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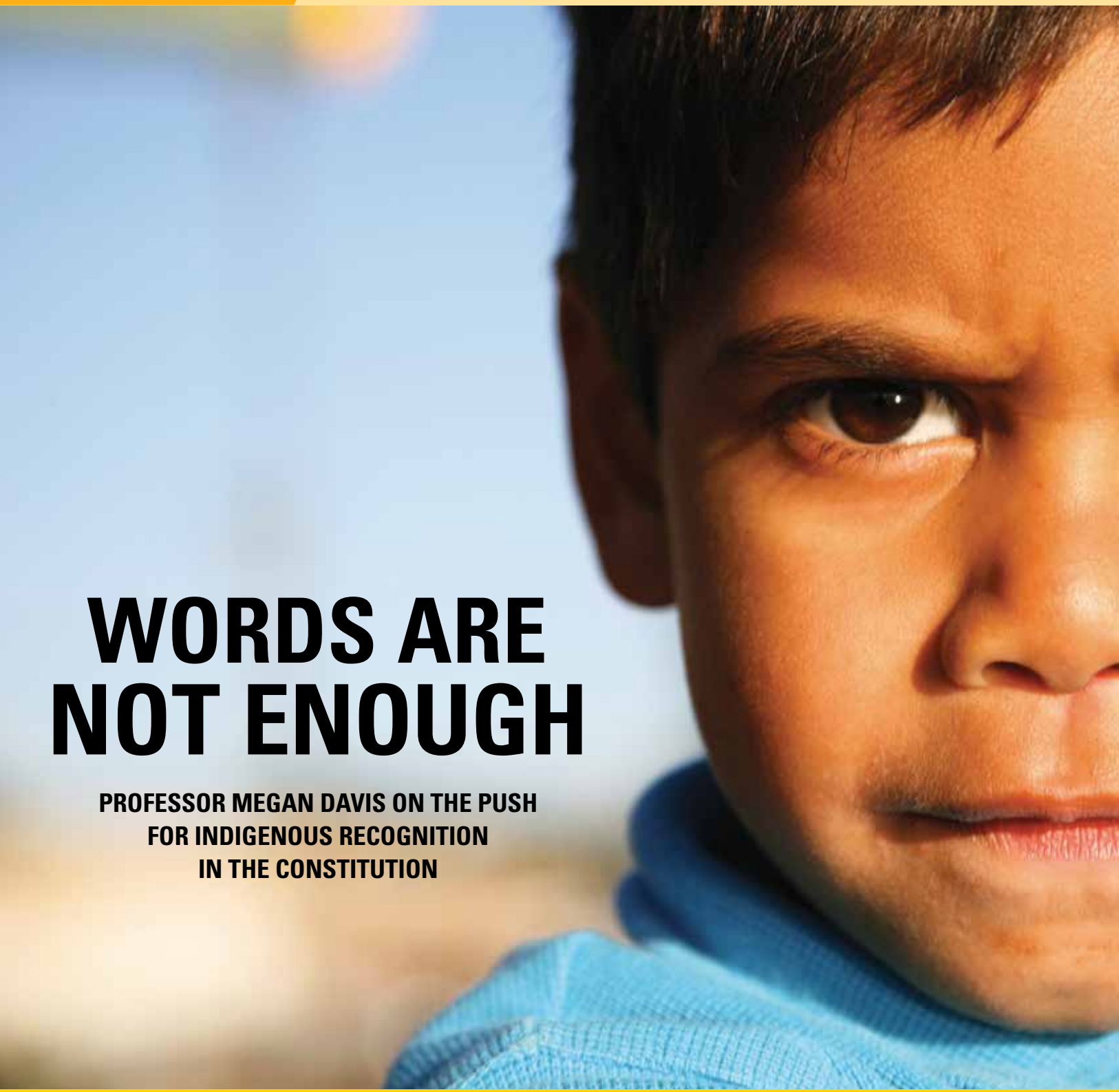
Never Stand Still



