, then citizens are capable of deliberation with respect to complex policies and decisions; ii) deliberation reduces polarisation of views; and iii) citizens will engage in decision-making processes if the deliberation is meaningful (Dryzek et al., 2019). At a national scale, Klein (2023) contends that deliberation is about i) improving the solutions available; ii) evaluating the possible solutions; and iii) selecting the best solutions.

An example of how citizen-based deliberations could work includes citizen assemblies and "mini-publics" (Riedy & Kent, 2017), where members are randomly selected from a representative sample of the population. Those selected as members are charged with providing recommendations on key decisions. Another deliberative approach is the use of facilitated online platforms, such as a *Delibratorium*, in which participating citizens, through a transparent process, arrive at a series of collective decisions (Klein, 2006). In terms of furthering active democracy, there must also be effective ways to transfer understanding, recommendations, and solutions from the public space to the empowered space where decisions of public importance get made (Riedy & Kent, 2017).

Going beyond deliberation is active democracy that includes participatory approaches for meaningful citizen engagement in democracy. A key benefit of active democracy is to balance the particular interest of the privileged few (e.g. Climatocracy, Biodiversocracy, Hydrocracy) with the public interest, such that the citizenry has a greater influence than they would otherwise in matters of public importance (local, regional, national and global). In Australia, there are successful examples, such as catchment management authorities in New South Wales, that between 2004–2012 brought together communities in planning and managing their landscapes and water allocations (Williams, 2011). The success of local, catchment or regional decision-making, however, requires multi-level governance (Thom & Steinfeld, 2024) including accountability and ownership of the decision-making outcomes, good and bad, and independent audits and oversight.

Active democracy requires reform at multiple levels of government. Actions to support active democracy include but are not limited to: i) ensuring public education is to a standard such that most citizens

can capably engage with complex problems (e.g. climate change) (Sabarwal et al., 2024); ii) "fact-checked" publicly available information analogous to "truth in advertising" — this fact checking requires adequate monitoring, compliance and enforcement to militate against public misinformation and falsehoods with respect to incontrovertible scientific and historical facts along with the empowerment of citizens to help them make well-informed judgements even in the presence of misinformation (Ecker et al., 2024); iii) civic education, participation and connection (Strengthening Democracy Taskforce, 2024) such that citizens can more effectively engage with decision-makers and among themselves; iv) diversity of ownership and views for all media and freedom of the press (Bennett, 2021); v) transparent participatory processes and dialogues (Russmann & Lane, 2020) on matters of key public interest (e.g. water insecurity); and vi) transparent mechanisms (e.g. effective public integrity commission) to hold decision-makers, and those that influence them, to account for their decisions (The Centre for Public Integrity, 2021).

Conclusion

Many democracies, including Australia's, face substantial and long-term environmental threats for which voters want meaningful actions. Effective solutions to these threats require actions over multiple election cycles and, thus, are vulnerable to "push back" that either slows or halts reform by vested interests; the Climatocracy (climate change), Biodiversocracy (biodiversity loss), and the Hydrocracy (water insecurity).

The remedy to the "push back" by the privileged few against the wishes of many voters, which is contrary to the public interest, requires a change in how democracy is currently practised in Australia and many other countries. Using the best practices of deliberation and participatory approaches, Australia needs to move towards a more active (deliberative *and* participatory) democracy. This shift is about redistributing power to the people, away from the privileged few, such that the long-term collective needs of the many are met.

Acknowledgements

I acknowledge the First Peoples of Australia who have sustainably cared for their own Country for millennia. I am grateful for the helpful comments and suggestions of Caroline McFarlane and John Williams on an earlier version of this manuscript. Mai Nhat Nguyen assisted in the preparation of the figures and Maurice Nevile provided exemplary copy editing.

Funding

This research was undertaken under the auspices of the Water Justice Hub. It was funded, in part, by the Australian Research Council grant FL190100164 "Water Justice: Indigenous Water valuation and Resilient Decision-making" and the Hilda John Endowment of the Australian National University.

References

Acheampong AO, Opku, EEO and Dzator J (2022) Does democracy really improve environmental quality? Empirical contribution to the environmental politics debate. *Energy Economics* 109: 105942. https://www.sciencedirect.com/science/article/abs/pii/S0140988322001190

Alestig M, Dabi N, Jeurkar A, et al. (2024) *Carbon Inequality Kills: Why curbing the excessive emissions of an elite few can create a sustainable planet for all*. Oxfam

International, Oxford, UK. https://oxfamilibrary.openrepository.com/bitstream/handle/10546/621656/bp-carbon-inequality-kills-281024-en.pdf;jsessionid=48A957776552AFB3BC6A527BF283E355?sequence=1

Bennett, E (2021) Why freedom of the press matters. The Australia Institute. https://australiainstitute.org.au/post/why-freedom-of-the-press-matters/

Berkeley Earth (2024) Global Temperature Report for 2023. https://berkeleyearth.org/global-temperature-report-for-2023/

Bernauer T and Koubi V (2009) Effects of political institutions on air quality. *Ecological Economics* 68: 1355-1365. https://www.sciencedirect.com/science/article/abs/pii/S0921800908004345

Beyer RM and Manica A (2020) Historical and projected future range sizes of the world's mammals, birds, and amphibians. *Nature Communications* 11: 5633. https://doi.org/10.1038/s41467-020-19455-9

Binder S and Neumayer E (2005) Environmental pressure group strength and air pollution: An empirical analysis. *Ecological Economics* 55: 527–538.

Biodiversity Council (2024) *2024 Biodiversity Concerns Report: A survey of community attitudes to nature conservation.* https://biodiversitycouncil.org.au/admin/uploads/2024_Biodiversity_Concerns_Report_f6ea3e5ee1.pdf

Brunner C, Hausfather Z and Knutti R (2024) Durability of carbon dioxide removal is critical for Paris climate goals. *Communications Earth and Environment* 5: 645, https://doi.org/10.1038/s43247-024-01808-7

Bureau of Meteorology and CSIRO (2024) *State of the Climate 2024*. http://www.bom.gov.au/state-of-the-climate/2024/documents/2024-state-of-the-climate.pdf

Cameron S and McAllister I (2022) *Trends in Australian Political Opinion: Results from the Australian Election Study 1987–2022*. Australian Election Study. https://australianelectionstudy.org/wp-content/uploads/Trends-in-Australian-Political-Opinion-Results-from-the-Australian-Election-Study-1987-2022.pdf

Cameron S, McAllister I, Jackman S, et al. (2022) The 2022 Australian Federal Election Results from the Australian Election Study. Australian Election Study. https://australianelectionstudy.org/wp-content/uploads/The-2022-Australian-Federal-Election-Results-from-the-Australian-Election-Study.pdf

Chu L, Grafton RQ, and Nelson H (2023) What will it Cost to Achieve the COP26 Glasgow Forest Agreement Commitment and Halt Global Forest Loss? *World Development Sustainability* 3. https://doi.org/10.1016/j.wds.2023.100106

Colloff M, Lanyon K, Pittock J, et al. (2024) Murky waters running clearer? Monitoring, reporting and evaluation of the state of the Murray–Darling Basin after more than three decades of policy reform. *Marine and Freshwater Research*, MF24193 https://www.publish.csiro.au/MF/justaccepted/MF24193

Convention on Biological Diversity (2022) 15/4. Kunming-Montreal Global Biodiversity Framework. https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf

Council of Australian Governments (2004) *Intergovernmental Agreement on a National Water Initiative*. https://www.pc.gov.au/inquiries/completed/water-reform/national-water-initiative-agreement-2004.pdf

Cowie RH, Bouchet P and Fontaine B (2022) The Sixth Mass Extinction: fact, fiction or speculation? *Biological Reviews* 97: 640–663. https://onlinelibrary.wiley.com/doi/epdf/10.1111/brv.12816

Deacon RT (2009) Public good provision under dictatorship and democracy. *Public Choice* 139: 241–262. https://doi.org/10.1007/s11127-008-9391-x

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2022). *2021 State of the Environment Report*. https://soe.dcceew.gov.au/

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024a) Net Zero. https://www.dcceew.gov.au/climate-change/emissions-reduction/net-zero

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2024b)

Australia's greenhouse gas emissions: March 2024 quarterly update. https://www.dcceew.gov.au/sites/default/files/documents/nggi-quarterly-update-march-2024.pdf

Dryzek JS, Bächtinger A, Chambers S, et al. (2019) The Crisis of Democracy and the science of deliberation. *Science* 363(6432): 1144-1146. https://www.science.org/doi/10.1126/science.aaw2694

Dyke J, Watson R and Knorr W (2021, updated 2024) Achieving Net Zero is a Deceiving Trap. *Inverse* https://www.inverse.com/science/climate-scientists-say-achieving-net-zero-is-not-nearly-enough

Ecker U, Roozenbeek J, van der Linden S, et al. (2024) Misinformation poses a bigger threat to democracy than you might think. *Nature* 630: 29-32.

Ermgassen SOSEZ, Devenish K, Simmons BA, et al. (2023) Evaluating the impact of biodiversity offsetting on native vegetation. *Global Change Biology* 29: 4397–4411 https://doi.org/10.1111/gcb.16801

Evans A and Stevens D (2009) An Institutional Architecture for Climate Change: A concept paper. Center on International Cooperation. https://globaldashboard.org/wp-content/uploads/2009/Institutional_architecture_climate_change.pdf

Fankhauser, S, Smith, SM, Allen, M, et al. (2021) The meaning of net zero and how to get it right. *Nature Climate Change* 12: 15–21. https://doi.org/10.1038/s41558-021-01245-w

Farzin YH and Bond CA (2007) Democracy and environmental quality. *Journal of Development Economics* 81: 213–235.

Flannery, T (2020) *The Climate Cure*. Text Publishing, Melbourne.

Fluet-Chouinard E, Stocker BD, Zhang Z, et al. (2023) Extensive global wetland loss over the past three centuries. *Nature* 614: 281–286. https://doi.org/10.1038/s41586-022-05572-6

Foa RS, Klassen A, Slade M, et al. (2020) *The Global Satisfaction withDemocracy Report 2020*. Cambridge, United Kingdom: Centre for the Future of Democracy. https://www.bennettinstitute.cam.ac.uk/wpcontent/uploads/2020/12/DemocracyReport2020_nYqqWio.pdf

Friedlingstein P, O'Sullivan M, Jones MW, et al. (2024) Global Carbon Budget 2024. *Earth System Science Data* https://essd.copernicus.org/preprints/essd-2024-519/essd-2024-519.pdf

Gilens M and Page BI (2014) Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens. *Perspectives on Politics* 12(3): 564-581. https://www.cambridge.org/core/services/aop-cambridge-core/content/view/62327F5139559D0A304D4893B382B992B/S1537592714001595a.pdf/testing-theories-of-american-politics-elites-interest-groups-and-average-citizens.pdf

Grafton RQ (2019) Policy Review of Water Reform in the Murray-Darling Basin, Australia: The "Do's" and "Do'Nots"'. *Australian Journal of Agricultural and Resource Economics* 63(1): 116-141. https://onlinelibrary.wiley.com/doi/full/10.1111/1467-8489.12288

Grafton RQ (2024a) Retelling Australia's Water Story: The Australian National Press Club Address 10 October 2024. https://openresearch-repository.anu.edu.au/server/api/core/bitstreams/63076069-e644-4134-8f07-16bcod8ac3e9/content

Grafton RQ (2024b) *Retelling Australia's Water Story*. Monash University Publishing, Clayton, Victoria.

Grafton RQ, Biswas AK, Bosch H, et al. (2023) Goals, progress and priorities from Mar del Plata in 1977 to New York in 2023. *Nature Water* 1: 230-240. https://www.nature.com/articles/s44221-023-00041-4

Grafton RQ and Fanaian S (2023) Responding to the Global Challenges of 'Too Much, Too Little and Too Dirty' Water: Towards a Safer and More Just Water Future. *Nota Economicas* 56: 65-90. https://econpapers.repec.org/article/gmfjournl/y_3a2023_3ai_3a56_3ap_3a67_3a90.htm

Grafton RQ, Fanaian S, Horne S, et al. (2025) Rethinking responses to the world's water crises. *Nature Sustainability* 8: 11–21 (2025)

Grafton RQ and Williams J (2020) Rent-Seeking Behaviour and Regulatory Capture in the Murray–Darling Basin, Australia. *International Journal of Water Resources Development* 36(203): 484–504. https://www.

tandfonline.com/doi/full/10.1080/07900627.2019.1674132
Greenwood EE, van den Hoogen J, Bain RES et al. (2024) Mapping safe drinking water use in low- and middle-income countries. *Science* 385: 784-790. https://www.science.org/doi/10.1126/science.adh9578
Gupta J, Liverman D, Prodani K, et al. (2023) Earth system justice needed to identify and live within Earth system boundaries. *Nature Sustainability* 6: 630–638. https://doi.org/10.1038/s41893-023-01064-1
Heagney EC, Falster DS and Kovač M (2021) Land clearing in south-eastern Australia: Drivers, policy effects and implications for the future. *Land Use Policy* 102: 205243 https://www.sciencedirect.com/science/article/pii/S0264837720325813
Hemming P, Campbell R and Venketasubramanian S (2022) *State-sponsored Greenwash*. The Australia Institute, Canberra. https://australiainstitute.org.au/wp-content/uploads/2022/10/State-sponsored-Greenwash-WEB.pdf#:~:text=The%20Australian%20Government%20doesn%E2%80%99t%20just%20turn%20a%20blind,reasons%20for%20Australia%E2%80%99s%20state-sponsored%20greenwash%20are%20not%20complicated.
Howard J (2007) A national plan for water security: Transcript of address to the National Press Club. https://parlinfo.aph.gov.au/parlInfo/search/display/display.w3p;query=Id:%22media/pressrel/K81M6%22
International Energy Agency (IEA) (2021) *Global Energy Review: CO_2 Emissions in 2020*. https://www.iea.org/articles/global-energy-review-co2-emissions-in-2020
International Energy Agency (IEA) (2023) *Australia*. https://www.iea.org/countries/australia/emissions
International Energy Agency (IEA) (2024) *World Energy Outlook 2024*, IEA, Paris https://www.iea.org/reports/world-energy-outlook-2024
International Institute for Democracy and Electoral Assistance (IDEA) (2024) *The Global State of Democracy 2024 Strengthening the Legitimacy of Elections in a Time of Radical Uncertainty*. https://cdn.sanity.io/files/2e5hi812/production-2024/0134f4cc56156db21ee23cf1072ab6d71704cd51.pdf
Jasechko S, Seybold H, Perrone D, et al. (2024) Rapid groundwater decline and some cases of recovery in aquifers globally. *Nature* 625: 715–721. https://doi.org/10.1038/s41586-023-06879-8
Johannessen SC and Christian JR (2023) Why blue carbon cannot truly offset fossil fuel emissions. *Commun Earth Environ* 4: 411. https://doi.org/10.1038/s43247-023-01068-x
Jones AHM (1960) *Athenian Democracy*. Basil Blackwell, Oxford.
King AD, Ziehn T, Chamberlain M, et al. (2024) Exploring climate stabilisation at different global warming levels in ACCESS-ESM-1.5. *Earth System Dynamics* 15, 1353–1383. https://doi.org/10.5194/esd-15-1353-2024
Klein M (2006) How to Harvest Collective Wisdom for Complex Problems: An Introduction to the MIT Deliberatorium. Technical Report. ResearchGate. https://www.researchgate.net/publication/316659681_How_to_Harvest_Collective_Wisdom_for_Complex_Problems_An_Introduction_to_the_MIT_Deliberatorium#fullTextFileContent
Klein M (2023) Crowd-scale deliberation for group decision making. In: Kilgour DM and Eden C (eds) *Handbook of Group Decision and Negotiation*. Springer. Available at SSRN: http://dx.doi.org/10.2139/ssrn.4418926
Kompas T, Che TN, Ha PV et al. (2024) The World Will Not Achieve Net Zero by 2050. Manuscript submitted for review at *Global Environmental Change* 18 November 2024.
Lægreid OM and Povitkina M (2018) Do political institutions moderate the GDP-CO_2 relationship? *Ecological Economics* 145: 441-450. https://www.sciencedirect.com/science/article/abs/pii/S0921800917300538
Lincoln A (1863) *The Gettysburg Address, 19 November 1863*. National Constitution Center. https://constitutioncenter.org/the-constitution/historic-document-library/detail/abraham-lincoln-the-gettysburg-address-1863
Lindvall D (2021) *Democracy and the Challenge of Climate Change*. International IDEA Discussion Paper 3/2021. https://www.

idea.int/sites/default/files/publications/democracy-and-the-challenge-of-the-climate-change.pdf

Lindvall D and Karlsson M (2022) Exploring the democracy-climate nexus: a review of correlations between democracy and climate policy performance. *Climate Policy* 24(1): 87–103. https://www.tandfonline.com/doi/full/10.1080/14693062.2023.2256697

Lowe P (2024) *Reducing or removing CO_2 emissions: Can offsets make the difference?* Centre for European Reform. https://www.cer.eu/sites/default/files/insight_PL_emissions_5.9.24.pdf

Macintosh A, Butler D, Larraondo P, et al. (2024a) Australian human-induced native forest regeneration carbon offset projects have limited impact on changes in woody vegetation cover and carbon removals. *Communications Earth and Environment* 5: 149. https://doi.org/10.1038/s43247-024-01313-x

Macintosh A, Evans MC, Butler D, et al. (2024b) Non-compliance and underperformance in Australian human-induced regeneration projects. *The Rangeland Journal* 46: RJ24024. doi:10.1071/RJ24024. https://www.publish.csiro.au/RJ/pdf/RJ24024

Mancini MC, Collins RM, Addicott ET, et al. (2024) Biodiversity offsets perform poorly for both people and nature, but better approaches are available. *One Earth* 7: 1-10. https://www.sciencedirect.com/science/article/pii/S2590332224004901

Merzian R and Hemming P (2021) *Banking on Australia's Emissions: Why creative accounting will not get us to net zero emissions.* The Australia Institute, Canberra. https://australiainstitute.org.au/wp-content/uploads/2021/05/P1076-Banking-on-Australias-Emissions-Commitments-.pdf

Milne S, Beaver S, Baljak C, et al. (2024) Carbon farming co-benefits: a review of concepts, policy and potential in Australian landscapes. *Rangeland Journal* 46: Rj24015. https://www.publish.csiro.au/RJ/RJ24015

MSCI Carbon Markets (2024) *State of Integrity in the Global Carbon-Credit Market*. https://www.msci.com/documents/10199/0c700856-3190-44c5-e77e-8fa5f16881bd

New South Wales Chief Scientist and Engineer (2023) *Executive Summary: Independent Review into the Mass Fish Deaths in the Darling-Baaka River at Menindee Findings and Recommendations*. https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0005/580658/Menindee-Fish-Deaths-Report_Findings-and-Recommendations.pdf

Oreskes N and Conway EM (2010) *Merchants of Doubt*. Bloomsbury Publishing Inc, New York.