WORDS ARE NOT ENOUGH

PROFESSOR MEGAN DAVIS ON THE PUSH FOR INDIGENOUS RECOGNITION IN THE CONSTITUTION

CURIOUS MINDS
Crowdfunding science to give young researchers a chance

FACTORIES OF THE FUTURE
A modern-day alchemist takes recycling to new heights

SONIC BOOM
The new discipline democratising music production

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Photo: Grant Turner/ Mediakoo

YOUR TIME STARTS NOW …

ANDREW WELLS, UNIVERSITY LIBRARIAN

RIPPING DOWN all the signs that said "Don't rearrange the furniture" was the first thing Andrew Wells did when he started working as the head of the University Library.

"The next day they'd be up again, and I'd tear them back down. I kept saying, 'This is the students' library. Not ours.' "

More than a decade later Wells has created a library he admits some people think is "a little bit out there". His aim to put students first has resulted in ample seating, group study spaces, beanbags, funky furniture and not a single service desk or officious sign in sight.

"Students are good at regulating each other – I never want them to feel like they're being supervised," he says. "I like seeing staff blending in with the students: it's a friendlier way to interact and our inquiry numbers have actually gone up.

"We had two and a half million people walk through the library doors last year."

As a dissatisfied engineering undergraduate, Wells spent many hours in the University of Queensland (UQ) library, "reading old newspapers and ignoring my engineering dynamics books". He eventually secured a job in the library's serials section, a decision that would mark the beginning of his career.

The UQ job led to senior positions at the National Library of Australia and the State Library of NSW. By the time he arrived at UNSW he had 25 years' library experience and had witnessed the biggest transition libraries have seen to date – the move online.

"In the print world libraries held the jewels and if anyone wanted them they had to come to us – it doesn't work like that anymore, libraries have to work a lot harder now."

Your dream job: A physician. I worked at Royal Brisbane Hospital as a nursing orderly when I was a student and had plans to become a doctor.

What people don't know about you: I'm a pianist and a gym junkie. I go to the gym most mornings and my life goal is to play all 48 Bach preludes and fugues.

Favourite book: *The Member of the Wedding* by Carson McCullers. I return to it every 10 years – I'm drawn to books about the American South.

Favourite song to dance to: I do most of my dancing in my head when I play old show tunes on the piano, but I do like to sway to a good Richard Rodgers waltz.

Funniest thing at work: Some glitches resulted in the library opening one Sunday when it shouldn't have. It functioned perfectly well for hours before anyone realised there was no staff. I love that story because it shows how trustworthy our students are. But once was enough.

– Fran Strachan

• TOP 50

RESEARCH FOCUS FOR INCOMING VC

New Vice-Chancellor Professor Ian Jacobs has a clear ambition for UNSW over the next decade – a spot in the world's top 50 universities.

FROM HIS vantage point on the Scientia balcony, Professor Ian Jacobs is impressed with the bustling University mall below.

"I think it is a spectacular and vibrant campus. It reflects the ethos and ambition of the University," he says.

That "ethos" is part of what attracted the eminent UK researcher and academic leader to the role of UNSW President and Vice-Chancellor.

"What I saw in UNSW was an exciting, well-run university that really was about doing practical things to improve people's lives, whether through education with an egalitarian dimension or translational and practical applied research."

Jacobs spoke to *Uniken* on the first of two short visits to Sydney before he officially starts his new job on 1 February, when Professor Fred Hilmer steps down after more than eight years as Vice-Chancellor.

Building on his strong leadership roles at University College London and the University of Manchester, where he is currently Vice-President and Dean of the Faculty of Medical and Human Sciences, Jacobs aims to take UNSW's research prowess to the next level.

"I am very clear about what I aim to do," says Jacobs, who is also the Director of the Manchester Academic Health Science Centre – a partnership linking the University with six healthcare organisations involving 36,000 staff.

"This is not a university that needs a turnaround, or a rescue; it is a university that is in very good shape with a trajectory taking it steadily higher in the league tables.

"My role over the next decade is to get UNSW from amongst the top 100–150 universities in the world to joining the top 50. That is my objective."