Palomo I, González-García A, Ferraro P J, et al. (2024) Business-as-usual trends will largely miss 2030 global conservation targets. *Ambio*. https://doi.org/10.1007/s13280-024-02085-6

Peters G, Marland G, Le Quéré C, et al. (2012) Rapid growth in CO_2 emissions after the 2008–2009 global financial crisis. *Nature Climate Change* 2: 2–4. https://doi.org/10.1038/nclimate1332

Probst B, Toetzke M, Kontoleon A, et al. (2023) *Systematic review of the actual emissions reductions of carbon offset projects across all major sectors*. ETH Zurich. https://www.research-collection.ethz.ch/bitstream/handle/20.500.11850/620307/230706_WP_full_vf.pdf?sequence=9&isAllowed=y

Productivity Commission (2021) *National Water Reform 2020, Inquiry Report No. 96*. https://www.pc.gov.au/inquiries/completed/water-reform-2020/report/water-reform-2020.pdf

Rampling EE, zu Ermgassen SOSE, Hawkins I, et al. (2023) Achieving biodiversity net gain by addressing governance gaps underpinning ecological compensation policies. *Conservation Biology* https://conbio.onlinelibrary.wiley.com/doi/epdf/10.1111/cobi.14198

Riedy C, and Kent J (2017) *Systemic Impacts of Mini-publics*. Report prepared for the new Democracy Foundation. https://newdemocracy.com.au/wp-content/uploads/2017/06/docs_researchpapers_2017_nDF_RP_20170613_SystemicImpactsOfMiniPublics.pdf

Riti JS, Shu Y and Kamah M (2021) Institutional quality and environmental sustainability: The role of freedom of press in most freedom of press countries. *Environmental Impact Assessment Review* 9:

106656. https://www.sciencedirect.com/science/article/abs/pii/S0195925521001062
Russell-Smith J, Holmes J, Lewis B, et al. (2024) Evolving nature-based solutions for Australia's Indigenous estate in 2024 — opportunities and challenges. *The Rangeland Journal* 46: RJ24019. https://www.publish.csiro.au/rj/pdf/RJ24019
Russmann U and Lane AB (2020) 'Mandating dialogue? International perspectives on differences between theory and practice', *Public Relations Review*, 46(1): 101819. https://doi.org/10.1016/j.pubrev.2019.101819
Sabarwal S, Marin SV, Spivack M et al. (2024) *Choosing Our Future: Education for Climate Action*. World Bank Group, Washington DC. https://openknowledge.worldbank.org/server/api/core/bitstreams/9d1c318a-bcd3-49fa-b1c6-cc03e18d4670/content
Schneier B (2023) Re-imagining democracy for the 21st century, possibly without the trappings of the 18th century. *The Conversation* 7 August 2023. https://theconversation.com/re-imagining-democracy-for-the-21st-century-possibly-without-the-trappings-of-the-18th-century-210586
Sheldon F, Rocheta E, Seinfeld C, et al. (2024) Are environmental water requirements being met in the Murray–Darling Basin, Australia? *Marine and Freshwater Research*, 75 https://www.publish.csiro.au/MF/pdf/MF23172
Shen Y, Shi X, Zhao Z, et al. (2024) Quantifying energy transition vulnerability helps more just and inclusive decarbonization. *PNAS Nexus* 3(1): 427. https://academic.oup.com/pnasnexus/article/3/10/pgae427/7828926
Slezak M (2024a) Successive Australian governments have done little to stop illegal land clearing. Will a new environmental regulator do the trick? ABC News. https://www.abc.net.au/news/2024-09-12/environmental-protection-biodiversity-conservation-logging/104337806
Slezak M (2024b) The deforestation on farms that 'people don't even know' is happening. ABC News. https://www.abc.net.au/news/2024-08-27/coles-woolworths-urged-to-dump-beef-linked-to-deforestation/104261314
Spinney L (2024) Reimagining democracy. *New Scientist* 5 October 2024, 3511: 32–35.
Stoddard I, Anderson K, Capstick S, et al. (2021) Three Decades of Climate Change Mitigation: Why Haven't We Bent the Global Emissions Curve? *Annual Review of Environment and Resources* 46: 653-689. https://www.annualreviews.org/content/journals/10.1146/annurev-environ-012220-011104
Strengthening Democracy Taskforce (2024) *Strengthening Australian democracy: A practical agenda for democratic resilience*. Department of Home Affairs, Commonwealth of Australia. https://www.homeaffairs.gov.au/about-us-subsite/files/strengthening-australian-democracy.pdf
The Centre for Public Integrity (2021) *A Design Framework for the establishment of a strong and effective National Integrity Commission*. https://publicintegrity.org.au/wp-content/uploads/2022/02/Design-Framework-NIC.pdf
Thom B and Steinfeld C (2024) Natural resource management and regional planning: a geographical perspective. *Australasian Journal of Environmental Management*, DOI: 10.1080/14486563.2024.2383436. https://www.tandfonline.com/doi/full/10.1080/14486563.2024.2383436
Thompson DF (1993) Mediated corruption: The case of the Keating five. *American Political Science Review* 87(2): 369–381. https://www.cambridge.org/core/journals/american-political-science-review/article/abs/mediated-corruption-the-case-of-the-keating-five/53E41F94AF2DA76ECC1569602B5768DB#access-block
Tollefson J (2023) Catastrophic change looms as Earth nears climate 'tipping points', report says. *Nature* 624: 233-234. https://www.nature.com/articles/d41586-023-03849-y
United Nations Department of Economic and Social Affairs, Social Inclusion (2021) *Trust in Public Institutions: Trends and Implications for Economic Security*. Department of Economic and Social Affairs, United Nations. https://social.desa.un.org/sites/default/files/migrated/22/2021/08/PB_108.pdf
United Nations' High-Level Expert Group on the Net Zero Emissions Commitments of

Non-State Entities (2023) *Integrity Matters: Net Zero Commitments by Businesses, Financial Institutions, Cities and Regions*. https://www.un.org/sites/un2.un.org/files/high-level_expert_group_n7b.pdf

Wentworth Group of Concerned Scientists (2024a) *Wentworth Group Submission to the Portfolio Committee No, 7 — Planning and Environment*. Wentworth-Group-submission-inquiry-into-Biodiversity-Conservation-Amendment-BOS-Bill-2024.pdf

Wentworth Group of Concerned Scientists (2024b) *Blueprint to Repair Australia's Landscapes National case for a 30-year investment in a healthy, productive & resilient Australia*. https://wentworthgroup.org/2024/07/blueprint-repair-australias-landscapes/

West TAP, Wunder S, Sills EO, et al. (2023) Action needed to make carbon offsets from forest conservation work for climate mitigation. *Science* 381: 873-877. https://www.science.org/doi/10.1126/science.ade3535

Wester P, Rap E and Vargas-Velázquez S (2009) The Hydraulic Mission and the Mexican Hydrocracy: Regulating and Reforming the Flows of Water and Power. *Water Alternatives* 2(3): 395-415. https://www.water-alternatives.org/index.php/allabs/64-a2-3-6/file

Wheeler SA (2024) Comparing the success and failure of the Murray–Darling Basin Plan's water recovery programs. *Australian Journal of Public Administration* 2024: 1-17. https://doi.org/10.1111/1467-8500.12672

Wilkinson M (2020) *The Carbon Club*. Allen & Unwin, Sydney.

Williams J (2011) *Catchment Management — Setting the Scene*. https://wentworthgroup.org/wp-content/uploads/2013/09/Catchment-Management-Setting-the-Scene.pdf

Wilson JK and Damania R (2005) Corruption, political competition and environmental policy. *Journal of Environmental Economics and Management* 49(3): 516–535. https://www.sciencedirect.com/science/article/pii/S0095069604001159

Winslow M (2007) Is Democracy Good for the Environment? *Journal of Environmental Planning and Management* 48(5): 771–783. https://www.tandfonline.com/doi/full/10.1080/09640560500183074

Wolf M (2023) *The Crisis of Democratic Capitalism*. Penguin Random House, United Kingdom.

World Economic Forum (2024). *Global Risks Report*. https://www.weforum.org/publications/global-risks-report-2024/

World Meteorological Organization (2024) *State of the Global Climate 2023* https://storymaps.arcgis.com/stories/2545ecd62e594005bb196boba962d7cb

WWF (2022) *Living Planet Report*. https://wwf.org.nz/news/our-planet/living-planet-report-2022

Young, O (2013) *On Environmental Governance: Sustainability, Efficiency and Equity*. Routledge, New York. https://www.taylorfrancis.com/books/mono/10.4324/9781315633176/environmental-governance-oran-young

Zickfeld K, Azevedo D, Mathesius S, et al. (2021) Asymmetry in the climate–carbon cycle response to positive and negative CO_2 emissions. *Nature Climate Change* 11, 613–617. https://doi.org/10.1038/s41558-021-01061-2

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 109–118. ISSN 0035-9173/25/010109-10

2024 Royal Society of New South Wales and Learned Academies Forum: "Threats to Democracy"

Panel Session 2: Challenges to Australian democracy[1]

Emeritus Professor Peter Shergold AC FRSSN FASSA, Vice President, RSNSW
p.shergold@westernsydney.edu.au

Dr Jeni Whalan, First Asst Sec and Head, Strengthening Democracy Taskforce, Dept. of Home Affairs
Jeni.whalan@gmail.com

Ms Leila Smith, CEO, Aurora Foundation
leila.smith@aurorafoundation.com.au

Mr Nick Bryant, Author and broadcaster
Nickbryantbbc@gmail.com

Peter Shergold: I'm the Vice President of the Royal Society of NSW, and I'm very pleased to introduce this next session on the future of Australian democracy, on the threats to Australian democracy, on the challenges to our structures of democratic governance, and on opportunities to reinvigorate or reimagine our understanding of democracy.

Kristy Muir, who's the CEO of the Paul Ramsay Foundation, and I started to open out this discussion earlier in the year in April, when we had a conversation for the Royal Society: on putting the civil back into civil society, the importance of the not-for-profit organisations that we were hearing about in the first session. You can find that, as well as many other good Royal Society functions, on YouTube.[2]

Just a few days ago, one of our Royal Society Fellows, Mark Evans, was part of a team that produced a new democratic audit of Australia's evolving democracy.[3] It's well worth looking at. I hope he will present his findings to a future meeting of the Royal Society. His well-balanced conclusion is that our long-established, solidly founded liberal democracy is not in crisis. They come to the conclusion that we're not now in the top ten democratic countries — over the last few decades our performance, they think, has been rather variable. There are signs of democratic malaise, and we need to find a way to renew ourselves and strengthen the protective power of democracy. So I think the Democratic Audit is a good foundation on which to base our session today.

I have pulled together a wonderful panel. Their biographies are in the programme.

The first to talk to us is Dr Jeni Whalan, who is a distinguished academic turned influential public servant, who headed the Commonwealth Government's Strength-

1 This is an edited transcript of the session, which can be viewed at https://www.youtube.com/watch?v=MLL05uwR9ts

2 See https://www.youtube.com/watch?v=BvPjaXBcQNo

3 Evans M, Dunleavy P and Phillimore J (eds) (2024) *Australia's Evolving Democracy: A New Democratic Audit*. LSE Press. https://press.lse.ac.uk/books/e/10.31389/lsepress.ada

ening Democracy Taskforce.[4] I think her strengths as a political scientist and a public policy strategist, author, and researcher are evident in the Report of that Taskforce, which was published in July this year.

Second is Leila Smith, a Wiradjuri woman and CEO of the Aurora Education Foundation, a Charlie Perkins Scholar, and Chair of the America Australia Association.

Third is Nick Bryant, who very modestly describes himself on his website as an author and journalist. In truth, Nick was for a long period one of the BBC's finest foreign correspondents, and then while in the United States wrote *When America Stopped Being Great*,[5] which I think, for perhaps the next two months, will sit in the library of the Oval Office with President Biden. More recently, he completed *The Forever War*.[6] Perhaps most pertinent today, he's also written *The Rise and Fall of Australia*.[7] And I do recommend all three books.

So now we're going to get a brief presentation from each.

Jeni Whalan

Thank you to the Royal Society for the invitation to come and speak to you today. Peter mentioned that I led the Australian Government Strengthening Democracy Taskforce in the Department of Home Affairs, which reported in July 2024. I thought I might talk to you about what that Taskforce found. The Taskforce has now rolled into an office — the Office of Community Cohesion — which I also lead in Home Affairs.

The Taskforce was set up in early 2023 by the then Home Affairs Minister, Clare O'Neil, who was troubled by the democratic backsliding we were seeing around the world and by a range of other challenges to democracy being felt here at home, particularly in her portfolio in the national security space. Challenges like foreign interference, violent extremism, but also a more pervasive sense of people's disconnection and disengagement from institutions. We were asked as a Taskforce to understand what the evidence around the world looked like, what the evidence here in Australia looked like, and then to be ruthlessly practical — not to start with Greek democracy, but to look hard at what we could learn from democracies around the world, what the state of play here in Australia was, and crucially, what could be done practically to strengthen Australian democracy in what feels like a more difficult time. That's what the Report lays out — we set out five ideas.

The *first idea* is that democracy is a national asset that's worth protecting. I hope that when we say that out loud it seems self-evident, but until we say it out loud it's perhaps not. In Australia, I think we've had a privileged complacency about our democracy for many decades. That's a terrific thing: we should be able, to some extent, to have as secure, robust and resilient a democracy that we can afford to take it for granted. But that time has passed. We're faced by a range of new challenges. We need to be more explicit about the contributions

4 *Strengthening Democracy* (2024) *Strengthening Australian Democracy: A Practical Agenda for Democratic Resilience*. Department of Home Affairs, Commonwealth of Australia.

5 Bryant N (2020) *When America Stopped Being Great: A History of the Present*. Penguin.

6 Bryant N (2024) *The Forever War: America's Unending Conflict with Itself — The History Behind Trump and J.D. Vance*. Penguin.

7 Bryant N (2015) *The Rise and Fall of Australia: How a Great Nation Lost Its Way*. Bantam.

of our democracy to our society. That goes not just for government — not just for the federal government and governments of all levels — but for all of our institutions, non-governmental as well, across society.

The *second idea* is that we can draw confidence in this task from Australia's long histories of creativity and ingenuity — often world-leading innovation and reform in our democracy. That's true through our modern democracy in our distinctive electoral institutions. In many respects, Australia has not only led the world but been the envy of the world for the strength and robustness of its electoral institutions: its pioneering use of the secret ballot, the extent to which our independent and professional electoral commissions make this the easiest place in the world to vote, and the extent to which our electoral commissions are independent in the first place. That's a tremendous strength. Not least our compulsory voting and our systems of preferential voting. It's also true in these long traditions of democratic innovation and ingenuity — in the integrity reforms which characterised the 1970s and '80s, in our incredibly vibrant and active civil society, about which we've heard some today. That is, Australian democracy has never stood still. The stewards of Australian democracy have never let it stand still. Every generation has risen to the challenge of protecting and nurturing our Australian democracy. That's the task for us today.

The *third idea* is that we needed a Strengthening Democracy Taskforce not because Australian democracy is fundamentally weak — in fact, the third idea is that Australian democracy is strong — but it's vulnerable to a range of shared challenges facing liberal democracies around the world. We heard a little in the previous panel about measures of trust and satisfaction, whether with democracy or government in different forms. One of the things that global comparison helps us with is that Australians value our democracy more highly than is common in liberal democracies around the world. Australians overwhelmingly think it's important — the majority think it's very important — to live in a country governed democratically.

But about one in two are concerned about the trajectory, the direction of travel, for democracy. They're concerned about a range of things: the rise of misinformation and disinformation in our environment, foreign interference, and also all the processes of governing and governments that we've heard so much about this morning. But here's the kicker: around 80% of Australians think it's worth doing something to fix the problems we might face. That's a tremendous reform constituency. That's a tremendous strength, again, that many democracies around the world would envy, with anti-democratic sentiment very low in this country.

I think it's important to recognise the strengths in our democracy so that we can protect and safeguard them, because the *fourth idea* of the Taskforce Report is that Australian democracy is facing a new constellation of challenges. I say constellation because it's not the effect of any one of these challenges or, in the framing of today, the threats — but the way in which they interact. We name them in the Report: they are from foreign interference; from rising misinformation and disinformation; from the role of social media and digital platforms, often interacting with those first two; increasingly, the role of algorithms and AI; dynamics of polarisation and division, of prejudice, hate, discrimination, of inequality; and finally,

perhaps the line through all of those — dissatisfaction and distrust in governments and processes of governing.

What do we do about it? This is the heart of the Report. The *fifth idea* is that there are very many things not only that we can do about it, but in fact many around this country are already doing on a daily basis to strengthen democracy — and around the world. If we look at those challenges to democracy, the Report sets out the way in which they come together to challenge three enduring strengths of Australian democracy. First: trusted institutions — we've heard a lot about institutions this morning. Second: credible information — I don't think we've heard that much about information. And third: social inclusion — we've started to hear a little about that today. But I think the interplay of institutions, information and inclusion is a crucial place for us.

The Report says there are really three things a practical agenda to strengthen democracy should do. First, it should protect our strengths. Act from a position of strength. Don't wait until we have a burning platform or democracy is on fire. Strengths like our electoral institutions, strengths like our information integrity, our free and open media environment, our citizens' engagement with the values and principles of democracy.

The second thing: strengthen people's civic engagement, their understanding of democracy — not in the academic sense or the theoretical sense that we've heard a lot of today — but in our everyday sense. What are your rights and obligations under a democracy? What does democracy give you? What are your duties to participate? Where are your opportunities to participate in democracy? How are you connecting with others in your community and across communities in our democracy?

Third — and I'll end here — is embrace democratic experimentation and innovation. We have a long history of doing that in our modern democracy. We're learning much more about the very long histories of governance in our First Nations history. And we need to embrace the experimentation and democratic innovation. That is why Australian democracy has the strengths it has today.

Leila Smith

First, it's so wonderful to be here. Thank you for having me. It's a really busy time of year for us all, but even doing the walk up the drive to come here and being in this stunning room, hearing all of the different perspectives and similar themes but different ideas, has been really inspiring. So thank you so much for having me.

As Peter said, my name is Leila Smith. I'm a Wiradjuri woman, so my family is from central west New South Wales. There's a small Aboriginal mission on the outskirts of Cowra — Erambie Mission. My father grew up there, and my grandmother and her mother grew up there as well. I think it's a really important place to start, because democracy is about having a voice.

When I arrived at Cambridge in 2013, I was the second Aboriginal student to study there. One other Aboriginal student — Lily Brown — had been there before me, and she had graduated just three months earlier. I mean, this is a really compelling, amazing institution — a bubble that is dripping in privilege. When I arrived and started thinking about our history — after tens of thousands of years of history — and realising this was something we hadn't had the oppor-

tunity to be part of, it was frustrating. We heard earlier about the economics of equality of opportunity. To think this university had been around for hundreds of years and this was a new experience for us — it was a very frustrating feeling. It's something — a theme and a sentiment — that we're hearing today about people feeling locked out and left behind. I think it really highlighted for me these two worlds, more than two worlds apart, that we were having.

That was ten years ago. We've now had nearly a hundred Aboriginal scholars go to top international universities with a 100% completion rate. These are mostly scholarship recipient students that the Aurora Education Foundation administers scholarships for. I'm the CEO of Aurora Education Foundation, so I've come full circle — from scholarship recipient to running the organisation. Ten years later, I get to do the call where I ring the scholarship recipients and tell them, "Guess what — you're going to Oxford!" It's the best part of the job.

We've had people going there. These are opportunities that are compelling, that are strength-based. Why don't more people know about it? This narrative that we're talking about — there is social change happening. There are good things happening. How do we capture people's attention in this world where people are absorbing news and information in so many different ways, in a world where attention spans are shorter than ever? This is something we really tackled and thought about on the Taskforce that Jeni talked about. I was an expert adviser on that Taskforce.

I'm also the chair of the American Australian Association. Two weeks ago, I was at a benefit dinner in New York. It was a week before the election. You want to talk about the Cambridge bubble? Well, New York is a bubble as well. We're sitting there on Wall Street in this massive fundraising gala, and everyone was saying, "It's going to be a close election — Kamala might get over, but it's going to be tight." There was somebody sitting next to me at the dinner who owns factories all around the US — Detroit, Dallas — and I said to him, "What do you think's going to happen?" and he said, "Trump by a mile." I said, "What makes you think that?" He said, "Because I've spoken to my factory workers and they're all voting for him." How can we have these bubbles where everyone — not everyone else, but a lot of people at that gala — was so sure it was going to be close, and then have this whole other world where they were so sure it was not going to be close?

That's something I spend a lot of my time thinking about: how do we bring worlds together? How do we bridge worlds — and generationally too?

Taking the theme today, which is about challenges to our democracy, I want to think about challenges to implementing change to strengthen our democracy. Another world we need to bring together, which we've heard about today, is the generational shift that is happening. We need to engage young people earlier. I am guilty of this as well, I have to say. I'm the first to put my hand up. Sometimes, by the time I engage young people in the design of something big, I do it later on. I leave it too late, and I don't think I'm alone in that. If we're going to be implementing any initiatives around democracy, we need to bring young people in earlier and earlier. We're getting better at it, but we still have a long way to go.

The second thing, which we've also touched on — thank you, Peter, for mention-

ing the importance of leveraging partners outside government — is thinking about not-for-profits at the regional and national level to achieve democracy goals as well. We heard, for example, in the Taskforce Report that participation in volunteerism, in sporting teams, in political parties, in unions is declining. So how do we engage people outside government when those rates are getting lower and lower? I think we need to look the next layer down and look at where the growth is happening. Women's sport, sure. Overall team sports might be declining, but let's take a look at women's football. Let's take a look at AFL. There are other areas of growth we can tap into, and I think looking outside government is really important to that as well.

I'm going to put one other thing on the table: I wonder if we also need to spend more time acknowledging the power of public-private partnerships to achieve goals. Corporates across the world are increasingly on board with ESG and long-term commitments to education, for example — something I see all the time. There is a role here for democracy work too. I don't know what it is yet, but I still think this is an important conversation for us to have. This is not just about everyday participants in society. It's not just about the philanthropic sector. It's not just about the community sector. It's about corporates. It's about everyone. And that's what we've been hearing here today as well.

In conclusion, the biggest challenge is timing. We need to act now. Once people start to feel they are left behind, they disengage, they don't speak up, our communities become fragmented. That's when discord, ignorance, and even hatred happen. And at the moment that hatred and intolerance and other sentiments like this start to crawl out from under their rock, that's when people start to think that others are less — and then they don't even want to try to understand them, because it doesn't really matter what they say.

So the biggest challenge is acting now and making space to focus on strengthening our democracy. Which is why I'm so thankful to be here today, and I'm so pleased to have this discussion. Thank you, everyone.

Nick Bryant

Thank you very much, Peter. It's very generous of you to mention that my book was in the Oval Office. I was rather hoping that, having passed the torch to Kamala Harris, Joe Biden would pass the book on to her as well. Unfortunately, that hasn't happened.

I've spent a lot of time talking this year — mostly about my new book. It's based on a simple premise: Donald Trump is as much a product of American history as Abraham Lincoln, F.D.R., John F. Kennedy, Barack Obama, or Joe Biden. It's just a history that gets forgotten, misremembered, and sometimes deliberately buried. It's a history that defies the grand narrative of American progress and advancement. How tempting it was to think that America's first Black president, Barack Obama, would be followed by America's first female president, Hillary Clinton. But history doesn't work like that, and that lesson has been underscored over the past few days.

After a year of speaking, it has been fantastic this morning to spend time listening. Just a couple of reflections on what I've heard: democracies work better when economies work better. If you look

at American history over the last 50 years, political polarisation closely tracks income polarisation. There's a missing middle in American politics because there's a missing middle in the American economy.

When I first returned to America in 2013 — before Donald Trump came down that famous golden escalator — I was struck by how many people told me they no longer believed their children would lead more abundant lives than they had. So, when Trump said "the American dream is dead," many believed him. Bill Clinton once boasted about building a bridge to the 21st century, but if you lived in the Rust Belt, it felt more like a bypass. Empty factories and derelict steel mills became echo chambers for the words "Make America Great Again." People genuinely felt like economic castaways in a globalised economy they couldn't understand and couldn't make work for them.

And I mention all of that because, when I returned to Australia three years ago, I heard the same thing: "I don't believe my kids will lead a more abundant life than I did. I don't believe they'll be able to afford property — the essence of the Australian Dream."

Another thing that worried me when I came back, in the midst of COVID, was during our two-week hotel quarantine. The first Saturday morning, we heard a muffled roar from the street below: an anti-lockdown protest. Turning on the television later that night, we saw people carrying signs and flags I was used to seeing in rural Michigan and Mississippi — Trump flags. One even showed him portrayed as Rambo, gripping an automatic weapon.

In Melbourne, too, we saw a grim kind of Americanisation. A gallows was paraded through the streets, aimed at "Dictator Dan" — the moniker increasingly used by Rupert Murdoch's tabloid, which had started to sound more shrill, more like its stablemate, Fox News. In a disturbing echo of January 6th, some protesters even urinated on the Shrine of Remembrance, Melbourne's most sacred site.

These anti-lockdown protests became a cause célèbre for the American hard right. Candace Owens, a cable blowhard, suggested America should invade Australia to liberate its people. Tucker Carlson lamented that John Howard had tightened up Australia's gun laws, preventing citizens from taking up arms against the government. Ron DeSantis, then Governor of Florida, suggested cutting off diplomatic relations. Ted Cruz complained that the "Texas of the Pacific" had gone soft. And Donald Trump Jr tweeted in September of that year: "Don't Australia my America." I found myself thinking the exact opposite: "Don't America my Australia."

Because it wasn't just street Trumpism that was on display — it was a small-t Trumpism in Canberra as well. There was a post-truth quality to Scott Morrison's government. I was troubled that the Liberals tried to push through voter ID laws — straight out of the GOP playbook — despite the Australian Electoral Commission (AEC) stating that voter fraud was vanishingly rare. After Morrison left office, we learned of the secretive multi-ministerial power grab, which defied democratic norms. During the Voice referendum, Peter Dutton questioned the integrity of the vote and of the AEC,

implying it was rigged.[8] The AEC is the gold standard. It should be treasured. It's part of a democratic model that I hope continues to serve Australia well.

I actually planned to begin my remarks by speaking about another Donald — not Trump, but Donald Horne. I loved his book, *The Lucky Country*.[9] I read it in one gulp flying from Sydney to Perth. It brilliantly encapsulated the land I was flying over. Horne is remembered for his famous line: "Australia is a lucky country run by second-rate people who share its luck." But it's worth remembering the subtitle: *Australia in the Sixties*. I'm not sure that line held through the '70s, '80s, or '90s — perhaps in the 21st century.

I see Mike Baird is here. I said to Mike before today's event, "Thank goodness, when you were changing prime ministers every few weeks and the reform era gave way to an era of revenge and retribution, the states were governed so well." In many ways, Australia became Canberra-proof.

But what really struck me in Horne's thesis was his second point: that Australia is a country of borrowed ideas. Derivative. Imitative. Mimicking others. Just look at Canberra — the names, House of Representatives and Senate, borrowed from America. The House chamber, with its green leather benches, looks like Westminster. The Speaker's chair in the old Parliament even contains wood from HMS Victory.

But this is where I think Horne was wrong. Australia has been brilliant at building its own democratic model: preferential voting, compulsory voting. I left Australia opposed to compulsory voting, but after eight years in America, I returned an absolute advocate. It's a safeguard. And weekend voting — what a celebration of democracy. America votes on Tuesdays, Britain on Thursdays. In America, they try to stop people from voting. Here, it's required — and that's a good thing.

So what I want to say today is: stick with the "democracy sausage." Don't go for the "democracy hot dog." And whatever you do, don't "America my Australia."

Q&A

PS: Well, that's great, and it gives me the opportunity to start the discussion and take questions or comments from the floor. Jeni, I was intrigued by what you shared about the Taskforce and its work. While you were doing this, was there anything that surprised you, or did everything turn out as you expected?

JW: I think I was somewhat surprised by the ongoing strength at levels I hadn't quite anticipated. When we started the Taskforce, I initially believed the situation might be worse than it turned out to be. The evidence doesn't entirely support that view, especially when you look at all the different aspects of democracy. One surprise was seeing how crucial everyday, practical spaces for democracy are — things that democratic theory and textbooks don't often mention. Public libraries, for instance, are incredible institutions. They do better than most in reflecting and serving specific communities.

For example, the library in my area is filled with people working on their side

8 AEC hits back after Peter Dutton suggests voice referendum rules are "rigged," *The Guardian*, 25 August 2023. https://www.theguardian.com/australia-news/2023/aug/25/indigenous-voice-to-parliament-referendum-aec-poll-unfairness-claims-rejected

9 Horne D (1964) *The Lucky Country: Australia in the Sixties*. Penguin.

hustles, laptops open. Meanwhile, other libraries serve as the only place people can access government services, update software, or check crucial government accounts. Some libraries even have domestic violence survival kits because they're seen as safe spaces for people with children. Beyond that, librarians are incredibly skilled in helping people navigate information — one of the most important skills in today's world. If we need places where people can come together across divisions to find credible information, public libraries are invaluable. So, stepping outside of democratic theory to understand democracy in people's daily lives was eye-opening.

PS: Thank you, Jeni. I completely agree with you on libraries. Around Australia, these spaces, which people once thought would disappear, have become the heart of many communities.

Leila, I love how you balance the strengths and weaknesses of our democracy. Should we start with the weaknesses or the strengths? What do you think is the best way to approach this?

LS: That's a really good question, and I don't have a simple answer. However, I've gone on a journey to find that answer. When I began at Aurora about five years ago, it was common in Indigenous Affairs to focus on what was wrong and how we needed help to fix it. But we, along with many others, started flipping that narrative. We wanted to talk about the strengths and why we needed people to work with us to build those strengths. It was successful, more than we expected.

Then came the 2023 Referendum, and people started thinking about how to frame the narrative around strength. One of our board members said, after the failed Referendum, "Maybe we focused too much on the strengths. We didn't highlight enough the real issues that this could help." I agree. We probably needed a better balance — acknowledging both strengths and challenges. The media, of course, plays a big role. Crisis narratives often get a lot of traction.

One example: Brooke Boney, one of our Perkins Scholars at Oxford, now works at *The Today Show*.[10] She's learned how to cater to mass audiences, which is a skill that could be combined with policy and media. We need more people who understand how to craft a narrative.

Another example: I also serve on UNESCO's Global Education Monitoring Group.[11] Every year they release reports on global education. People's attention spans are shrinking, so last year they tried something new. They brought in a communications specialist, and the first report released with that help was on technology in education. The media simplified it to "UNESCO says ban mobiles in schools." This oversimplification got huge traction, but it missed the nuance in the report. It got media attention, but the question is: Was it the right approach? The jury's still out. My answer, Peter, is I think we need to temper it — balance strengths with challenges, and keep an eye on the larger picture.

PS: Nick, you've been a strong advocate for keeping the Australian democracy

10 Boney B (2025) Welcome to Country is not an election issue, so why are we talking about it? I think I know, *SMH*, May 1; also her book of essays, *All of It*, Allen & Unwin, 2025. [Ed.]

11 https://www.unesco.org/gem-report/en/about-us

sausage, and I'm with you on that. When I first arrived in 1972, I thought compulsory voting was strange, but now I'm a complete convert. When you talk about preserving our strengths, what do you think needs to change in order to sustain our democracy?

NB: I think you need to tell a different story about your democracy. Celebrate it and reject that "Lucky Country" mentality. Let go of the "mother-country thinking," the "tyranny-of-distance," and the cultural cringe.[12] Too much of the intellectual architecture that dominated post-war Australian thought is now outdated. You've made your own luck. In the late 1990s, you developed an economic model that works, and you've built a democratic model that works as well. You didn't just copy others — you improved on a system.

As Jeni mentioned, there's a strong tradition of democratic innovation in Australia. Other countries have borrowed your ideas, like the Australian Electoral Commission (AEC), which is now regarded as the gold standard. Tom Rogers, head of the ACCC, often gets asked by other countries how Australia managed it.

The same goes for compulsory voting. Even American thinkers like EJ Dionne have written books about it — although they call it Universal Voting, because "compulsory voting" wouldn't fly in the U.S.[13] Australia's democratic model is something other countries look to, and yet Australians often underestimate their own success.

There are serious national issues Australia hasn't fully addressed, but there are also many things you do well — things that could be exported. Australia's democratic model is something the world could learn from. You need to tell the world your story. There's still a tendency in Australia to downplay your achievements, especially when it comes to democracy. But Australia has a great story to tell, both to itself and the world. I'm not always a fan of Australian politics, but I am a big fan of Australian democracy.

12 Phillips AA (1950) The cultural cringe, *Meanjin* 4. The author is a distant cousin of the Editor's.

13 Dionne EJ, and Rapoport M (2022) *100% Democracy: The Case for Universal Voting*. The New Press.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 119–129. ISSN 0035-9173/25/010119-11

2024 Royal Society of New South Wales and Learned Academies Forum: "Threats to Democracy"

Panel Session 3: Technological challenges to democracy[1]

Prof. Sally Cripps FRSN (Chair), Director, Technology, Human Technology Inst., UTS
sally.cripps@uts.edu.au

Prof. Ed Santow FAAL Inst., UTS, Director, Policy & Governance, Human Technology Inst, UTS
Edward.Santow@uts.edu.au

Dr Darren Saunders, NSW Deputy Chief Scientist & Engineer
Darren.saunders@chiefscientist.nsw.gov.au

Assoc Prof Fatemeh Vafaee, Sch. Of Biotechnology & Biomolecular Science, UNSW
f.vafaee@unsw.edu.au

Sally Cripps: My name is Sally Cripps, and this session is titled *Threats? to Democracy*. The question mark is important — I'd also like us to explore not only the threats, but the potential opportunities that technology can offer.

To set the scene before introducing our fantastic speakers, I want to talk briefly about the relationship between democracy and technology over the last 200 years. There's a graph I often use that shows the various forms of democracy and how they've changed from around 1780 up to the present. Of course, this evolution didn't happen in isolation — many things were happening in the world during that time.

I'm a statistician, and I don't know if any of you are familiar with the wonderful Hans Rosling. He might just have been the world's only charismatic statistician. He created an animated presentation for the BBC, showing in real time how the health and wealth of societies changed from 1810 through to 1960, and then up to 2009 — which was when the presentation was made.[2] His key message was that back in 1810, almost everyone was poor and sick. Life expectancy was under 40 years. But over time, aligned with the rise of democracy, we saw an enormous expansion in both health and wealth across the globe. Rosling attributes this to the rise of technology — particularly the Industrial Revolution — and when you look at the data, it's a compelling story.

However, when you plot technology against democracy directly — for example, industrial production versus democratic development — you see that the relationship is not linear. It's complex and has shifted over time. In the so-called "Swinging 60s," for example, we saw a particular phase of development.

The worrying part, though, is what's happened in the past decade. On the democracy graph, after decades of growth, we see a clear decline. That's what has been alarming many people — those data points are now much

1 This is an edited transcript of the session, which can be viewed at https://www.youtube.com/watch?v=MvP5X5_5i6Y

2 https://www.youtube.com/watch?v=jbkSRLYSojo

lower than what we might expect given the continued advancement of technology.

So, what's going on in the relationship between technology and democracy? How can we better understand the present moment, both in historical context and looking ahead? Let me put forward a few ideas.

First, and perhaps unsurprisingly, technologies like ChatGPT and generative AI have enabled misinformation and disinformation at an unprecedented scale. My brilliant colleagues at the Human Technology Institute have written extensively about facial recognition technology and the way it invisibly violates privacy — again, at a speed and scale we've never seen before. And these issues — privacy, access to reliable information — are fundamental to functioning democracies, as our speakers this morning reminded us.

But there is also an upside. I had the privilege of meeting Audrey Tang, Taiwan's first Digital Minister. She made remarkable use of digital platforms to enhance democracy. In fact, under her leadership, the government's approval rating rose from just 9% in 2014 to 90% in 2020 — it's since dropped slightly to 60%, but still, that's extraordinary. In Taiwan's case, digital platforms helped build trust between the government and the people.

Hopefully, that gives you a picture of how technology can sometimes support democracy and sometimes undermine it.

Now, it's my pleasure to introduce our speakers, who will explore these issues from different perspectives.

Our first speaker is Professor Ed Santow. Ed is the co-founder and co-director of the Human Technology Institute at UTS. He's also a former Australian Human Rights Commissioner, a board member of several charities, and — along with Professor Nicholas Davis — one of the country's leading experts on AI regulation and governance. Ed will speak about the impact of AI on human rights, drawing on his excellent recent book.[3]

Our second speaker is Dr Darren Saunders, the Deputy Chief Scientist of New South Wales. Darren has spent more than two decades working across academia and industry, with a background in science, biology, and neurology. He's also an outstanding communicator and advocate for making science accessible to the public.

Our final speaker is Associate Professor Fatemeh Vafaee. She is based at the School of Biotechnology and Biomolecular Science at the University of New South Wales and serves as Deputy Director of the Data Science Hub. Her work focuses on applying AI to medical contexts, right down to the cellular level. Today, she'll talk about the potential benefits of that work — and also the risks it could pose, and what harm might look like in practice. Without further ado, I'll hand over to Ed.

Ed Santow

I'm going to talk about the intersection of freedom of expression, technology — particularly artificial intelligence — and our democracy. I say that because I'm going to take a somewhat circular route to get there, but rest assured: I will reach that destination.

Let me begin with a name that I suspect few, if any of you, have heard: Stephen Ayres. If you were of a more writerly bent and tried to sketch the true 21st-century

3 Santow E and Mellor D (2024) *Machines in Our Image: The Need for Human Rights in the Age of AI*. LexisNexis.

American everyman, it might look a lot like him. Ayres spent most of his adult life in employment — not wealthy, not politically engaged—but deeply proud of his American identity. Ayres will be remembered, if at all, because he committed a serious crime. He was one of those who stormed the U.S. Capitol on January 6, 2021. He was convicted for offences connected to what can reasonably be described as an attempted *coup d'état*.

What's interesting is his own reflection on how he ended up there. He has spoken candidly about his motivations. Three things stand out.

First, he had disengaged from conventional, authoritative sources of news and information. Second, his worldview was shaped by a deep sense of nationalism and a perception that others were progressing more quickly than he was. Third, and perhaps most importantly, his understanding of the world came almost exclusively from social media — Facebook and what was then called Twitter.

From that extremely narrow information diet, he became utterly convinced that the 2020 election had been stolen from Donald Trump. And he believed, as a patriotic American, that the only proper course of action was to act. Now, I suspect very few in this room would share that worldview. But it's important to try to understand how someone could arrive there.

1. Freedom of expression

This leads me to the first of three key points: freedom of expression.

We often hear — from people like me, or from Emeritus Professor Rosalind Croucher — that freedom of expression is one of the critical preconditions of a healthy, functioning democracy. And that's true. But there's a catch: too often, we think of free expression only in terms of the right to speak — the right to be "on transmit," so to speak.