From his initial discussions with staff and students, Jacobs senses there is broad agreement that this is the right ambition. He believes it is achievable, notwithstanding the real challenges being posed within Australia by the political uncertainty around fee deregulation and funding cuts, and the intense competition from universities worldwide.

"It is not an easy target to deliver and it's not about the University being high up in the league tables as an end in itself. The very best universities in the world have an enormous impact on people's lives and make a major contribution to society, regionally and globally. The opportunity to provide talented people with better opportunities is what excites me," he says.

Jacobs emphasises the importance of providing high-quality education alongside the research agenda. "UNSW educates very large numbers of students to the highest standards. It is essential that we continue to develop our approach to teaching, using modern technology to enhance and personalise the student experience. The very best universities excel at both education and research."

A desire to change lives also drives Jacobs' medical research in women's cancers, which has attracted more than $55 million from UK funding bodies.

In one of his most significant projects, an international team he leads is working to develop a test for the early detection of ovarian cancer, which is usually diagnosed at an advanced stage, when survival rates are poor.

Central to this research is a 15-year trial, led by Jacobs, involving 202,000 British women. "I have been working on a screening strategy using circulating biomarkers and ultrasound imaging that is able to detect ovarian cancer two to three years earlier than it would otherwise be diagnosed in 85–90% of affected women."

By January next year, when the study's findings are due to be announced, Jacobs and his wife Chris, who works in cancer genetics at Guy's Hospital in London, will have relocated to Sydney and he will know whether the program saves lives.

"If the results are positive the screening strategy will make a real difference to women threatened by ovarian cancer," says Jacobs. He expects to continue his research in Sydney "in so far as I can given the responsibilities of my exciting new role".

"I am looking forward to getting to know students and staff and to working with outstanding new colleagues across UNSW."

– Denise Knight

▲ Professor Jacobs at UNSW. *Photo: Grant Turner/ Mediakoo*

BRIEFS

EUREKA HOPEFULS

UNSW has 11 finalists in seven categories of the Australian Museum Eureka Prizes – prestigious national awards dubbed the "Oscars of Science" that celebrate excellence in fields including scientific research, leadership and communication. The finalists are vying for 15 prizes worth a total of $150,000. The UNSW nominees are: Michelle Simmons, Darren Curnoe, Steven Sherwood, David Keith, Justin Gooding, Katharina Gaus, Peter Reece, Lisa Alexander, Sarah Perkins, Markus Donat and Maree Teesson. Winners will be announced at the awards dinner at Sydney Town Hall on 10 September.

JOHN HOWARD READING ROOM

The John Howard Reading Room has opened its doors to the public at the UNSW Canberra Academic Library. It provides secure access for researchers, students and the general community to view and research items in the Library's Special Collections, including the papers of the former PM. The collections are of national significance and include more than 350 manuscripts on military history and contemporary Australian literature; 13,000 rare items, audio-visual material and photographs. The Room is a unique partnership with the National Archives of Australia.

PHYSICS MOOC LAUNCHED

UNSW has launched its first science Massive Open Online Course (MOOC) on the Coursera platform. The free MOOC, titled "Mechanics: Motion, Forces, Energy and Gravity, from Particles to Planets", uses animations, experiments, quizzes and online discussions to provide a stimulating introduction to mechanics – the physics of motion. "First-year physics starts with mechanics, so this course will get students off to a flying start," says Professor Joe Wolfe, who co-presents the course with Dr Elizabeth Angstmann.

OPEN LETTER

Researchers from UNSW's Andrew & Renata Kaldor Centre for International Refugee Law led condemnation of the federal government's return of asylum seekers to Sri Lanka in July. The researchers were among more than 50 legal scholars from 17 Australian universities who wrote an open letter, calling on the government to make public its legal justification for the return. The group said the operation violated international law and was inconsistent with Australia's position on the UN Security Council.

Photo: Brett Boardman

• BEAUTIFUL EXECUTION

COLLEGES WIN ARCHITECTURE AWARD

The newly opened Kensington Colleges – home to almost 1,000 students – have been recognised for their "beautifully executed" design. The colleges, designed by architects Bates Smart and owned and operated by UNSW, won a 2014 Multiple Housing Award from the Australian Institute of Architects NSW Chapter.

The jury citation noted that student accommodation was a distinct type of multiple housing, which had to respond to the common needs of a diverse group of occupants.

"Bates Smart is known for its careful, restrained and beautifully executed work, and this project is no exception … avoiding fashion and excess, this project will stand the test of time."

The University's $110 million two-year redevelopment of the Kensington Colleges, which include the historic Basser, Philip Baxter and Goldstein colleges – is part of a major expansion in student accommodation. UNSW now offers close to 5,000 on-campus beds, more than any other university in NSW.

WESTACOTT CALLS FOR "CITIES AGENDA"

The world could be "on the cusp of a return to the Renaissance-style City State", with two-thirds of its population living in a city by 2050, according to the Chief Executive of the Business Council of Australia, Jennifer Westacott.

Ms Westacott (pictured) made the comment in a presentation for the Faculty of Built Environment's Utzon Lecture Series.

Australia should adopt a "cities agenda", she said, adding that in a decade or so, just 600 cities will be responsible for two-thirds of world economic growth and 200 of them will be in China.

"Instead of Australian cities competing with each other, we need to think about competing with Singapore, with Chengdu, Hong Kong, Mumbai, Dallas, and the policy settings that will allow us to do this."

Sydney and Melbourne should start planning for populations of eight million each by 2050 and the spatial dynamics of cities should be rethought from suburbs and cities to corridors and hubs. "While I am not advocating a central planning approach, I am saying that accidentally becoming a city of eight million people will lead to very poor outcomes indeed," she said.

The free public lecture was followed by a panel discussion led by Professor Bill Randolph, director of the UNSW City Futures Research Centre.

TEN FINE FELLOWS

The evolutionary forces shaping bacteria, the fate of engineered nanoparticles in groundwater, and the psychology behind obsessive thinking and anger are among the research projects led by our newest Future Fellows.

Ten UNSW researchers were awarded Future Fellowships worth $7.8 million in the latest federal government funding round. The Australian Research Council (ARC) scheme provides funding of up to $1 million over five years to highly qualified mid-career researchers working in areas of critical national importance as an incentive to keep them in Australia.

UNSW's successful applicants include Engineering's Associate Professor Denis O'Carroll, and Associate Professors Torsten Thomas, Thomas Denson and Dr Jessica Grisham, all from the Faculty of Science.

Deputy Vice-Chancellor (Research) Professor Les Field said: "My congratulations to these excellent researchers, it's very pleasing to see their impressive work being recognised for its national importance.

"The Future Fellowship scheme is one of the few remaining schemes that support our early-to-mid career researchers and provides career opportunities in non-medical areas. It was a very welcomed initiative to see the Future Fellowships given a new lease of life in the last federal budget and now recognised as a program that will continue in the ARC."

• POLICY PLAUDIT

RESEARCH WITH IMPACT

The Productivity Commission has put UNSW research at the centre of its proposed childcare shake-up, adopting key principles from a Social Policy Research Centre (SPRC) submission in its review.

Professor Deborah Brennan (pictured) from the SPRC said the Commission adopted three central positions from her submission, co-authored with PhD student Elizabeth Adamson, including the notion of a single means-tested payment, a sliding scale that includes high earners but gives the most benefit to low-income families and the introduction of a link between subsidies and "reasonable costs".

"We are delighted that key concepts and policy design principles that we've developed at SPRC have been taken up in such an authoritative report," said Brennan, who chaired a 2012 review of early childhood education funding for the NSW government and is one of Australia's leading family and work researchers.

• KICKING GOALS

SOCCERBOTS, SUNSWIFT ARE WORLD BEATERS

Robot footballers and electric cars are two very different disciplines but UNSW engineering students have taken on the world in both and emerged champions.