Certainly, we have never lived in an era where that right has been more accessible. Despite the complaints of certain billionaires, we all now hold a virtual microphone. Social media gives everyone a platform to speak.

But freedom of expression has two critical elements: not just the right to speak, but also the right to *receive* information. If the information you receive is so polluted — by falsehoods, ideological distortion, and disinformation — that you can no longer form a rational view of the world around you, then you are not truly free to express your views either. Because your thinking itself has been manipulated. And that, I think, is one of the major challenges we now face in sustaining a functioning democracy.

2. Social media and new technologies like AI

This brings me to my second point: social media and new technologies, particularly artificial intelligence.

For a long time, people like me — rather embarrassingly — have said that we're living through a dramatic rise in the volume of hoaxes and false information. It felt intuitively true. But recent research[4] shows something surprising: there hasn't been a

4 Uscinski J et al. (2020) Have beliefs in conspiracy theories increased over time? *PloS one* 17(7);
Osman M (2023) Conspiracy theories aren't on the rise — we need to stop panicking. *The Conversation*, 20 June;
Park S et al. (2020) Global mistrust in news: the impact of social media on trust. *International Journal on Media Management* 22(2): 83–96.

significant increase in the *amount* of false information circulating.

Instead, what we're experiencing is something more subtle and more dangerous: a *collapse in the authority of truth*.

What I mean by that is this: in previous decades, people like Chief Scientists, public health officials, or experienced journalists could say something clear — like "Don't inject disinfectant to cure COVID" — and it would be believed. Not by everyone, but by a critical mass. Their statements had authority. There was a common reference point for facts. Now, that's changed. Truth and falsehood are increasingly treated as morally or politically equivalent. That's been hastened by the platforms we use.

3. The attention economy

This leads me to my third and final point: what's accelerating this collapse?

There are many factors, but one of the biggest is the design of social media platforms themselves. When people once got their news from regulated, professional media organisations — however imperfect those organisations were — there were checks and balances. Journalists operated in a market where truth mattered. If they consistently published falsehoods, they would suffer reputational and commercial damage. Regulators and editorial oversight — however flawed — still mattered.

Social media is different. These platforms are not regulated like media companies, and their currency isn't truth. It's attention. The "attention economy" rewards content that keeps you looking longer — whether it's true or not.

The algorithms that drive social media don't have a political agenda, but they have shown us one undeniable thing: the best way to hold someone's attention is not with calm, well-evidenced statements from human rights commissioners or scientists. It's with extreme views, emotionally charged content, and polarising narratives.

Conclusion

Put all that together, and, yes — I am worried about democracy. I share the perspective of Jeni Whalan and Nick Bryant, who spoke earlier today: we're not at a point of collapse in Australia. But we are at a point of serious risk.

We need to push back on three fronts:

1. *Freedom of expression* must be understood as both speaking and receiving reliable information.
2. *Our information environment* cannot be dominated by platforms that treat truth and falsehood equally.
3. *Social media platforms* must be properly regulated — not only to moderate harm, but to safeguard democratic functioning.

If we can address those challenges, we will be in a better position to protect and sustain our democracy. Thank you.

SC: Thank you, Ed. That was absolutely wonderful. I love things in threes — and the point about misinformation not increasing, but our declining ability to debunk it, is absolutely fascinating. Now it's my very great pleasure to introduce Darren Saunders.

Darren Saunders

Now, I want to very quickly talk about the tension between the risks and benefits of technology. I'll focus on a few examples from my own field, because one of the key points I want to make is this: the threat to democracy doesn't necessarily come from

the technology itself, but from how it's applied and perceived.

There are some unbelievably powerful technologies currently reshaping not just everyday life, but also how scientists like me understand the natural world — particularly the human body and brain.

Take fruit flies, for instance. They're a favourite tool for geneticists. A fruit fly brain contains about 140,000 neurones — the human brain, by comparison, contains tens of billions. Recently, researchers created a complete wiring diagram of the fruit fly brain. They sliced a brain into 7,000 sections, ran each through an electron microscope to produce 21 million images, and then used AI to reassemble it into a 3D map. This wiring diagram lets you trace how a taste of sugar activates specific neurones and triggers muscle movement. It's a small but profound example of how technology is transforming fundamental biological research.

We're now trying to do the same with the human brain — an even more complex challenge. Here's another example: if you look up into the Milky Way and see billions of stars, that's roughly the same number of protein molecules in a single brain cell — and there are billions of those cells in every human brain. It's an almost impossible problem to understand on a human timescale without advanced technology. That's why AI has been so revolutionary, particularly in the field of protein folding. The 2023 Nobel Prize in Chemistry was awarded for work in this area. Why does protein folding matter? Because misfolded proteins cause diseases like Alzheimer's and motor neurone disease. Understanding how they fold is a game-changer.

Another area is synthetic biology — where we manipulate genomes to create entirely new forms of life. This has major applications: in agriculture, to create new food, fuel, and fibre; in medicine; in decarbonization; and even in semiconductor design. These engineered life forms are not only philosophically new, but fall completely outside current regulatory frameworks.

Let me share one more example: Athena — an AI tool recently adopted by the NSW Rural Fire Service. Athena aggregates data from weather satellites, on-the-ground reports, aircraft surveillance, and even social media — like geotagged images of fire trucks or smoke. It combines this with CSIRO's decades of modelling to predict the impact of fires and help allocate resources. This is another powerful application of technology that most people never think about, but that saves lives.

Now let's look at genomics — a field where some of these challenges are most evident. You've probably heard of the Human Genome Project. But as genomics becomes more embedded in our healthcare system, it raises new ethical and social issues — especially around identity, privacy, and control.

One high-profile example is the company 23andMe. For a few hundred dollars, you could send in a saliva sample and get a detailed genetic profile — your health risks, ancestry, and more. But what most users didn't realise was that the company's business model relied on collecting and selling that data to pharmaceutical companies. That company recently filed for bankruptcy, and may be sold to another entity.[5]

Now millions of users are worried: "Who owns my data? What are they doing with it?"

5 In March 2025, 23andMe filed for Chapter 11 bankruptcy. [Ed.]

The implications are vast — for insurance, family histories, and personal privacy. These issues go right to the heart of democratic control.

Let's return to the notion of control and misinformation — two themes Ed touched on. In medicine, genomic technology has created an expectation that your genome will be decoded by a doctor who then hands you a personalised treatment. That's the dream. And for a few rare conditions, it's a reality. For instance, spinal muscular atrophy — a fatal condition affecting children — now has a genetic therapy that is literally saving lives. But it costs millions of dollars per patient. It raises huge questions around cost, access, and fairness.

The broader problem is a mismatch between hype and reality. Most people won't receive a personalised treatment when they walk into a hospital. That gap breeds disappointment and mistrust — and it's exactly the space exploited by misinformation peddlers like Pete Evans and Belle Gibson.[6] These influencers profited off people's frustrations, offering false hope in place of scientific medicine.

This all came to a head during COVID-19. Trust in public health, science, and technology was badly shaken. People conflated frustrations over lockdowns and vaccine mandates with distrust in the science itself. That's when we started seeing truly bizarre theories — like 5G networks controlling people through vaccines. It's worth noting the irony that most conspiracy theories were spread via the very same 5G-connected smartphones.

And here's the kicker: even when scientists like me went on TV to debunk these myths — like Donald Trump's suggestion to inject disinfectant — we may have inadvertently amplified the misinformation. There's solid evidence that even addressing false claims can reinforce them in people's minds. It's a paradox. A wicked, unsolvable problem.

So, what are the core challenges and risks?

- *Equity*: in medicine, and beyond, we face serious inequities in how technology is accessed and applied. Without fair access, we undermine trust — and, as Ed said, that's a big problem for democracy.
- *Bias and assumptions*: many datasets and models are built using people who look like me — white, male, Western — and that excludes much of the world's diversity. That skews outcomes, and it's dangerous.
- *Control*: who controls the tech and the data? That's where trust often breaks down.
- *Surveillance*: a few years ago, researchers swabbed subway handles in New York and sequenced the DNA. They not only found traces of the plague in rats, but could also identify the ethnic profiles of entire neighbourhoods. That level of biological surveillance raises deep ethical concerns.
- *Misinformation and misunderstanding*: we're already seeing this play out. Genetically modified food. COVID vaccines. And it's likely to get worse as new vaccines developed with advanced technologies hit the market. Hesitancy and mistrust will follow if we're not prepared.
- *Technology, evidence, and policy*: often, what the technology tells us — "Here's the problem, here's the fix" — doesn't align with how policy works. That mis-

6 See Netflix TV series "Apple Cider Vinegar." [Ed.]

alignment creates disillusionment and makes people feel shut out of democratic decision-making.

So I'll stop there. Hopefully, that gives you a few points for discussion.

SC: Thank you, Darren. It's amazing to hear the breadth of your work and insights. You drew an important connection between equity and democracy. A fantastic talk — thank you. Now, speaking of equitable access to health, I'd like to welcome our final speaker, Fatemeh.

Fatemeh Vafaee

AI opportunities to enhance democratic principles

I see myself as an "AI citizen" — I've been in this field for over 15 years. I completed my PhD in computer science and artificial intelligence back in 2011, right when deep learning models were first being published. Since then, I've contributed to the field through research, leadership in biomedicine, and entrepreneurship. I'm an associate professor, a team leader, and I run a proprietary company focused on translating AI innovations into practical healthcare solutions that directly reach patients.

Today, I want to talk about both the positive and negative sides of AI — specifically through three opportunities (Access, Insight, and Empowerment) and three threats (Bias, Transparency, and Privacy). I describe myself as a thoughtful optimist when it comes to AI adoption, so let's start with the opportunities.

Equitable access and the democratisation of knowledge

Remote diagnostics and telemedicine: access to expertise

First, AI can democratise access to expertise. Take the example of Millie, the Northern Territory breast-screening bus. It travels to remote areas, providing mammography to over 1,000 women across 20+ Aboriginal communities. Imagine a future where these women have access to the world's best diagnostic tools — right there in their communities, at no cost. That kind of access should not depend on whether you live in a city or a remote area, or whether you can afford a specialist.

Yes, developing and training AI models is expensive. But once trained and deployed at scale, the cost of querying these systems is negligible. So it becomes an affordable, scalable solution that can truly bridge equity gaps.

Translation and customisation of health information

During COVID-19, AI helped translate public health information into different languages for diverse communities. In a multicultural, multilingual country like Australia, this was critical. But beyond translation, AI can customise information to match a person's context, culture, and understanding — which is crucial for informed decision-making and, by extension, for democracy.

Enhanced decision-making and accelerated discovery

A few years ago, MIT showed that AI could detect breast cancer from mammography images five years earlier than conventional

methods — by identifying patterns too subtle for the human eye. And it's not just medical imaging. AI now processes molecular data at a scale impossible for humans.

In my own work, we've focused on liquid biopsies — measuring thousands of molecules in just a few drops of blood to detect or monitor cancer. These methods, powered by AI, allow us to track treatment response with a blood test, instead of costly, invasive procedures.

Whether it's genomics, microbiome data, wearables, or electronic health records, we're surrounded by diverse health data. When AI integrates these sources, it gives us a comprehensive view of health and disease — the vision behind precision medicine. We're not fully there yet, and some are sceptical. But I believe that without AI, this kind of personalised, holistic care simply isn't possible.

Personalised medicine, by nature, supports democratic principles. It ensures that people aren't disadvantaged just because their genome or biology deviates from the average.

Citizen empowerment and enhanced autonomy

AI also enables citizen empowerment — giving individuals tools and resources to take control of their health decisions. That includes personalised health management tools, decision support systems, and better access to understandable, relevant information.

These systems promote autonomy and support community building by helping people connect and share experiences. They also offer new ways to inform policymakers — giving communities a stronger voice.

But there are serious threats

Surveillance and privacy erosion

Of course, the flip side of AI-enabled access is surveillance. AI systems often depend on massive amounts of personal data. How that data is stored, sold, or used to monitor people poses a serious threat to democratic freedoms. The chilling effect — where people censor themselves because they feel watched — directly undermines free speech and open dialogue.

Bias in data and inequity in decisions

Bias is one of AI's most dangerous challenges. It comes from the data, and it gets baked into the decisions AI makes.

Here's a real example: I asked a generative AI model (GPT) to draw an image of a scientist. It produced a white man in a lab coat (A). I then asked for a university professor: again, a white man with a beard and an open-neck shirt (B). A research centre director? Same (C). A CEO? White man in a suit (D). I then asked it to draw an image of *me*, based on publicly available information. It showed a white woman in a suit, speaking outdoors (E). I asked, "How do you know I'm a woman?" The model replied: "Because you won an award in Women in AI APAC." Fair enough.

But then I asked it again: "Draw an image of me: a university professor, director of a centre, and CEO." The result? Back to an AI-generated image of a bearded white man in a suit (F), despite prior context indicating a female identity, reflecting the model's bias at the time (November 2024).

Clearly, the bias goes deeper than job titles or gender. And this isn't limited to

Figure 1: AI-generated illustrations created using GPT-4o based on a series of prompts.

illustrations. In our breast cancer blood test project, we trained a model using data from Eastern Europe. It performed well — until we tested it in Australia. It failed for women who weren't Caucasian. The model had learned bias from its training data, and couldn't generalise to Australia's diverse population. That's a critical equity failure — and it's happening in real-world applications.

Transparency and interpretability

If I ask you, "How does AI work?" and you say, "I don't know," you're not alone — even experts often don't know. That's because AI, especially deep learning, operates as a "black box:" millions or billions of values interacting in complex, nonlinear ways to generate an output.

Figure 2: Assoc Prof Fatemeh Vafaee

Yes, we have metrics to improve transparency in medicine, but accountability must go further. We need explainable systems that people — not just engineers — can understand and trust.

From fragile to antifragile

Let me end with a big-picture point: Right now, we're in a fragile state. We don't fully understand how AI systems behave, or how they will evolve. That unpredictability makes us vulnerable.

So how do we become antifragile — able to adapt, improve, and use AI responsibly?

We need measurement tools, transparency, auditing, and incident reporting. Only then can we truly evaluate AI's impact. And let me be clear: there is no path forward that doesn't include AI. We must embrace it — but we must do so responsibly.

SC: That was a fantastic talk about AI. I especially loved the example about bias — and how you still ended up as a white man in the end!

Q&A

Q1: That was a great discussion. My name is Essen, from the Office of the Chief Scientist and Engineer. I really appreciated hearing the different perspectives on how technology affects democracy — particularly around misinformation, equity, and bias.

We heard from Darren about how genomics and medicine are subject to bias, based on the data they're trained on — mainly from Caucasian populations. The same is true for AI. Recent research also shows that even language can introduce inequality. For example, English-speaking users receive significantly better responses from ChatGPT than people using minority languages.

I'd like to hear the Panel's thoughts on how this bias — whether in medicine, genomics, or AI — will impact democracy not just in Australia, but globally. Especially considering Australia's diversity, how do you see this playing out?

FV: Wearing my technical hat, I'd say there are real opportunities to address these issues using both regulation and technology. Many of the harms AI can cause — bias being a key example — can be mitigated when we combine thoughtful regulation with innovation.

In the case of bias, particularly related to ethnicity, we can begin by measuring the extent and nature of that bias in AI models. That helps users, developers, and regulators understand where corrections are needed. We're actively working on reducing data bias — both within the models themselves and in how we collect data across diverse populations.

But the solution isn't just about data collection. It's also about understanding how to reduce structural bias within the algorithms. Transparency and deeper technical insight are essential for making meaningful progress. This is a complex issue, but one we can address if we treat it as both a social and technical challenge.

Q2: This question is for all of you, especially Ed and Darren.

Given the rise of misinformation and declining trust in authority, do you think we need to explicitly teach critical thinking in schools? I have two teenage daughters, and while critical thinking is loosely part of the curriculum, it's not necessarily taught as a direct skill — like how to evaluate sources or understand what "truth" means online. Should this now be a core part of education in primary and secondary schools?

ES: The short answer is yes. It's essential for all the reasons you've mentioned.

But I do have a concern about where we tend to direct our solutions. Often, we put the burden on the victims of bad systems — like people being misinformed — to protect themselves. It's like saying, "We've

created a dangerous environment, now it's your job to wear armour."

I'll give you a real example. I once gave a big talk on facial recognition and how it risks creating a mass surveillance society. Afterward, a man raised his hand and said, "You've talked about legal and policy solutions, but I've got a better one." I got my pen ready, curious. He said, "I wear a beak in public." A beak? "Yes," he said. "It's modelled after an exotic South American bird, and it defeats all the facial recognition systems. If everyone wore beaks, we'd be fine."

Now, technically, he's not wrong — but I don't like the idea that people have to contort themselves, literally or metaphorically, to resist the harms of bad technology. Yes, teach critical thinking — wear a beak if you must — but more importantly, let's regulate and design technology to be human-centred from the start.

SC: You've got to give him full marks for lateral thinking.

DS: Just to add to that: while I'd love to think that teaching critical thinking will solve the problem, I'm actually not sure it will. From my experience communicating complex science to the public — and there's good research backing this — just giving people more or better information doesn't necessarily help. In fact, it can make things worse.

A lot of misinformation uptake is driven by belief systems and emotional reactions, especially during times of stress. Sometimes, when people are given facts that challenge their worldview, they double down instead of changing their minds.

So yes, teach critical thinking, but we also need to address the emotional and psychological roots of misinformation. It's not just a cognitive issue — it's a deeply human one.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 130–141. ISSN 0035-9173/25/010130-12

2024 Royal Society of New South Wales and Learned Academies Forum: "Threats to Democracy"

Panel Session 4: Challenges to public sphere: educating for democracy[1]

Emeritus Prof. Christina Slade (Chair); Chair, Forum & Program Cttee, RSNSW
christinamslade@outlook.com

Ms Carly Kind, Privacy Commissioner, Office of the Aust. Info. Commissioner
carly.kind@oaic.gov.au

Prof. Catherine Lumby, Foundation Chair, Media & Communication, Univ. of Sydney
catharine.lumby@sydney.edu.au

Prof. Amanda Third, Co-Director, Young & Resilient Research Centre, WSU
a.third@westernsydney.edu.au

Christina Slade: This session follows on naturally, and was designed to follow on naturally, from the debate that we've just had. It's been an interesting day. We began with a philosophical debate about why democracy matters and the importance of polycentric systems. We might come back to that in the conclusion: global challenges to democracy, Australian attitudes to democracy, and now we've been looking at technology and all of the challenges and the problems.

What I'm hoping that this panel can do is start to think about how we might move ahead. We're particularly lucky to have here the new Privacy Commissioner, Carly Kind; Catherine Lumby, a journalist first turned scholar — one of the first to call out disinformation and misinformation loudly; and Amanda Third, who's an expert on social media and young children. She's the co-director of the Young and Resilient Research Centre.

Thinking back to Cambridge Analytica — and it seems a very long time ago now, doesn't it? The great shock was the one that I think Fatemeh identified. That was realising that Facebook and the other social media platforms gathered our data — not only did they gather it and sell it on — but with the capacities of their algorithms, they could put together that data and know more about our choices than we do ourselves. Cambridge Analytica knew how to change votes because they understood the patterns of behaviour that we ourselves couldn't introspect.

Now that's a big hit to identity. It makes one really nervous about understanding what your own choices are. And I think that sense of surveillance, which Fatemeh talked about so clearly — that appalling sense that you are being seen all the time. It's not just private companies that do this, it is the public companies as well, or nation states, that know more about than you do yourself. And really there's no way you could find out how they reached that understanding — it is hidden in the data sets and algorithms they use.