The UNSW robot football team, rUNSWift, were victorious in the standard platform league of RoboCup, the world's largest robot competition, against 19 other teams from around the world. The UNSW robots were ruthless in their march to the final, racking up 37 goals against their opponents with only one goal conceded.

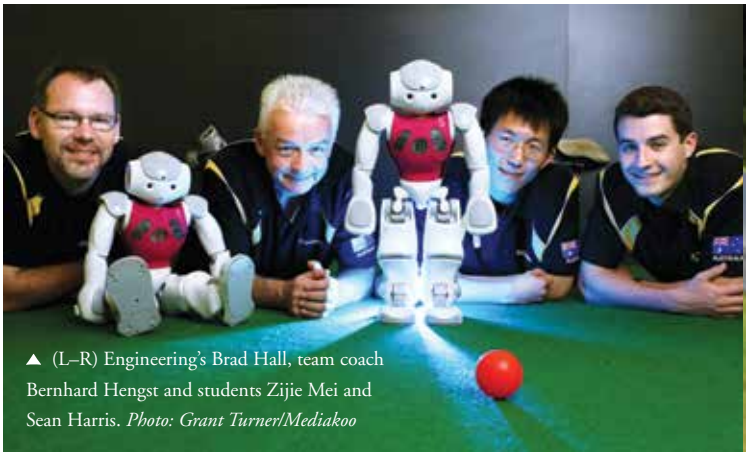
"To win the overall tournament, as well as the demo 'All-Stars vs Champions', wrapped up a great year," said Brad Hall, from the School of Computer Science and Engineering.

In the same week, the Sunswift electric car team broke a 26-year-old world speed record at a racetrack in Geelong, Victoria.

The car achieved an average speed of more than 100 km/h during the attempt, beating the previous world record of 73 km/h. The performance establishes the eVe car as the fastest electric vehicle over a distance of 50 km, on a single battery charge.

The record will be officially approved by the Fédération Internationale de l'Automobile (FIA), world motorsport's governing body.

"This record was about establishing a whole new level of single-charge travel for high-speed electric vehicles, which we hope will revolutionise the electric car industry," said project director and third-year student Hayden Smith.



▲ (L–R) Engineering's Brad Hall, team coach Bernhard Hengst and students Zijie Mei and Sean Harris. *Photo: Grant Turner/Mediakoo*

▼ The world-record-breaking eVe. *Photo: Daniel Chen*

DARK SIDE OF THE NET

▲ Protecting internet systems that control vital utilities like electricity, water and gas … Professor Jill Slay. *Photo: John Carroll*

A new centre is taking on cyber criminals and the threats they pose to our national infrastructure.

FOR THE PAST DECADE Professor Jill Slay has chosen not to publish details of much of her impressive body of work because, she says, "I don't want the bad guys to know what we're doing".

Those "bad guys" are the online criminals, spammers, phishers and identity fraudsters who make our online life a misery, and the cyber terrorists whose aims are even more malevolent.

As Director of the recently launched Australian Centre for Cyber Security (ACCS) at UNSW Canberra, Slay has been working with federal and state police forces in Australia to help identify the main areas of threat presented by our digital world.

Her work revolves around the most likely targets for online crime, how the criminals might exploit various weaknesses, what evidence they will leave and how police can access that evidence.

"My own research looks more towards the protection of critical infrastructure," says Slay, who in 2011 was awarded an OAM for service to the information technology industry in the areas of forensic computer science, protection of infrastructure and cyberterrorism. "When systems that manage and control such vital utilities as electricity, water and gas are connected to the internet, how do we protect them?"

It's a big question with no simple answer, and it represents just a fraction of the issues the ACCS will be looking to resolve.

Cyber attacks already impose a massive burden on the Australian economy – $1.06 billion to be exact, with five million Australian victims, according to the 2013 Norton Report. Globally the bill stands at US$5.9 billion, according to the RSA/EMC Current State of Cybercrime 2014.

On a larger scale are the acts of cyberterrorism – many of which, by their very nature, go unreported. "Sometimes it seems the problem is so complex and overwhelmingly bad," Slay says, "but as engineers we can break it down into pieces and solve the issues one by one. I won't allow myself to be overwhelmed by the scope of the warfare."

She says the ACCS aims to become a national thought leader in combating cybercrime. "It's important because although we all benefit from smarter and faster communication and technology, it has left end-users exposed. Somebody needs to close the gaps and protect those users."

One of the powerful tools available to the ACCS is the Cyber Test Range, built by the US-based global security company Northrop Grumman. Based at UNSW Canberra, it is essentially an enclosed internet simulation environment that is highly controllable and configurable, with technology that allows network testing, including the use of exploitation and attack tools that are too sensitive to release in the "real" internet world.

ACCS research projects will include one that leads to the development of new, internationally recognised standards concerning corporate policy for the use of IT, risk management and business continuity. Another investigates the boundaries of internet regulation in international law.

A third research stream will look into swarm intelligence, demonstrated in nature as the collective behaviour and interactions between self-organised systems (think of ant colonies or bird flocking), and how it can be used to develop computational intelligence – ultimately big data analytics – that can detect intrusions and cyber attacks.

The ACCS already boasts around 50 well-established researchers, including 16 professors and 15 associate professors, across the disciplines of Information Technology, Information Systems, Computer Science, Engineering, Law and Politics.

"If I can't achieve something with these resources and that sort of talent," Slay smiles, "then I'm not a very good leader".

– Chris Sheedy

CURIOUS MINDS

Crowdfunding courageous science will give young researchers the chance to risk it all on an idea, writes Deborah Smith.

"I HAVE NOT FAILED, I just found 10,000 ways that don't work," Thomas Edison, the prolific 19th century inventor best known for the electric light bulb, once famously said.

And when it comes to breakthrough science and innovation it is a sentiment that holds true today, says Dr Ben McNeil.

"Failure – paradoxically – is the basis of success. If researchers are not testing new ideas and failing, then they're not innovating; they're just making incremental advances in knowledge," says McNeil, a QEII Research Fellow in the UNSW Climate Change Research Centre.

He is critical of the current approach to funding scientific research, which tends to favour established researchers over younger investigators with a passion for discovery. "Risk-taking and pursuit of crazy-sounding – but potentially transformative – ideas are not supported under this system," he says.

Success rates for competitive government grants have also fallen to record lows, with on average more than four out of five applicants missing out. "And it's even worse for early-career researchers," McNeil adds.

But rather than just grumble, like many, McNeil has created a new initiative – a crowdfunding platform called thinkable.org – to tackle this important issue.

Launched in partnership with UNSW, thinkable.org "democratises" science by allowing the public around the world to directly fund bright young scientists wanting to pursue blue-sky research, and to follow their progress as they test out their ideas.

"We embrace the idea of people going down pathways that have never been thought of before," says McNeil, who adds the new model is meant to complement, rather than replace, the traditional one.

Not only will thinkable.org help increase support for risky, cutting-edge research and accelerate discovery, McNeil hopes the initiative will also build greater trust, understanding and communication between scientists and the society they serve. "As a climate scientist I know how important this is," he says.

Traditionally, scientists have published their research through jargon-filled articles in scientific journals. But researchers on thinkable.org will also provide short, easily understood insights into their projects, to put their work into context for the public and their peers.

These video "snapshots" may include their adventures on a field trip, a striking new electron microscope image, or a commentary on a new finding – whatever the researchers feel will interest their sponsors and followers.

The first thinkable.org participants are five UNSW Goldstar recipients – researchers who have been awarded up to $40,000 by the University because their projects were highly ranked, but just missed out on funding from the Australian Research Council or National Health and Medical Research Council.

In the early stages of the initiative, this University backing will give prospective sponsors more confidence that the researchers they are supporting are well regarded. Funds raised will go to the researchers via the UNSW Division of Advancement.

Two Australian Nobel laureates, Professor Peter Doherty and Professor Brian Schmidt, exemplify the adage that researchers tend to do their best work when they are young.