1 This is an edited transcript of the session, which can be viewed at https://www.youtube.com/watch?v=O47lc50T7M8

I've heard doctors say one of the problems they have with AI is that they put their results into the black box and then the decision is made for them. If you're going to get eye surgery, and that decision is made for them, who's responsible if it goes wrong?

I'm glad that we are finishing the session on the question of children and privacy. The next generation and how we look after children is really important. We're going to be talking about misinformation and disinformation in the new media landscape. Should we be worrying about social media, which of course has been such a big topic that our third speaker has been totally taken up with over this week?

We begin with Carly Kind. Carly joined as Privacy Commissioner from the UK-based Ada Lovelace Institute — a human rights lawyer, a leading authority on the intersection of technology, policy, and human rights. She's worked at the European Commission, the Council of Europe, and a range of civil society organisations. She's also no defeatist. I don't know that there could have been a tougher introduction to Australian processes than the rather rocky road of the privacy legislation over the last few months. Changes were made, but there was this strong pushback from private industry and from businesses, who say protection of data is going to stop free global trade. Carly's response: we need trade and tech, but we need protection too.

I'll hand over to Carly.

Carly Kind

It's interesting that you start off talking about Cambridge Analytica. The Office of the Australian Information Commissioner — which is the home of the Privacy Commissioner — is still in mediation with Facebook (now Meta), some six years on from commencing legal action against them for that very incident. These things have a long tail, as they do — obviously across many aspects.

I think one of the really interesting things about Cambridge Analytica — and I wanted to start off talking about this anyway — was what it revealed to many of us who already had an eye on technology. This is not a bug; this is a feature of digital tools. The ability to target and to influence behaviour was not some perverse thing that Facebook was doing behind the scenes — it was a feature of its system, something it was out there selling to advertisers. I think that Cambridge Analytica was a big wake-up point for society at large about the political economy of the information environment.

I think it's important that we stay there for a second to understand that political economy. We all know: if you're not paying for the product, then you are the product. That is no more true than in the online realm. As Professor Shoshana Zuboff called it — surveillance capitalism is the overarching framework within which we go onto digital technology.[2]

The major social media platforms have a data-driven business model. What is a data-driven business model? It's a business model that's based on data that we, as its users, create — either our personal information or information that's derived from our personal information. Inferences about who we are, based on the things we do online.

I think that this political economy creates a few incentives — often perverse incentives.

2 Zuboff S (2019) *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. Profile.

One of those is to collect more and more personal information about individuals. That creates a range of additional risks, not least the risk that that data then gets exposed in large-scale data breaches, of which we've seen many here in Australia in the last few years. Darren talked about 23andMe — they were subject to a data breach earlier this year: 7 million people's genetic information exposed to hackers.

But it also creates incentives to use that data to keep us online longer and longer. We know that the longer we stay on digital tools, the more times our eyeballs will look at digital advertising, and the more money that platforms will therefore be able to charge their advertisers. It's a pretty simple set of steps.

Therefore, to keep us online longer, what do they do? They show us content that we already agree with, so that we're more likely to keep scrolling. They show us other people who are like-minded. We get to feel safe, like we're amongst friends. Therefore, we see the emergence of filter bubbles, echo chambers, and so on. They show us more and more outrageous content — things that are going to excite us and keep our attention for longer. Essentially, these platforms are optimising for our attention alone, without thinking about those potential societal flow-on impacts. This foundation really has shaped the social media environment that we have today.

I'll give you an example of an issue we're looking at, at the moment. One way in which social media platforms are able to make sure their advertising is as personalised and curated as it is, is through the use of something called "tracking pixels." If you go on a website — you might be scrolling through that website — and then you later go to your social media account, you'll notice that something you looked at earlier is advertised to you. You looked at a pair of shoes on, say, Country Road, and then you go onto your Instagram account and there are those Country Road shoes. That's through the use of a particular piece of technology called a tracking pixel.

That kind of technology is being deployed pervasively throughout the online ecosystem, and it's not discriminating as to whether the browser is an adult or a child. We're now at the use of pixels on sensitive websites, such as health insurers or online therapists. We're finding that, for example, a website that might offer a helpline to children is using tracking pixels to later track those children when they're going onto TikTok or onto Instagram.

There's an argument to be had that there may be some social benefit in doing so — because they want to make sure that that child is reminded of the services available to them. If they're, for example, looking for information about bulimia, and then they're later on their TikTok and targeted with "you can get help if you're experiencing bulimia." But on the other hand, you have to think that many of these children are going to feel that it's creepy, that there's some form of surveillance. They might be less likely to search for the information in the first place.

From a strict regulatory privacy perspective, there are a lot of real legal concerns as to whether those websites are allowed to disclose that information to social media companies. That's what we're looking at.

I raise that because I'm preoccupied at the moment — and I'm very much looking forward to hearing what Amanda has to say — about the proposed social media

ban, wherein the government wants to stop children under the age of 16 from going onto social media sites. I think the thing that sits uneasily with me about the ban — and there are many reasons, but one for me — is that it accepts the premise of the current state of the online ecosystem. That it's data-driven, this kind of surveillance capital business model, and that it can't be shaped in the way that we want it to be shaped. I simply feel unwilling to accept that.

I think we've only had these technologies for less than two decades. They are not permanent features of our information environment. They can be shaped — including through regulation, including through the proper administration of existing laws. We're not even talking necessarily about new regulation. In that sense, part of that's on my shoulders — to make sure that existing privacy laws are enforced.

But I still think that by saying we need to keep children off these tools, we're accepting that the tools are the way they are. That technology is some kind of inevitable fact, rather than solely the product of human engineering and ideas. That engineering and those ideas can be changed at our will.

One other lever we can pull is through improving our privacy regulation. I'm relatively new in the role and have been grappling with this dual challenge of enforcing the law as it is and also asking for new laws. I do think there's scope to strengthen the privacy framework here in Australia. But I would also say there's a lot we can do with what's already there.

The regulator hasn't been particularly well resourced historically — certainly not to meet the scale of the challenge. I think there's a lot of scope there. That's what I'm really looking to do — to use the powers that I have to shape this online environment. I keep asking myself: how could we shape what these tools look like if we actually address the underlying business model? Essentially, that is about curtailing the use of personal information.

I'll wrap up, but I just want to say one final thing. Last night, the Communications Minister introduced the idea of a duty of care that would be imposed on tech companies. I'd love to hear from my panellists about that. One thing I've observed moving from the UK to Australia this year is a lot more appetite in Australia to exert some power vis-à-vis those large tech platforms. I view the government here as much more willing to take that on.

It was very interesting to hear Minister Michelle Rowland talk about introducing a digital duty of care last night — on the same day her counterpart in the UK, Peter Kyle, said, "We have to act with humility when it comes to big tech companies. We have to accept that they are akin to nation states." I thought that was very interesting. That's definitely my view having been in the UK — there is this sense that we actually have to treat them as equals and we can't just exert our power. Then to come to Australia, where I think there's actually much more appetite for trying to exercise power. I just think that's an interesting feature of the environment that I thought I'd call out for our conversation. Thank you.

Christina Slade: Thank you. Can I just ask — Elon Musk being in government — do you think that reduces the possibility or the chances of a strong regulatory regime in the United States?

Carly Kind: Oh, absolutely in the United States. I absolutely do. I don't know if others are frequent Twitter users, but if you are,

you will have noticed that the quality of information on X has declined dramatically in the last year. I've just moved over to Bluesky, and I would really encourage others to do the same. It's so nice there — just all these well-meaning people who want to have intellectual conversation, and no outrage or horror.

CS: We're going to continue now with Catherine Lumby. Many of you will know her — she's been a journalist at *The Sydney Morning Herald*, the ABC, *The Bulletin*; she was a Harkness Fellow in New York; founding director of the Journalism and Media Research Centre at UNSW; and Chair of the Media and Communications Department at the University of Sydney. But I suppose what we mainly all know her for are those early books where she called out journalism — *Bad Girls: The Media, Sex and Feminism in the '90s* (1997) and *Gotcha: Life in a Tabloid World* (1999).[3]

She writes on pornography, violent extremism, the sexualisation of children, and social media. She's worked with the NRL, and now she's published a biography of Frank Moorhouse.[4] So she is, I suppose, what you might call a leading public intellectual.

Catherine Lumby

Carly, I'm so thrilled you're our Privacy Commissioner. You're focusing on the right stuff. And when Fatemeh showed those AI images, it brought to mind a summer 15 years ago. If you're a female professor at a university, they always make you sit on every promotions committee. I was in a little silk frock — it was hot, and I was five minutes late. I walked in the door and a lot of the guys on the panel were science professors. One of them looked at me and said, "I'll have a macchiato." So I got him one anyway.

I'll move on now. Threats to democracy — where do I begin? After last week, it honestly crossed my mind to ditch this talk, get up, sob, and rend my garments, taking a leaf out of the Old Testament. But I'll go on as planned.

I'm a recovering print and TV journo, and I now research social media. Amanda and I are close colleagues — we're working on a big research project on this. We've both long been concerned about young people, but also about the way we are concerned about them. Why don't we listen to them? Why don't we acknowledge their agency? Amanda will talk about that.

Today I want to talk about something I'm writing a book on for Simon & Schuster. I'm concerned about the rise of what I'll call hard- or far-left identity politics. I say this as someone who comes from the political left. I try to be balanced in my scholarship, but I'm worried about the direction these debates are taking — especially on the left. For me, this is about democracy.

The book came out of what I call the "third rail" question. When I moved to New York in 1992, I learned a phrase for topics you're not supposed to talk about at middle-class dinner parties: the "third rail." Like the electrified rail on the subway — touch it, and you die. I'm concerned that many of us are now at risk of getting electrocuted — unable to speak coherently about

3 Lumby C (1997) *Bad Girls: The Media, Sex and Feminism in the '90s*. Allen & Unwin; Lumby C (1999) *Gotcha: Life in a Tabloid World*. Allen & Unwin.

4 Lumby C (2023) *Frank Moorhouse: A Life*. Allen & Unwin.

politics or social justice, or even just listen to each other.

I'm left-wing, I come from a largely Christian family, I have Muslim friends, my husband's Jewish. I care deeply about inclusivity. But I'm seeing things on university campuses — my own tribe — that concern me. I hear people shouting, "You're on the wrong side of history!" (Personally, I always thought history was three-dimensional.) I want to understand how we ended up in a place where complex issues like the horrific Israel-Hamas war, or the debates about trans and women's rights, have become so polarised. Why are some activists using tactics like doxxing, social media pile-ons, and deplatforming to shut down any possibility of debate or reconciliation?

These tactics — which we now call "cancel culture" — certainly occur on the political right. But I'm seeing them increasingly on the left. That's why I'm writing this book, *Cancel This* — probably an unwise title, but I'm sticking with it.

What do the hard left and hard right have in common in terms of messaging? Why so much shouting and so little listening? And what role — here's the heart of this talk — does social media play in all of this?

"Cancel culture" is a term that originated on the right — like "political correctness," which was once weaponised against the left. But I believe there's a truth in it that we on the left need to reckon with.

I don't come with answers, just questions. I see too many "answers" that suggest we're asking the wrong questions. As a former law student and journalist, I've been trained — like many of you — to ask forensic questions, evaluate evidence. But as Ed Santow said, that's not what gets traction on social media. That kind of analysis is often seen as elitist. And I'm not saying it *should* be irrelevant — but we need to understand how most people make decisions now.

I come from a working-class background. I learned critical thinking because I got into Sydney Uni Law School — luck and hard work, yes, but also privilege. That's cultural capital. And a lot of people don't have access to that — just as they don't have access to economic resources.

One of the great things about the online era is that everyone gets a say. That's still an improvement on the old days, when white men behind desks controlled public discourse — in the media, the courts, Parliament. I was a utopian — I even wrote my PhD lauding the internet.

But we didn't foresee monetised algorithms. Carly spoke so eloquently about this. The honeypot of data. Who knew that late capitalism would profit from democracy itself? Well, it has. Look at Elon Musk — he helped put a president in the White House.

Algorithms send users down information rabbit holes. I taught media law and ethics last year to 120 incredibly bright students — Law or Media Communications. I asked them in our first class, "Where do you get your information?" Ten hands went up for newspapers — ten out of 120. They don't listen to radio. They don't watch the news. They get their news from social media. And I'm not moral panicking. But that's the reality.

Let me end — and this is the most sensitive part of my talk. I want you to understand I'm not taking sides. But I'm worried about what social media is doing to political discourse and activism.

Two days after the appalling Hamas terrorist attack on Israel — and two weeks before Israel launched its brutal retaliation

in Gaza — I went to give an evening lecture at Sydney University. On my way to the theatre, I saw a young woman wearing a Star of David, sobbing uncontrollably. I put my arms around her. She said, "I was holding it together, but when I got to campus, I had to walk through a rally where people were calling Jews genocidal — all Jews. Don't they know anything about history?" She had a nuanced view. She opposed Netanyahu and the West Bank settlements. But she was falling apart. I got her an Uber and made sure she got home safely.

That wasn't the last time I saw Jewish students or staff feeling unsafe. And at the same time, I strongly support peaceful protest. I'm no fan of Netanyahu's far-right government or many of its military actions. But what I see in some of these pro-Palestinian encampments is a kind of heat — that third-rail energy again.

Many of the protesting students are passionately opposed to imperialism — just like the Vietnam protesters of the '70s. But there's a qualitative difference. For most of them, this conflict is remote. For others — those of Muslim or Jewish background — it's personal. But for many, the activism is grounded in ideas, not lived experience.

And that raises the question: why has Israel become the limit case in colonisation debates, when most of us are standing knee-deep in colonial history ourselves, unless we're First Nations Australians?

I'll end with this. Emile Sherman and Lloyd Vogelman have a podcast called *The Principle of Charity*. They invite guests with opposing views to argue each other's position — in pursuit of truth, not victory. I did it with Clive Hamilton — who has said some pretty unpleasant things about me — on pornography. He thinks it should be banned. I don't. But we argued each other's case. And I thought, "Yeah, I'd have a glass of wine with you, mate."

My concern is the rabbit holes. In a *New Yorker* piece two weeks before Trump was elected, Adam Gopnik wrote: "We may be standing on the edge of an abyss … but nothing is wrong in the expected way. The vehemence of conflict is confined to what we might call the cultural space."[5] We live in the age of individualised collective action — the "like"-driven post. And I wonder whether performative politics on the left has eclipsed the deeper question of what we're actually trying to *change* about democracy. Because there's still so much that needs changing.

CS: Thank you, Catherine. I think we are being quite controversial — and if I can just make one comment: when I was a young mother, I got involved in Philosophy for Children. I'd been a logician, and one of the first things we tried to teach three- and four-year-olds was: listen to people's arguments. Discuss the argument, not the person. We seem to have lost that completely. I've tried to reintroduce it with my grandchildren — with great failure. They're very sick of me telling them things.

Amanda is one of the new wave of researchers working with young people and social media. Apart from her role at Western Sydney Uni, she was a faculty associate at the Berkman Klein Center at Harvard. She's worked with Sonia Livingstone on the UN's work on children's rights in digital spaces, and she led a global team gathering evidence

5 Gopnik A (2024) How alarmed should we be if Trump wins again? *The New Yorker*, October 14. An excellent prediction of Trump's first 100 days. [Ed.]

from over 700 children about digital access. I think it's worth remembering — when we debate social media — how important even electricity is to a child's life chances in rural Pakistan.

Amanda Third

I want to begin by thanking Christie for organising all of us. She had to rustle black cats at midnight to get us here today, but she's done it. I'm going to talk to you about children, social media, and democratic life — and take you on a bit of a journey. I ask you to suspend any strong beliefs, either for or against technology, and enter an imaginative space for a moment.

To be clear, I'm not an expert in civics education. While we're here to talk about educating for democracy, that's not my specific area. My expertise lies in using youth participation research methods to hear directly from children and young people — under the age of 18 — about how and why they use technology, what they get from it, and how it shapes their sense of self and their place in the world. I've led projects in over 80 countries, and what's remarkable is how consistent children's messages are. They tell us two things. First, they love their technology — no surprises there. And, second, adults, including parents and teachers, just don't get it. So I'll start with that insight.

Let's begin by asking: Should we be concerned about the future of democracy in a digital world?

That question conjures two key dynamics. First, the proliferation of digital technologies that are deeply embedded in everyday life. And, second, as Whitney Houston once reminded us, "children are the future" — an idea deeply ingrained in our culture. Educating for democracy, then, is really about how we socialise children into democratic life — how we shape the next generation. But I'd also argue that the question reveals a deeper adult anxiety: the fear that children might slip out of our control.

So, should we be concerned? The short answer is both yes and no.

Yes, we should be concerned, because children across Australia are increasingly disengaged from and disillusioned with democratic processes. In a recent study, my team and I worked with children from communities deeply affected by climate change. Across the board, they expressed feeling alienated from decision-making processes — and, interestingly, let down by adults. The word they repeatedly used was "abandoned." Now, abandonment is a form of neglect. And while you could argue it's not always severe, widespread feelings of abandonment can amount to a brewing social crisis.

It's time we listened to what children are telling us — that we are not listening.

Because they aren't seen as full citizens, children are often invisible to democratic institutions. There aren't enough mechanisms to ensure their needs, rights, and aspirations are heard and acted on. If this is how children are imagining their place in democracy, we can see how it might feed into long-term disaffection.

Yet, on the other hand, children are using digital technologies in droves to participate politically. For most young Australians, digital technologies are seamlessly integrated into daily life. For them, there's no meaningful distinction between online and offline — the digital is simply part of how they experience the world.

Our research consistently shows that children use technology to learn about, organise around, and act on issues that matter to them — mental health, climate change, and more. They are growing up in an information ecosystem that could support an exceptionally well-informed citizenry — one that could underpin a vibrant democracy.

Of course, as my co-panellists have noted, the digital world also poses challenges — misinformation, data privacy, and so on. We absolutely need robust regulation and thoughtful design to mitigate harms. But we also need to be ambitious: to harness technology's potential for democracy. That means strengthening online safety, boosting digital literacy, and exploring ways to connect children's digital practices to democratic processes. Too often, our national conversation about children and technology focuses narrowly on protection, missing the opportunities to revitalise democracy.

What we need is to imagine new "democratic imaginaries" — to reimagine what democracy can look like in a digital world.

This brings me to Benedict Anderson's concept of "imagined communities," coined in 1983 to explain how large populations — who can't all meet face-to-face — come to imagine themselves as part of a nation.[6] He described the act of reading the morning newspaper as a powerful way people connected to the idea of nationhood.

While the digital world is different — multi-directional, participatory — it still enables new imaginative possibilities. For the first time in history, children can connect with each other globally, share information, and organise. This gives them a new sense of themselves as a political constituency capable of demanding and enacting change.

And they're already doing it. Hundreds of thousands of children are using digital platforms to educate themselves, organise, and march in climate strikes. These emerging transnational democratic imaginaries could be critical to building the global solidarity we'll need to face the overlapping crises that define our era. But because these imaginaries transcend national boundaries, we need to think carefully about how to nurture and support them in democratic ways.

So, what's holding us back?

I'd argue that technophobia, our fear of technology, is a key barrier. I'm not a techno-utopian; I call myself a technological pragmatist. I've worked extensively on online safety and digital literacy, and I'm well aware of the risks. But instead of letting fear dictate our approach, we need to think pragmatically about both the risks and opportunities.