Doherty was a postdoctoral-researcher in his twenties when he made a groundbreaking discovery on how the immune system recognises virus-infected cells. And Schmidt was about the same age when he started to study distant exploding stars called supernovae – a quest that led to the discovery that the expansion of the universe is accelerating.

The first 10 years after gaining a PhD tend to be a scientist's most creative for a variety of reasons, says McNeil. They have more time, more energy, fewer academic responsibilities, and less historical baggage that constrains their thinking about what approaches will work. "In effect, they don't know what they don't know. If someone says: 'That approach is impossible,' they say: 'Well, I'm going to try it anyway.'"

▲ If researchers aren't testing new ideas and failing, then they're not innovating … thinkable.org creator Dr Ben McNeil. *Photo: Quentin Jones*

A NEW ERA

Some of the biggest names in HIV/AIDS research have helped the Kirby Institute celebrate its move to state-of-the-art facilities on UNSW's main campus. Susi Hamilton reports.

▲ A who's who of HIV activism (L–R) Neal Blewett, Michael Kirby, Jillian Skinner, David Cooper, Fred Hilmer, David Gonski and Peter Baume. *Photo: Sarah Rhodes*

IF BUILDINGS MATTER, then blood-borne virus research in Australia has an impressive future, says Kirby Institute Director Professor David Cooper.

The former national centre for research into HIV/AIDS has moved from its long-time base in Sydney's Darlinghurst – the epicentre of Australia's HIV pandemic – to purpose-built facilities on UNSW's Kensington campus.

The relocation to the upper floors of the refurbished Wallace Wurth Building includes the provision of a high-level PC3 containment laboratory – the only one on campus – and offices with sweeping city and ocean views.

But it's not all about real estate: the move reflects the consolidation of the institute as Australia's leading researcher of blood-borne and other infections.

The Kirby Institute's work has grown exponentially since the early days of the HIV/AIDS pandemic. Today its scope has expanded internationally to a range of other infectious diseases, notably viral hepatitis and sexually transmissible infections.

The institute's national programs are across disease intervention, surveillance and evaluation, and include important work in Aboriginal and Torres Strait Islander communities. International programs span Africa and Asia.

Significantly the move unites the institute's previous three locations into one facility – a development certain to aid research collaboration and outcomes.

However the institute will maintain a presence in Darlinghurst with researchers able to work from St Vincent's Hospital's Centre for Immunology.

"The cross-fertilisation of ideas matters, the ability to interact and bounce ideas off colleagues matters," Cooper said at the facility's official opening in July.

Launching the new premises, NSW Health Minister Jillian Skinner paid tribute to Cooper's work, noting teams he has led have been involved in almost every major HIV breakthrough in Australia.

Cooper was the first to describe the initial response of the body to HIV infection and AIDS, and has since been involved in the development of every existing antiretroviral drug on the market.

Skinner also announced a $1.5 million grant to support the evaluation of the state's HIV strategy, a figure matched by the University.

The five-year project, which is being led by Professor Andrew Grulich, is a partnership involving researchers, government, community and professional organisations to build structures to

allow real-time monitoring of the state government's current three-pillar strategy of HIV testing, treatment and safe sexual behaviour.

"We at Kirby are also researching a fourth pillar to this elegantly simple equation, and that is PrEP, or pre-exposure prophylaxis, targeted to the appropriate high-risk population. It's a sort of contraception for HIV and it works," Cooper says.

Also new on the research agenda is a program to increase the uptake of HIV testing and antiretroviral treatment in gay men and sex workers in Indonesia, with $2 million in federal government funding to expand to Bandung, Yogyakarta and Bali. The project will also look at improving links, and capacity building of PhD programs, between Indonesian universities and UNSW.

The opening of the Kirby Institute's new home heralded an important and historic time for AIDS research as it coincided with the 2014 International AIDS Conference in Melbourne and a satellite event in Sydney, the second annual Kirby Symposium.

Former High Court judge and Kirby Institute Patron Michael Kirby delivered the opening address at the Melbourne conference and urged the social and physical sciences to continue to work together and engage with affected communities.