And that's hard — because when you put children and technology together, it triggers massive anxiety. Children are the bearers of our greatest hopes and our deepest fears. We project onto them. And children also make us confront how much the world has changed since we were young. That's unsettling.

Technology does the same. It reminds us how quickly the world is changing, and how little control we often feel we have over that change. Think about how you remember your first gramophone, Walkman, mobile phone. Technology marks time and stirs unease. So, when children and technology collide, it creates deep cultural anxiety.

6 Anderson B (1983) *Imagined Communities: Reflections on the Origin and Spread of Nationalism*. Verso/New Left Books Ltd.

Unless you've been living under a rock, you'll know that the federal government is proposing to raise the minimum age for social media access — from 13 to 16. This proposal was announced, controversially, on the same day as Donald Trump's re-election, in the shadow of a media frenzy.

The rationale is that social media causes undeniable harm to children, exacerbating the youth mental health crisis. And yes, some children are harmed, and we absolutely must act to protect them. But I want to highlight three problems with this debate:

First, children themselves have been almost entirely absent from the conversation. We're talking about fundamentally changing how they experience the world, and yet they've had no say. Instead, we're regulating parents' anxieties. This reinforces what children already tell us — that they're excluded from decision-making. That's a democratic failure.

Second, the evidence linking digital technologies to youth mental health issues is inconclusive. Numerous studies and systematic reviews have failed to establish causal links. Technology doesn't cause change — it is implicated in change. It's embedded in everyday life. And children use it for connection, learning, information, support, and advocacy. Many of these uses benefit their mental health. For some young people, digital spaces are a lifeline — a source of community, identity, and agency.

In today's world, where children are overprotected and overscheduled, social media may be one of the few places where they can exercise genuine agency — just as earlier generations did at the park or shopping centre. These experiences are vital for healthy development.

Third, if the goal is to hold tech companies accountable, banning children from platforms is counterproductive. It removes their obligations to young users. Children will still find ways to access these spaces, but potentially in more dangerous ways. And if something goes wrong, they may be afraid to seek help because they "shouldn't have been there." These bans have already failed in multiple European countries. What we need instead is systemic regulation that puts children at the centre.

We also need to support parents. Many are understandably anxious. But we must provide better tools and knowledge to help them realistically assess online risks, and empower their children.

So when we talk about educating for democracy, it's tempting to focus on the next generation. But what I'd like to leave you with is this: it's time to re-educate the adults. Parents need to understand the benefits, policymakers need to grasp the consequences of their actions, and we all need to do better at imagining how digital technology can serve a democratic world.

CS: Thank you very much, Amanda — an impassioned speech.

Dorothy Hoddinott: I was a high school principal in a disadvantaged public school for 23 years. I can't see any point in imposing a ban on social media for young people. I think the horse has completely bolted — and not just in terms of young people, but also in terms of adult responsibility for what children are viewing. There's a strong case for educating parents about proper supervision. We advise parents who complain that their children are going into dark places online in the middle of the night: "take all of those things out of their rooms: no television, no radio, no computers, no phones. Let them

sleep, because they actually need to sleep a lot longer than you do".

These are serious issues. I don't see how saying, "You can't access social media until you're 16 or older" is going to help. It sounds a bit like trying to regulate sex until you're 16, doesn't it? The prohibition — I don't see how the government can control that, or how it could be enforced. So, instead of that, maybe what we should be doing — and this ties into your point about teaching critical thinking, which is hard to teach — is engaging more in giving children agency, and giving them the skills to think through ethical issues and find ethical ways to navigate them.

CL: Very quickly — thank you for that. Amanda and I work together, and I'm with everything she said. But I want to bring Carly in for a second because we were both at the Sydney Institute dinner last night and heard Minister Michelle Rowland speak. She gave a lot of detail, which I didn't expect. Carly, do you want to respond to that — how it's going to map out?

CK: I'd just say that the implementation has its own problems. Essentially, what will happen is that social media companies will need to verify the age of everyone accessing their platforms. From a privacy perspective, we have real concerns about that — because now, whether you're a 15-year-old or a 55-year-old, you'll have to prove your age to use Facebook.

That creates new incentive structures to collect information. There's also talk of AI-based age verification — tools that analyse your face to determine your age. We can all see the problems with that. So you're right: the implementation is challenging and problematic. That's part of the issue.

CS: In the spirit of this discussion, is there anyone who'd like to take a contrary point of view? This is an issue that seems to have bipartisan support and almost no real debate in the mainstream media. So, this is going to go through, isn't it?

AT: There are 150 experts across the country calling for a parliamentary committee process. At the very least, we can't rush such an important piece of legislation through — it needs proper scrutiny. The detail needs to be looked at carefully. The issues Carly has raised are extremely important.

We also need to consider how a ban would sit alongside the review of the Online Safety Act, which, as of last night, now includes a statutory duty of care. It's unclear how all of these pieces fit together. Those questions need to be addressed.

CS: What's really interesting is that this takes us back to the very first session today, where Philip Pettit argued that our idea of democracy is polycentric — and that requires strong, distributed forms of control. But with this kind of legislative pace, you do worry a little.

Helen Jones: I think one reason for the bipartisan support around an age limit is that it's a knee-jerk reaction to parents who want information and support, but don't know how to solve the problem in their own homes. It seems like a quick, simple solution — which of course, it isn't.

And one silly thing: what happens to all the kids under 16 who already use social media? Are they supposed to stop tomorrow?

Q: Carly and Amanda, you both mentioned the importance of reshaping social media to make it better for young people — and for everyone, really. But thinking of something

Nick Bryant mentioned this morning, is it a kind of self-belittling to imagine that Australia, or societies like ours, can realistically influence global tech platforms controlled mostly by people in the US or China?

CK: I agree: it's a huge problem. Just look at the eSafety Commissioner's efforts to use lawful powers under various pieces of legislation against Silicon Valley-based companies.[7] Not only do these companies defend themselves forcefully, but the courts here are reluctant to issue injunctions.

They're afraid that if orders are ignored, it will expose the fact that the system has no real teeth — that the emperor has no clothes. So that's a real dilemma for regulators. Why would I take a platform to court, knowing the Federal Court won't back enforcement because they're afraid it will just be ignored, and that would undermine our legal system? I'm cynical about the prospects, but we absolutely need some kind of cross-jurisdictional consensus to tackle these challenges.

CL: I want to endorse what you're saying, Carly. Back in 2010, I did a major research report for Google with Kate Crawford, who's now a global leader in AI ethics. We looked at content regulation through a three-tier model: government, industry, and digital users. All three are part of the system.

But in Australia, there is no meaningful content regulation. I say that as a law graduate, and I know the lawyers in this room will agree. Elon Musk is a cowboy — I mean, he doxxed the eSafety Commissioner, Julie Inman Grant, and her family. It's horrifying.

One big issue we haven't talked about is the misinformation and disinformation bill. How do we meaningfully distinguish between free speech and hate speech — legally, ethically, and in the context of the internet?

CS: There's a very good recent book by Ed Coper that deals with exactly those questions.[8]

AT: I fully understand what Carly is saying, and I worry about it too. But I think there's some cause for optimism. First, our eSafety Commissioner is highly respected internationally — governments around the world are watching that office very closely.

Second, she has helped build a network of international regulators, aimed precisely at shaping these global conversations. In some ways, this push for a ban has reminded me of how much of a leader Australia actually is in this space.

Over the past few days, I've had about 30 calls from major international media outlets wanting to report on the social media ban. And I've had to say, very carefully: this is a policy driven by domestic political and economic interests. It is *not* a policy centred on the wellbeing of children. The timing — right before an election — is not a coincidence.

CS: I want to thank our speakers, who moved the discussion very effectively toward the next generation.

7 See Inman Grant J (2024) How a single letter changed the world: W×3 — the World Wide Web (we weaved). *Journal & Proceedings of the Royal Society of New South Wales* 157: 266–284.

8 Coper E (2022) *Facts and Other Lies — Welcome to the Disinformation Age*. Allen & Unwin.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 142–150. ISSN 0035-9173/25/010142-09

2024 Royal Society of New South Wales and Learned Academies Forum: "Threats to Democracy"

Closing Session: Panel Chairs and reports and open discussion[1]

The Hon. Michael Baird AO (Chair), Chief Executive, Susan McKinnon Foundation
annabel.andrews@susanmckinnon.org.au

Mr Peter Varghese, Chancellor, University of Qld
chancellor@uq.edu.au

Emeritus Prof. Peter Shergold, Vice-President, RSNSW
p.shergold@westernsydney.edu.au

Prof. Sally Cripps, Director, Technology, Human Technology Institute, UTS
sally.cripps@uts.edu.au

Emeritus Prof. Christina Slade; Chair, Forum & Program Cttee, RSNSW
christinamslade@outlook.com

Michael Baird: I've started a new role at the Susan McKinnon Foundation.[2] It's an organisation that believes in the power of better government and the impact that can have on a stronger Australia. We've heard a lot about where government has failed today, but there is a belief that good government can make a difference. We have had good leaders and good government. One of the things we have done at McKinnon is to acknowledge political leaders who have done great things. Next week we're acknowledging Dominic Perrottet and Chris Minns, who ran a state campaign that didn't go into personal attacks. It was quite respectful, and it stood out: you can have discourse in a respectful way on policies and not bring people into it. That's being acknowledged. Bridget Archer is being acknowledged for standing up against corruption by having an independent national commission against corruption. We have to celebrate democracy and good leadership. I can tell you, as a political leader — and I stand here as one of those in the last 25 years who didn't get a great rap — there are good examples of political leaders, and we need to hold to account those who aren't, and celebrate those who are. Political leadership, our institutions, and democracy have never been more important than right now. That's why we're here today.

I'll just give a quick outline, trying to synthesise what I heard today — some of the key issues — and a quick reflection, then one point that you, the panellists, think is a takeaway, and then we'll go to the room.

This is what I heard today: it is polycentric: there are multiple elements to democracy and the problem. A big part of it is where governments haven't focused on the long term, and that has started to break down. The performance and delivery, the listening, the policy that's addressing the real issues,

1 This is an edited transcript of the session, which can be viewed at https://www.youtube.com/watch?v=mq4M7EPcF2g

2 https://mckinnoninstitute.org.au

the challenges they're facing are not being addressed. That then leads to a loss of trust in governments and institutions. People are feeling less optimistic — as we heard in terms of some of the data — with a lower quality of life. Good government should enhance the capability of our leaders, giving them the research and policy to attract more talent into the public service — part of what we're doing at McKinnon. But the things I heard today where we need action or attention were brought to light in quite graphic ways: we need more participation — this came through strongly — more information, and things like transparency, using collective intelligence through the integrity of data. Engaging our young people seems like a dominant theme. More partnerships — the "democracy sausage" — I like that because it's quite easy to understand. It's celebrating democracy, something that we take for granted. It's so important: compulsory voting on a Saturday. We get together with differences and we vote different ways as we go in, but we're one, and that was a really good message. Misinformation and disinformation came up. Katherine raised the "third rail," and I'll reflect on this before I hand to the panel. I participated in the Voluntary Assisted Dying debate. It doesn't matter what my view was or where I went, but this struck me: I had a position where those against were many and quite aggressively opposed, but there was a group in the middle who said, "Thank you for your contribution, because, even though I disagree with you, I felt you listened; I felt that you were doing it in a respectful way." It was very simple, but I thought in these sorts of debates where people are actually willing to listen to both sides and have an understanding that your view is different. We seem to have lost that. That's something that's stuck with me.

So, I'll go to the panel. Peter, anything you think we should focus on?

Peter Shergold: My reflection on the day comes back to that wonderful opening session. It seems to me that the strengths we've got in Australia are partly due to that small part of democracy: the contest. I actually think we do it well: we've got an independent Australian Electoral Commission, we have compulsory voting, and we have a system where, time after time, the leader of the party that loses the election accepts that with good grace. These are important things. Going back to the democracy sausage, there is one issue which I think is important. I don't think we're thinking through enough what the impact is of increasing numbers of people in every election voting early, even before the campaign has scarcely begun. I think we need to think that through.

But the part where we've got to make change is what happens during the three or four years between elections. You've got to somehow make sure that people know that there is democratic governance going on between those elections. We know there are different ways we can do it, but we're doing it to a limited extent. I think what people are increasingly feeling is that elites get a voice through lobbying, but many people are not having that same impact. I think there is a challenge here. I think we saw it in the 2023 Referendum[3] of people being sick and tired, as they see it, of being told how to think by those at the top. We've got to find ways in which we can engage people,

3 The 2023 Australian Indigenous Voice Referendum.

including young people, in our democratic processes. I heard that time and time again during the day.

Peter Varghese: I think the quality of democracy tends to go in cycles, and at the moment, globally, it's in downturn. If I were to try and put my finger on what's at the heart of this, I think politics struggles with substance in the current environment, and that leads to large levels of dissatisfaction. It leads to a sense that the political system is not paying attention to what matters most, and it erodes trust. A political system that's delivering substance will not have any of those problems at the end of the day. The question is: how do you get to that point?

I think it's easy to be very critical and dismissive of the quality of political leadership today and say, "Just go back to the Hawke/Keating/Howard days and pursue a big agenda." But this is a difficult environment for political leaders to actually pursue a big agenda, in part because their political antennae, in my view, have been completely distorted by social media and technology. Old-fashioned politicians — and you'd know this, Mike — had an instinctive feel for where the centre of gravity of issues lay in the community. I think the current generation of politicians really struggles, so anything we can do to signal the value of substance as voters and as members of the community can help us move away from "politics as sloganeering" to politics as substantial delivery.

I'll make one other point, and that is the public service has an important role to play in this. I think at the moment the way the public service operates does not help with bringing substance before political decision-makers. For the most part, our public service, which is staffed by bright people, is focused on second- and third-order issues, because they happen to be first-order political issues, and the first-order substantive policy issues are, to use Katherine's term, the third rail. In other words, you can't go near them. So we need to find a way to shift that culture in the public service and give the public service more room for genuinely "frank and fearless" — to use the cliché — advice to go to ministers.

If I can end on an optimistic note: genuine democracies, in my view, in the long term, are self-correcting because they are, by design, intended to respond to the will of the people and what people want. So I know we'll go through periods of despair in this discussion, but I remain a long-term optimist about the ability of democratic systems to self-correct.

Michael Baird: As a modern politician[4], I can understand that, but I'll pick up on two points. First, I think that the public service has the substance issue — and knows it. One of the things that kept me awake at night was the long-term gap in health funding. We do not have the capacity — the revenue — to meet the health needs of the community, not just now, but in the next ten years. So why are we not dealing with that? That was a challenge, and the public service has ideas and approaches. So, how do we get that sort of issue to the top on substance? The second point is connected: in the last state election, Dom Perrottet took a strong view on gambling reform. There are lots of vested interests in that. He was attacked in many

4 Baird was the 44th Premier of New South Wales, the Minister for Infrastructure, the Minister for Western Sydney, and the Leader of the New South Wales Liberal Party from April 2014 to January 2017.

different ways. But interestingly, what came through in terms of research is that people resonated with it because he was standing up against those interests, as there is a view that all lobbyists run around behind closed doors. He was making a stand on actual policy that's going to make a difference to people who are vulnerable. It came through in his polling. So, it's the substance of an issue, in taking a stand. Good policy can be good government. There's a social media site led by donkeys, and it goes around highlighting poor political leadership across the world with ridicule. There's plenty of material.

Sally Cripps: I'm going to come out of the closet as a technological optimist in terms of democracy. While I understand the very real concerns around social media, I think it is too easy just to blame things on social media and then talk about shutting it down for children. I will give a few reasons why I think this. I really loved the last session because that spoke to a lot of work I've been engaged in. What I've noticed: the printing press was an enormously democratically empowering piece of technology, and empowering communities with digital technologies for communication amongst themselves and to politicians is equally empowering. We have messed it up, but that doesn't mean we can't get it right going forward, just as the printing press, when it came out, was going to be the end of the world.

One of the reasons I feel so strongly about this is two experiences: one of them was meeting Audrey Tang,[5] who at the age of 15 mobilised the youth of Taiwan via digital platforms. He had algorithms designed to tell people what they really had in common. The upshot of it was they used this to get the education department to change practices in classrooms, and that was a 15-year-old using technology. When I talk to people about that here, all I'm told is that's Taiwan, we're different, don't try it. I think that it may just be Taiwan — we may not get there, but to just dismiss it and not even try it is really not very courageous of us. I think we need to be a bit more courageous than we have been. I'm really pleased to say that I've been working with the Department of Education. I think the way forward in terms of engaging people who make policy, improving democracy, is to recognise their fears. The Department of Education initially made us take AI out of everything we were doing, but we have now got to a point where they are talking to us about using their chatbot in classrooms to collect data in real time. They haven't actually signed on the dotted line, so I'm not counting my chickens before they hatch, but to understand what's going on in the classroom — what works, what innovations help children finish school well. I want to end on that note.

I think I just want to take my hat off to the last session because we're focusing too much on our fears and not enough on the next generation coming through and what technology actually could do for them if we had a serious attempt at making it work in a really positive way.

Christina Slade: I want to start by going back to what I thought was quite an inspirational first, theoretical piece, because what it did was throw the responsibility straight into our court. The polycentric model means that our Royal Society, the civil service — all these other parts of the structures which

5 https://www.britannica.com/biography/Audrey-Tang

support an elected democracy — have got to stand up and start being engaged. I think that is a very good message for us because we're part of the groups where we're discussing these and trying to think of ways forward. I found that very helpful. On the other hand, I quoted Ed Coper, who has a fantastic new book.[6] He said tweaking the algorithm of what information we digest will not reinvent the "golden age of journalism" or restore trust in honest politicians. So, the issue is not for us to try and think nostalgically about what was actually never as golden as all that. Indeed, in my lifetime, Rupert Murdoch moved to Adelaide, where I was born, and set up the News. So there's been ups and downs all the time, but we do need to be really proactive, thinking not just about children but about these new technologies, and working closely with the regulatory structures. I think that what Carly has done — this battle where she says we need technology and regulation in privacy law — that's the right way for us to think about it.

My colleagues in the World Trade Organization community are appalled because what happens if you have more data regulation is that digital international trade slows down, and less free trade pushes up prices. I'm not an economist, but that's what happens. So, it's going to have impacts, and we're going to have to think about those to and fro. I feel very much the same about social media and children. Of course, we worry about this, so we need to start thinking about it. The other side of the polycentric model is the community. It really does mean that we need to be more engaged. I found today very interesting. I thought that *Strengthening Australian Democracy*,[7] which Jeni Whalan talked about, was actually a case study in polycentric action, and it's quite impressive. I've only looked at a few pages of it, but I do think that we're all going to have to stand up and start thinking about it, thinking about things we don't want to think about — like pornography on the internet, which I don't want to think about.

MB: I think that's a good balance from the Panel. There are obviously concerns and various actions and approaches, but also optimism. I think it's the two together that are a big part of today. Does anyone want to comment?

Michael Baume: I'm one of the old politicians. In his excellent keynote address this morning, Professor Pettit talked about democracies, and he said the health of democracies depends on the strength of the checks and balances that are present. We see around the world systematic attempts to dismantle checks and balances in many countries. President Trump has said that he'll dismantle one of the checks and balances in the Department of Justice. Prime Minister Netanyahu tried to make the judiciary subsidiary to the Knesset. What should be done to protect those checks and balances?

PV: I thought one of the many interesting things that Philip Pettit said was that elites are playing a very important role in anti-majoritarianism, in constraining majoritarianism. To my mind, there are both positives and negatives. What is to be done is to remain constantly vigilant

6 Coper E (2022) *Facts and Other Lies — Welcome to the Disinformation Age*. Sydney: Allen & Unwin.

7 Strengthening Democracy Taskforce (2024) *Strengthening Australian Democracy: A practical agenda for democratic resilience*. Dept. of Home Affairs, Commonwealth of Australia.

about the weakening of guard rails and institutional scaffolding that support democracy. That includes the rule of law, the independence of the judiciary, the integrity of electoral machinery, and maintaining a broad social consensus on red lines in the public sphere. You can have different views about many things, but a democracy that doesn't understand its red lines is in trouble. We will see how far Donald Trump goes in dismantling many of those guard rails. He may succeed in going very far — potentially even eliminating the concept of a conflict of interest from government. That is a serious risk. That said, it is important for elites to uphold guard rails. However, they should not constrain majoritarianism by dictating what is acceptable in terms of thought and expression. That is a risk for democracies, and elites — of whom there are many in this room — need to be careful not to cross that line. I hope that helps.

PS: I'd like to follow up and turn the coin over. I agree with the need to strengthen elite institutions, including the public service. But it is equally important to support and strengthen civil society organisations. It is no surprise that governments leaning towards authoritarianism often try to weaken or eliminate civil society organisations that stand up fearlessly to anti-democratic trends. We must strengthen both elite institutions and civil society, allowing more opportunity for individuals and organisations to participate in democracy beyond just voting.

MB: Two points. First, the onus is on us and leaders across the system to stand up when safeguards are challenged. The Electoral Commission has come under attack — not as severely as in other countries, but still enough that we must defend it. We must use our influence to stand up for what we believe in. Second, I reflect on the experience with the teals. They were marginalised and attacked in many ways. Simply put, the community felt they weren't being listened to or prioritised. I'm in teal country, I know the community — they did not feel heard. That applies across all politics and leadership. The more the community feels engaged, the more those safeguards will remain intact.

Q: As a sociologist, I followed today's discussion with great interest. It seems the main lesson is that the modern nation-state developed in parallel with rising literacy and national media. In the past 20 years, the idea of the nation has splintered into bubbles of interest and culture. How does a national state like Australia create an inclusive, reimagined nation to reintegrate particularly young people who no longer feel connected to a now historic idea of nation?

CS: I think that's the right question, but I have two contradictory thoughts. When my husband and I were in Mexico, we hosted Anzac Day. We invited backpackers from across the city, and they came to the residence for breakfast with a strong sense of national belonging. These were backpackers from every ethnic background. That really gave me a jolt — I'm a '70s kid and we didn't attend Anzac Day. So, there are sources of national connection. But what that imagined national identity looks like — whether it's national or transnational — is another question. Do we foster it? I'm not sure I want to. Nationalism often leads to war if unchecked. I would ask the sociologist: how do you think we should move forward? This isn't my area. I just think all children should learn rigorous philosophy and logic from the age of three.

SC: That's a great question — what fosters belonging? At the micro level, what makes a school tick is a sense of belonging. That sense of belonging varies — there's no single recipe. I'm a big believer in the scientific method, and with digital technologies we can learn rapidly what works. This empowers communities to adapt and share solutions. Communication is key. The one thing I would hate to see shut down is communication — even if the channels aren't ideal, we need to fix them, not eliminate them.

PV: I would add: in a diverse country, the only path to unity is unity of values. In Australia, that means values based on a secular liberal democratic tradition, with some uniquely Australian characteristics that give it a particular texture. Diversity alone isn't a basis for unity.

Des Griffin: I agree with Peter. The absence of shared values is a major issue. Democracy, as I understand it, is built on the idea that involving more people in decision-making leads to better outcomes. But it's been distorted by powerful interest groups and a toxic, oppositional culture in public discourse. Abuse has replaced kindness. This behaviour gives social permission for violence and polarisation. The 2023 Referendum debate was full of hideous statements. No effort was made to understand the underlying issues. This happens elsewhere too — like with debates on social media and children. Children are never asked their views. The education system is failing them, and they're excluded from policy discussions that affect them.

MB: Thank you. That connection to young people and the need to bring people together — the polarisation is real. There's a group in the UK called *More in Common*[8] that does amazing work facilitating respectful debate. It encourages leaders to see both sides and focus on shared values.

Vince di Pietro: A major threat to democracy is the disenfranchisement of regional and rural Australia. I led the recovery committee for the Currowan Bushfire, which devastated 82% of the Shoalhaven. City residents have more options: cheaper energy, better telecommunications, safer infrastructure. In regional areas, there are single roads in and out, vulnerable to disaster. Census data gathered in the months of August dictate whether or not we invest in telecommunications and power, which is totally inadequate for the number of people who visit regional and rural Australia in the summer months for Christmas holidays and in the winter months for skiing. The net result of that was that during that fire we had situations where if people could get to a petrol pump, they couldn't pump it because the power was out, and if they could pump it, they couldn't pay for it because the mobile phone network was out. Nothing has changed since. This neglect poses a threat to democracy, especially since 85% of national defence capabilities operate in those regions. People have lost trust in leadership.

MB: Thank you. That's a powerful point and an important one. I know how hard that work must have been and how deeply it affected those communities.

Erica from RSA: FOMO — fear of missing out — is a real threat to democracy. Academics call it "relative deprivation." It's when people believe they're missing out compared to others — that newer communities, for

8 https://www.moreincommon.com/about-us/our-dna/

example, are getting better opportunities. Politicians can exploit this. The ultimate threat to democracy isn't technology, it's people. When politicians use deprivation narratives to win votes, how do we work with them to stop fuelling distrust in our institutions?

MB: I'll give one example that addresses both trust and policy. For years, infrastructure was planned based on political needs rather than public good. An independent authority was set up to prioritise projects — schools, hospitals, roads — transparently. Governments didn't have to follow it, but if they didn't, they had to explain why. It also quarantined funding for regional NSW. While not perfect, the mindset was to govern in the state's best long-term interest. When people see sensible, fair decisions, they gain trust. That approach helps.

John Timmons: Three-year terms lead to short-term policies and populism. The UK's five-year terms might be too long, but how can we move the federal government to four-year terms?[9]

MB: I can speak for McKinnon here. We're running a program on this, with Peter Shergold involved. Both major parties have said they're open to four-year terms. Under the current system: year one is for implementing promises, year two for action, and year three is an election campaign. It's chaos. Four-year terms offer stability, trust, and better governance. But no government wants to spend political capital on it — it's too easy to be accused of trying to stay in power longer. That's why groups outside the system must lead. If you can build bipartisan support and engage the public with the real benefits, it can happen.

Ian Walker, New Democracy: Governments love regulation in areas like social media but seem devoted to self-regulation when it comes to democracy. As Jeni mentioned, innovation is key. Is it the role of groups like ours to disrupt that complacency?

PS: Yes, I believe it is. These pressures need to be applied to government and parliaments. Sometimes, we do it by demonstrating what works — you've done that through direct democracy initiatives. We must take responsibility for encouraging leaders to implement needed reforms. Most reforms should strengthen democratic processes not just during elections but every day of the year.

Tibor Molnar, Sydney University: I want to return to the forum title: "Threats to Democracy." I once heard Joe Hockey say Australia should "wind up the economy to create more jobs." That's backwards. You create jobs, and the economy grows. Similarly, democracy is a symptom of a healthy civic society. If you build an egalitarian, idealistic, functioning society, you get democracy for free. So perhaps we should be asking: what are the threats to civic society, not democracy? What fundamental issues do we need to address?

MB: Good point. I think they are connected, not separate.

CS: I would add that in the polycentric model discussed this morning, it's up to all of us to do what we can.

9 Of the world's 186 nations with active legislatures, just over half have five-year terms, and 40 per cent have four-year terms, according to Gary Nunn in the *SMH* of April 28, 2025, p.22. [Ed.]

SC: Spaces like this one — third spaces — are crucial. Thank you for organising it. This is how we address those threats.

MB: Agreed. You won't get everything resolved in one day, but collectively we've raised a broad range of ideas. We've identified threats and opportunities, and multiple stakeholders are engaged.

Let me finish by thanking Her Excellency the Governor for returning and for lending us her House. Thanks to all the staff — you did an amazing job. And congratulations to the Royal Society. These kinds of days are genuinely helpful. I've been challenged, and our future work will be shaped by today. The more people work together on these issues, the better chance we have of success. Thank you to everyone who participated.

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, p. 151. ISSN 0035-9173/25/010151-01

Thesis abstract

Defining the molecular details of hSSB1 oligomerisation in response to oxidative DNA damage

Serene El-Kamand

Abstract of a thesis submitted to Western Sydney University

Cells are constantly exposed to sources of oxidative stress. If left unrepaired, the oxidative modification of DNA can result in a loss of genome integrity and may lead to diseases including cancer. The most common form of oxidative DNA damage is the oxidation of the DNA base guanine to the highly mutagenic 8-oxo-7,8-dihydroguanine (8-oxoG). To protect the genome from mutagenesis, the modified base is removed through the process of Base Excision Repair (BER). Single stranded DNA binding proteins (SSBs) are a family of proteins that act to protect the genome from mutagenesis by recognizing and binding to sites of DNA damage, where the DNA is unwound into its single strands. Human Single Stranded DNA binding protein 1 (hSSB1), a novel human SSB, is crucial in the removal of 8-oxoG from the genome through the BER pathway. Previous research has found that the ability of hSSB1 to form dimers, tetramers and higher aggregates (through the formation of disulfide bonds at the C81 and C99 residues) under oxidative conditions is critical in its function in BER. This thesis examines the molecular details of hSSB1 oligomerisation in response to oxidative DNA damage and the mechanism by which the hSSB1 oligomer binds DNA. In this work Nuclear Magnetic Resonance (NMR) spectroscopy and Surface Plasmon Resonance (SPR) experiments are used to determine how oligomeric hSSB1 binds ssDNA and ssDNA incorporating 8-oxoG bases. The findings reveal that binding of non-reduced hSSB1 to 8-oxoG ssDNA is indistinguishable to its binding to unmodified ssDNA, indicating no change in the underlying mechanism. Further, using SPR I show that non-reduced hSSB1 binds more strongly to ssDNA than reduced protein, confirming that hSSB1 oligomers recognise ssDNA with a tighter binding affinity. To determine the structural basis of these oligomeric hSSB1-ssDNA interactions 2D 1H 15N HSQC NMR titrations were carried out with ssDNA oligos of varying length. The data reveal that ssDNA binding takes place via hSSB1 tetramers that are structurally identical to the ones that were previously described in the absence of ssDNA and suggests that hSSB1 binds DNA bi-directionally. Additionally, using 2D 1H-15N HSQC NMR and 2D 1H-1H NOESY NMR experiments, I show that the hSSB1 oligomer unwinds damaged dsDNA and binds to its single strands.

Dr. Serene El-Kamand
Brain and Mind Institute
University of Sydney

E-mail: serene.el-kamand@sydney.edu.au

URL: https://researchers.westernsydney.edu.au/en/studentTheses/defining-the-molecular-details-of-hssb1-oligomerisation-in-respon

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 152–153. ISSN 0035-9173/25/010152-02

Thesis abstract

Investigating changes related to gender equality in water, sanitation and hygiene: transformative approaches and opportunities

Jessica MacArthur

Abstract of a thesis submitted to University of Technology Sydney

The (re-)emergence of a gender-transformative model of development has challenged the narrow women's empowerment paradigm to engage in a more nuanced conversation in development research and practice. Gender-transformative programs aim to transform gender dynamics and structures within and through development interventions. In parallel, the evaluation field has been considering opportunities to apply gender-transformative approaches to assessments. Hence, there is both opportunity and imperative to investigate how assessments can meaningfully explore and foster gender-transformative change in the development sector. This inquiry focused on a particular subsector of development — water, sanitation, and hygiene (WASH) — which is in the early stages of engagement with gender-transformative approaches. This methodological inquiry adopted a collaborative action research approach and partnered with a sanitation program in Cambodia to investigate opportunities for innovative and qualitative forms of gender-transformative assessments. Through a compilation of eight studies, the inquiry reviewed, designed, piloted and evaluated practitioner-focused gender-transformative assessment approaches. The inquiry focused on the creative use of two visual storytelling assessment practices: micronarratives and photovoice. First, the inquiry critically reviewed relevant literature from international development and the WASH sector, to investigate methodological and conceptual alignment with a gender-transformative approach. Second, the inquiry clarified the extent to which assessments can be designed to meaningfully explore gender-transformative forms of social change. Last, the inquiry considered how assessments can foster gender-transformative change by strengthening their transformative potential. Together the eight studies clarify definitions of a gender-transformative approach in the WASH sector and provide insights on how to strengthen the transformative potential of assessments. The studies indicate that design considerations such as respondent-led interpretation and centring embodiment, can help programs to meaningfully explore gendered change. The studies suggest that gender-transformative potential in an assessment approach requires: (1) assessment quality, in terms of overall assessment rigour; (2) efficacy to ensure elicitation of gender-related insights; (3) inclusivity throughout all stages of the assessment process; (4) reflexivity to be cognisant of power dynamics and structures; and, last, (5) a purposefully transformative objective in pursuit of gender-transformative change. Throughout the thesis, I argue

for the purposeful integration of investigation and intervention, in an expanded definition of the transformative paradigm of research and evaluation. I suggest that gender-related assessments provide a distinct opportunity to raise critical reflection and catalyse critical action amongst both participants and evaluators. Adopting the methodological advancements and insights generated through this thesis, the WASH sector has potential to better explore and support gender-transformative change.

Dr Jessica (Jess) MacArthur
Institute for Sustainable Futures
University of Technology Sydney

E-mail: jessica.macarthur@uts.edu.au

URL: http://hdl.handle.net/10453/169182

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 154–157. ISSN 0035-9173/25/010154-04

Thesis abstract

Effect of agricultural certification on smallholder coffee producers in Vietnam

Thanh Hien Nguyen

Abstract of a thesis submitted to the University of New England

Coffee is an important commodity traded globally and a primary source of income for millions of households around the world, including in Vietnam.[1] Despite its significant socio-economic role and impact on rural landscapes, there are concerns about the bio-physical and socio-economic sustainability of coffee production. Certification schemes such as Organic, Fairtrade, and Rainforest Alliance offer the potential to enhance environmentally friendly farming practices and build the resilience of livelihoods for smallholder coffee farmers and their local communities.

This thesis examined the adoption, outcomes, resilience, and challenges of certification schemes in coffee production. The research explored the main factors influencing certification adoption, how these certifications influence farmers' ability to cope with challenges (resilience), and the involvement of various stakeholders in supporting the certification process. The research is structured around three primary questions: the drivers behind certification adoption, its role in enhancing farmer resilience, and the efficiency of supporting bodies.

Existing studies about the adoption and impacts of coffee certification schemes have explored the factors affecting farmers' decisions to adopt certification programs and the resilience that these programs generate for coffee growers. While a number of organisations offer support for certified coffee production, the level and effectiveness of support in Vietnam and the effectiveness of these support interventions varies. This research sets out to bridge the gap, in the unique context of the Central Highlands region of Vietnam.

Previous studies have investigated the relationships between farmer demographics, farming systems characteristics, and the financial and marketing factors that determine the uptake of certification programs. A significant amount of attention has also been paid to the role that certification plays in enhancing resilience among coffee farmers. Furthermore, various organisations, both private and governmental, have been known to offer support to stimulate and broaden the reach of certified coffee production. Despite this, there is an evident gap in understanding the unique challenges associated with certified coffee production in specific regions like Vietnam. Additionally, questions remain about how effective these support initiatives truly are in promoting certification and whether there is a cohesive story that ties adoption, resilience, and support efforts together. This research contributes to bridging these knowledge gaps, providing a comprehensive understanding of certification adoption processes,

1 Doctoral Chancellor's Medal Award March 2024

their impacts on resilience, and the role of support entities.

We employed a mixed-methods approach, incorporating both quantitative and qualitative data collection and analysis. Our fieldwork spanned two primary coffee-producing regions in the Central Highlands of Vietnam, Quang Phu commune in Dak Lak province and Nghia Hung commune in Gia Lai province, areas renowned for their contributions to global coffee output and featuring extensive use of certification schemes. Data collection methods encompassed household surveys, focus groups, and key informant interviews, including 219 household surveys (92 certified and 127 uncertified), ten focus groups, and 20 interviews. A range of topics were covered, such as the characteristics of respondents, their motivation for the adoption of certification, their perceived resilience due to specific shock and stress, and the effectiveness of supporting interventions. Data analysis methods were chosen based on the research objectives and the nature of the data, prioritising validity and reliability. The adoption of certification was modelled in three distinct ways: whether certified or not certified, the duration of certification, and the percentage of farmland allocated to certified coffee production. Analytical methods included descriptive analysis, significance testing, and the use of logistic and Tobit regression (adoption), and multiple regression (resilience). To assess resilience, the framework of five Livelihood Capitals was used.

Our research indicated that several factors influenced certification adoption, and that these determinants varied depending on the way adoption was measured: (1) adopted certified coffee production or not (binary), (2) duration of adopting certified coffee production, and (3) proportion of land used for certified coffee production.

In the socio-demographic dimension, the impact of certain factors on adoption varied. Age, education, and gender significantly correlated with the duration of certification adoption, while education was the only factor influencing the proportion of land used for certification. In the physical dimension, larger farms showed a positive correlation with certification adoption but a negative correlation with the proportion of land used for certification. Distance from the household to the communal centre did not significantly impact adoption or certification duration, but it had a negative correlation with the proportion of certified land. The labour-to-land ratio had varied effects, with no impact on certification adoption, a negative influence on certification duration, and a positive effect on the proportion of certified land. The number of coffee plots did not correlate with decisions to adopt certification nor with the duration of certification, but households with more plots allocated a higher proportion of land to certified coffee. Regarding support dimensions, affiliation with organisations and training positively affected both the likelihood of adopting certification and the land area certified. In the financial dimension, households with significant non-coffee income initially exhibited reluctance towards certification. However, once committed, they typically maintained certification and allocated more land to it, highlighting the role of financial stability.

Certification appeared to have a positive impact on the resilience of smallholder coffee farmers. The key threats were drought, disease, flood, and price volatility (shocks,

stresses). Resilience was reported to be influenced by factors such as a farmer's willingness to take risks, plot size, and certification. Additionally, the types of challenges that farmers faced also determined the coping and adaptive strategies employed by coffee farmers. In response to market shocks, farmers demonstrated a focus on diversification by incorporating additional crops alongside coffee, such as durian, pepper, and avocado. In contrast, when faced with drought, coffee farmers implemented alternative measures, including digging or deepening wells, purchasing water, and adjusting watering schedules.

Certified practices were associated with improvements in farmer livelihoods, notably their financial, human, and social capital, thereby enhancing resilience. The link between the adoption of certified farming practices and increased resilience suggested that farmers open to sustainable practices like certification were better equipped to cope with adverse events such as drought and price volatility. Farmers with multiple coffee plots displayed greater resilience, indicating the potential benefits of farming systems diversification and technological experimentation. Farmers with greater resilience tended to employ fewer coping and adaptation strategies. This suggests that more resilient farmers were proactive rather than reactive in their approach to adaptation.

Regarding the entities involved in the certification process, including support for adoption, our research identified coffee processing and trading companies, certification bodies, extension providers, and banks as crucial players in advancing sustainable certified coffee farming in the Central Highlands. These groups supported farmers by offering capacity building (training, technical consultation), input assistance (seeds, fertiliser), and market and financial incentives (low interest, contract farming). The findings underscored the value of collaboration across sectors to promote the adoption of coffee production.

The study also highlighted inconsistencies in the suitability and impact of these support interventions. Specifically, market and financial measures were often viewed as less impactful than capacity building and input assistance, pointing to potential areas for refinement. Additionally, we identified challenges within the certification realm, such as uneven benefit distribution, difficulties in complying with standards, low coffee farm-gate prices, and increased workloads. Female-led households often experienced increased workloads due to certification, including more work related to harvesting and weeding. They also reported challenges in fully complying with standards compared to men. These challenges could hinder broader certification adoption.

Addressing these issues could increase the wider acceptance of sustainable practices in the coffee sector in Vietnam. Notably, despite the growth of digital channels, traditional media and interpersonal networks remained vital for conveying information to farmers. This implied a continued need for blended communication methods that cater to farmers' diverse preferences, enabling them to make well-informed choices that advanced sustainable farming.

In conclusion, this research emphasised the role of certifications in fostering sustainable practices, evaluated key adoption factors in terms of adoption per se as well as duration of certification and land allocation for certified coffee production. Common

shocks and stresses were identified, as were the various adaptive strategies used by certified and non-certified coffee producers in the study areas. The potential for certification to enhance resilience of coffee growers was noted. Finally, the contributions of supporting entities to increasing the adoption of certified coffee production were evaluated from the grower perspective.

The ramifications of our findings span both practical applications at the local and regional levels, and policy development at the provincial and national levels. Policymakers and certification organisations should carefully consider the various elements influencing certification uptake. Simplifying and democratising these processes is essential to ensure fairness and accessibility, particularly for smallholder farmers. Current and future policies, coupled with support structures, should be adaptive and prioritise minimising the financial and administrative compliance burdens of certification. This approach is more likely to empower smallholder farmers to navigate the certification landscape more efficiently, upholding required standards without unnecessary hardships while maintaining their certified status and increasing the proportion of coffee-growing land that is certified. Future research could benefit from a focus on regional differences and a closer examination of various certification systems, offering insights into localised challenges and opportunities and illuminating the strengths and weaknesses of diverse certification models.

Dr Thanh Hien Nguyen
School of Environmental & Rural Science
University of New England

E-mail: N.HienHVN@gmail.com

URL: https://rune.une.edu.au/web/handle/1959.11/60295

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, p. 158. ISSN 0035-9173/25/010158-01

Thesis abstract

Cultural responsiveness: a conceptual model for mental health professionals engaging with Aboriginal and Torres Strait Islander People

Peter John Smith

Abstract of a thesis submitted to the University of New England

Cultural responsiveness is a term that has become more commonly used by a wide range of organisations and disciplines when referring to the ways in which mental health practitioners work and interact with Aboriginal and Torres Strait Islander people.[1] Within the discipline of psychology cultural responsiveness is seen as a fundamental learning and skill area for all practitioners and has become an essential feature of the psychology curriculum taught in universities. However, the concept has lacked clear definition, understanding and measurement.

Through a series of peer-reviewed journal articles, this thesis comprises four components focused on cultural responsiveness when working with Aboriginal and Torres Strait Islander clients. Initially, the literature is reviewed using a concept analysis, which then formed a foundation for a conceptual model of cultural responsiveness which the author has called Foucault's Oscillation. Following this, a qualitative study involving 12 participants who identified as Indigenous Australians and who were former clients of mental health practitioners were interviewed using a semi-structured format based on the conceptual model. Adopting an Indigenous Standpoint Theory approach, and listening to their stories, it was crucial both culturally and from the perspective of fuller understanding to afford these people a voice in shaping a sense of meaning of cultural responsiveness.

The fourth and final part of this study sets out the process of designing and validating an instrument to assess cultural responsiveness, which the author has called the Cultural Responsiveness Assessment Measure (CRAM). A Qualtrics survey assisted in the gathering of data from a sample of 400 respondents whose contributions led to a nine-factor instrument that can help mental health practitioners to evaluate and to improve their interventions with Indigenous clients.

Dr. Peter John Smith
School of Psychology
University of New England

E-mail: Peter.Smith@une.edu.au

URL: https://rune.une.edu.au/web/handle/1959.11/57950

1 Chancellor's Doctoral Research Medal 2024

Journal & Proceedings of the Royal Society of New South Wales, vol. 158, part 1, 2025, pp. 159–163. ISSN 0035-9173/25/010159-05

Royal Society of New South Wales

Awards 2025

The Royal Society of New South Wales has long recognised distinguished achievements in various fields of knowledge through its Awards. Some are amongst the oldest in Australia while others are more recent. From its Act of Incorporation in 1881, the Society's mission has been to encourage "studies and investigations in Science, Art, Literature and Philosophy."

Nominations for all available Awards open on 1 July each year and close on 30 September. Awardees are announced by the end of that calendar year with formal presentations of their Awards in the following year. Almost all nominations require a nominator and a seconder. All RSNSW Awards are assessed relative to opportunity.

See the Awards page for all links, at https://royalsoc.org.au/awards.

Career Excellence Medals

Nominations for Career Excellence Medals are called for annually in the four categories described below. Please note that the call for nominations for all awards opens on 1 July and closes on 30 September of each year.

RSNSW Aboriginal and/or Torres Strait Islander Scholars Medal

Awarded for sustained, meritorious contributions to knowledge and society made by scholars identifying as Australian Aboriginal or Torres Strait Islander and conducted mainly in NSW. Recipients may be resident in Australia or elsewhere.

The application procedure for this Medal is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

Note: When appropriate, this Medal recognises teams as well as individuals. Nominators are welcome to consult the Society for guidance before making a team nomination, noting that only one physical medal is presented.

RSNSW James Cook Medal — for lifetime career contributions

Awarded for the most meritorious lifetime contributions to knowledge and society in Australia or its territories made by an individual and conducted mainly in NSW. The recipient may be resident in Australia or elsewhere.

The James Cook Medal was established by Council in 1943 following a donation made by Henry Ferdinand Halloran to celebrate his 50 years as a member of the Society and it has been awarded periodically since 1947.

The application procedure for this Medal is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Edgeworth David Medal — for mid-career researchers

Awarded for the most meritorious contributions to knowledge and society in Australia or its territories, conducted mainly in NSW by an individual who is from 5–15 years post-PhD or equivalent on 1 January of the year of the award, together with signs of leadership. The recipient may be resident in Australia or elsewhere. All assessments consider interruptions and performance relative to opportunity.

The Edgeworth David Medal was established by Council in 1943 in honour of Sir TW Edgeworth David FRS, who compiled the first comprehensive record of the geology of Australia, and following a donation made by Henry Ferdinand Halloran to celebrate his 50 years as a member of the Society. It has been periodically awarded since 1948.

The application procedure for this Medal is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Ida Browne Early Career Medal

Awarded for the most meritorious contributions to knowledge and society in Australia or its territories made mainly in NSW, together with signs of emerging leadership. The recipient may be resident in Australia or elsewhere. Applicants are expected to have been awarded a doctorate or equivalent postgraduate degree. In addition, since this is an early academic career award, applicants are expected to be in the first few years of their career. To be eligible they must have published their first research paper no more than 6 years ago (that is the date that the publication was formally accepted, as shown on the formal publication — not electronic pre-print, should be no more than 5 years prior to the close of applications, normally 30 September. So, for 2025 the publication acceptance date of the first paper should be no earlier than 30 September 2019). All assessments consider career interruptions and performance relative to opportunity.

The Ida Browne Medal was established by Council in 2023 in honour of Ida Browne DSc, palaeontologist and first woman President of the Royal Society of NSW, serving from 1953–1954.

The application procedure for this Medal is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

Discipline Awards and Lectureships

Applications for the Society's discipline awards and lectureships will be called for annually.

These Awards are made on a three-yearly cycle, in Years A, B, and C, as indicated in the listing of the Awards. Please note that the call for nominations for all awards opens on 1 July and closes on 30 September of each year. Year C Awards — offered in 2025, 2028, 2031 (see below.)

RSNSW Liversidge Award and Lectureship in the Chemical Sciences

Awarded for distinguished research in any area of the Chemical Sciences, conducted mainly in NSW. Recipients may be resident in Australia or elsewhere.

The Liversidge Lectureship was established in 1931 by the Royal Society of NSW in conjunction with the Royal Australian Chemical Institute (RACI), in honour of Archibald Liversidge MA LLD FRS, Professor of Chemistry at The University of Sydney (1874–1907), and one of the Society's Council members who sponsored its Act of Incorporation in 1881.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Warren Award in Engineering, Technology, Architecture, and Design

Awarded for distinguished research in any area of Engineering, Technology, Architecture and Design, conducted mainly in NSW. Recipients may be resident in Australia or elsewhere.

The Warren Award honours William Henry Warren, Foundation Professor of Engineering at The University of Sydney, establishing the first faculty of engineering in NSW in 1884. He was founding President of the Institution of Engineers, Australia, and twice President of the Royal Society of NSW. The Warren Prize (then Medal) was first awarded in 2020.

The application procedure for this Award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Award in the Creative and Performing Arts

Awarded for distinguished research in any area of the Creative Arts and/or Performance, conducted mainly in NSW. Recipients may be resident in Australia or elsewhere.

Council established the Royal Society of NSW Creative and Performing Arts Award in 2023 to reflect the full scope of the Society's founding values.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Award in the Life Sciences

Awarded for distinguished research in any area of the Life Sciences, excluding veterinary and medical sciences, conducted mainly in NSW. Recipients may be resident in Australia or elsewhere.

Council established the Royal Society of NSW Life Sciences Award in 2023 to reflect the full scope of the Society's founding values.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

Scholarships, Early Career, and Student Awards

RSNSW Bicentennial Postgraduate Scholarships (3)

Each year, the Society awards three Bicentennial Postgraduate Scholarships. The value of the scholarships is determined annually by Council, and includes a complimentary year of Associate Membership of the Society. The awards will be made primarily on the basis of an academic paper that is published by a higher-degree research student, enrolled at a uni-

versity in NSW or the ACT. The paper must have been published in final form (electronic or paper form) after 1 July in the preceding year. The student must have been enrolled as a higher-degree student at the time of the initial submission to the journal in which the paper appeared. The student need not be the only or the first author on the paper, but, if there are multiple authors, their role in the work should be carefully explained. These details and an outline of the paper and its significance should be summarised in no more than one page. The curriculum vitæ of the student will also be considered, as will recommendations by the nominators, one of whom should be the supervisor.

Winners will be expected to deliver a short presentation of their work at a general meeting of the Society in February or later of the year following that in which the award was made, and also submit a paper to the *Journal & Proceedings*.

Scholarships were first awarded by the Royal Society of NSW in 1999 and in 2023 were redesignated by Council to commemorate the Society's Bicentenary.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Bicentennial Early Career Research and Service Citation (3)

Three citations plus a complimentary year of Associate Membership of the Society are awarded each year to recognise outstanding contributions to research and service to the academic and wider community. Applicants must on 1 January of the year of nomination be no more than 5 years after the award of their PhD or equivalent by a university or other research institution in NSW or the ACT.

Winners will be expected to deliver a short presentation of their work at a general meeting of the Society in February or later of the year following that in which the award was made, and also submit a paper to the *Journal & Proceedings*.

Council established these Early Career Citations in 2023 to commemorate the Society's Bicentenary.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Jak Kelly Postgraduate Award

Awarded for excellence in postgraduate research in physics annually. The winner is selected from presenters at each year's Australian Institute of Physics, NSW Branch Postgraduate Awards, as advised to the Awards Committee of the Royal Society of NSW.

The Jak Kelly Award honours Jak Kelly (1928–2012), Professor and head of Physics at the University of NSW (1985–1989), Honorary Professor at The University of Sydney (2004), and President of the Royal Society of NSW (2005–2006). It was first awarded in 2010.

There is no nomination form for this award.

Internal and Discretionary Awards

Notes relating to Internal and Discretionary Awards:

- For Internal Awards, the nominator and seconder must be either a current Member or a current Fellow of the Royal Society of NSW.
- Selection of these Awards is made by the Council of the RSNSW, excepting for the Archibald Ollé Award.

RSNSW President's Award

Awarded at the discretion of the President and Council of the RSNSW to an individual whose distinguished work in any area has made an outstanding and eminent contribution to the State and people of NSW. The recipient may be resident in Australia or elsewhere.

Council established the Royal Society of NSW President's Award in 2023 to reflect the full scope of the Society's founding values. There is no nomination form for this award.

RSNSW Citations (3)

The Royal Society of New South Wales Citations recognise an individual who has made significant contributions to the Society, but who has not been recognised in any other way.

The Royal Society of NSW Citation was first awarded in 2019. Council may make up to three Citations in any year at its discretion.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

RSNSW Medal

The Royal Society of New South Wales Medal recognises an individual who has made meritorious contributions to the advancement of knowledge in any field and also to the Society's administration, organisation, and endeavours.

The Royal Society of NSW Medal was first awarded in 1884, revived in 1943, and has been awarded periodically thereafter. Council may award the Medal in any year at its discretion.

The application procedure for this award is described on the nomination form. Each nomination must comply with the conditions of award and will consist of a completed nomination form together with supporting documentation as specified on the form.

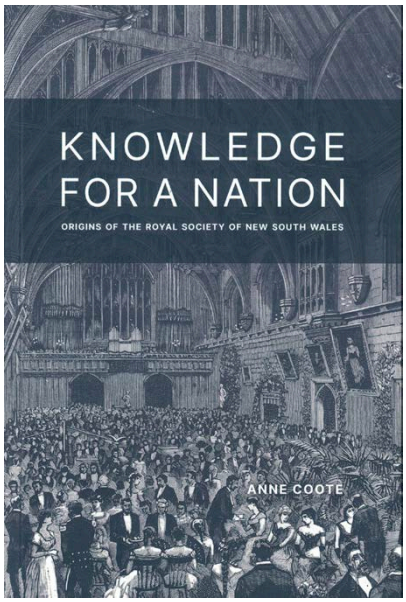
RSNSW Archibald Ollé Award

Awarded to the author/s of the best paper submitted to the Society's *Journal & Proceedings* in any year in which the Award is made.

The Archibald Ollé Prize was first awarded in 1956, established by a bequest from Mrs AD Ollé. The award of the Prize (currently $500) is determined by the Editor of the Society's *Journal*, in consultation with the Editorial Board. There is no nomination form for this award.

Knowledge for a Nation:
Origins of the Royal Society of New South Wales

Anne Coote



The Governor: "this wonderful history"
The State Librarian: "a crystal-clear and beautifully constructed exposition on the intellectual milieu, international parallels and the political machinations behind the creation and administration of the Royal Society. It helps inform not only the history of science in NSW, but more broadly the larger intellectual climate of Australia."

"a book which is genuinely engaging" "the storytelling is compelling"

"takes the story outside the constrictions of Royal Society personalities, into the much more significant world of colonial society and politics"

"tells the early history of a learned society still active in the intellectual culture of 21st century Australia. Dr Coote's *Knowledge for a Nation* beautifully captures this story."

The Society President: "a very readable account that is hard to put down. By using the characters involved in the Society to tell its story, she has produced a rollicking recital of their lives and times, of the Society's fortunes and misfortunes, ebbs and flows, highs and lows."

Peter Shergold: "Pick up this wonderful and engaging history by Dr Anne Coote, and you will find yourself in a different place. You will be transported to another time, listening in on vigorous debates about science, technology, medicine, philosophy and society. More importantly, you will gain a sense of the world which shaped their views and their approach to intellectual discovery."

"because of Coote's wonderful attention to just the right detail, we are allowed to comprehend the world that existed" 140 years ago

"Coote centres her history of the scientific establishment on the flesh, blood and temperament of the participants, not just on the ideas that they espoused. We meet real people, some snooty, some engaging, some dull, some respectable, some downright unethical but, nearly all of them, insatiably curious or at least feeling the need to behave so in front of others."

"between the covers of this absorbing book lies ... more than a travel guide to a foreign country... History is not just a quaint place to visit. It has made the world in which we live today and beckons to the future which awaits."

"To potential readers — Royal Society members and beyond — I thoroughly recommend this book. **Buy it. Read it. Think about it."**

Knowledge for a Nation: Origins of the Royal Society of New South Wales by Anne Coote

ISBN: 9780645859409

Publisher: The Royal Society of NSW, Sydney

Publication date: 1 October 2024

The book is available from the RSNSW Online Shop at $50 for RSNSW members (https://members.royalsoc.org.au/rsnsw- shop/), or from John Reed Books ($59.95), https://johnreedbooks.com.au/p/knowledge-for-a-nation?barcode=9780645859409

The Royal Society of New South Wales

Information for authors

The *Journal & Proceedings* welcomes manuscripts for review in the many areas of interest to the Royal Society: science, engineering, social science, politics, arts, philosophy, and the humanities. Papers presenting aspects of the historical record of research carried out by Australians or within Australia are particularly welcome. Papers (other than those specially invited by the Editorial Board) will only be considered if the content is either substantially new material that has not been published previously, or is a review of a major research programme.

Letters to the Editor, Discourses, Short Notes and Abstracts of Australian PhD theses may also be submitted for publication. We welcome sets of papers where disagreements among authors are ventilated and argued. Please contact the Editor if you would like to discuss a possible article for inclusion in the *Journal*.

In the case of papers presenting new research, the author must certify that the material has not been submitted concurrently elsewhere nor is likely to be published elsewhere in substantially the same form. In the case of papers reviewing a major research programme, the author must certify that the material has not been published substantially in the same form elsewhere and that permission for the Society to publish has been granted by all copyright holders.

Details of submission guidelines can be found in the online Style Guide for Authors at: https://www.royalsoc.org.au/society-publications/the-royal-society-of-nsw-journal/information-for-authors/.

Note that references should be formatted using the Sage-Harvard reference style. Include the DOI or ISBN of each reference when available. Do not attempt to copy the page layout of the *Journal*.

Manuscripts are only accepted in digital format (generally Microsoft Word) and should be e-mailed to: editor@royalsoc.org.au. In the unlikely event that a file is too large to email, it should be placed on digital media and posted to:

The Editor,
The Royal Society of New South Wales,
PO Box 576,
Crows Nest, NSW 1585

Manuscripts will be reviewed by the Editor, in consultation with the Editorial Board, to decide whether the paper will be considered for publication in the *Journal*. Manuscripts are subjected to peer review by at least one independent reviewer. In the event of initial rejection, manuscripts may be sent to other reviewers.

The Society does not require authors to transfer the copyright of their manuscript to the Society, but authors are required to grant the Society an unrestricted licence to reproduce in any form manuscripts accepted for publication in the *Journal & Proceedings*. Enquiries relating to copyright or reproduction of an article should be directed to the Editor.

Volume 158 Part 1 2025 Numbers 497 & 498

CONTENTS

The Royal Society of New South Wales
P.O. Box 576, Crows Nest, NSW 1585, Australia

info@royalsoc.org.au (general)
editor@royalsoc.org.au (editorial)
www.royalsoc.org.au
www.facebook.com/royalsoc
www.youtube.com/@RoyalSocNSW

ISSN 2653-1305

9 772653 130007 01 >

Published June 2025