He also noted the tragic loss of six researchers and delegates to the conference in the MH17 air disaster, in particular former president of the International AIDS Society Joep Lange, a close friend and colleague of Cooper.

But he pointed out there were others in the AIDS community "who have suffered, or are suffering, through irrational, unjust and destructive acts".

He cited the murders of gay activists; the fight by South African mothers for access to antiretroviral drugs; new anti-gay laws in Africa that incite violence; and lonely patients dying without hope.

"Those of our companions who were lost on their way to join us … also had these images in their minds. They would expect us to pick up our shattered spirits. They would demand that we renew and redouble our efforts."

Kirby said "stigma and discrimination remain the most substantial barriers to conquering HIV", offering the Australian experience as proof.

"Virtually from the start of the epidemic, we realised tackling discrimination was essential," he said.

The Kirby Symposium attracted Nobel Laureates Professors Francoise Barré-Sinoussi and Peter Doherty who delivered keynote research papers.

Barré-Sinoussi was also awarded an honorary doctorate in recognition of her contribution to HIV/AIDS research.

Accepting the degree, Professor Barré-Sinoussi offered her "deep thanks", noting it would lead to further collaboration with her team at the Institut Pasteur in Paris.

Two of the men credited with stemming the epidemic here in the 1980s, then-Health Minister Dr Neal Blewett and his Opposition counterpart, Professor Peter Baume, were also honoured at the symposium, receiving Kirby Institute life governorships for their bipartisan approach.

▼ Future collaboration … Nobel Laureate Francoise Barré-Sinoussi. *Photo: Sarah Rhodes*

Two Sydney men "clear" HIV after bone marrow transplants

When David Cooper, the Kirby Institute's director, first heard two patients in Boston had cleared HIV after bone marrow transplants, he was intrigued. It came on the back of a similar procedure which "cured" an American living in Berlin of HIV six years ago.

After the Boston research was presented last year, Scientia Professor Cooper and St Vincent's Hospital's bone marrow transplant specialist Dr Sam Milliken searched the records in Sydney for patients with HIV who had undergone similar procedures.They tracked down two.

One man had received a transplant in 2010 to treat non-Hodgkin's lymphoma. A year later, a second man underwent a similar procedure for acute myeloid leukaemia.

When the doctors followed up with the patients, the news was good. No HIV can be detected in either man and the virus antibody seems to have disappeared from one patient's serum and is barely detectable in the other.

Most significantly, however, the bone marrow the men were treated with did not contain all the copies of a rare gene (CCR5 delta 32 mutation) that affords protection against the virus. In his second transplant, the Berlin patient had a bone marrow donor with both copies of the protective gene, which is found in less than one per cent of the population. The Boston patients each had single copies of a faulty version of CCR5, giving them partial resistance to the virus.

"The bone marrow in the [second Sydney] patient didn't contain any protective genes at all," Cooper told the *New Scientist*. "This is a very important clue, that an immune response prompted by the bone marrow transplant has such a strong anti-HIV effect."

The work was presented at the Towards an HIV Cure Symposium, part of the 2014 International AIDS Conference in Melbourne.

The patients remain on antiretroviral therapy. If discontinued, the researchers suspect the virus could re-emerge from hiding, as it did in the Boston patients.

American Timothy Ray Brown remains the only person to have cleared HIV in the long term, after transplants in Berlin in 2007 and 2008, and is no longer on antiretroviral therapy.

"Working out where the remains of the virus are hiding has become the big scientific question in the HIV/AIDS research community. It will be essential to understand in order to achieve a cure," says Cooper.

While bone marrow transplants are not practical for everyone, Milliken says the finding is an important first step: "This is a terrific unexpected result for people with malignancy and HIV. It may well give us a whole new insight into HIV, using the principles of stem cell transplantation."

– Susi Hamilton

THE GREAT TRANSFORMER

Little goes to waste in modern-day alchemist Veena Sahajwalla's factories of the future, writes Louise Williams.

◀ Professor Veena Sahajwalla at OneSteel's recycling plant in Botany. *Photo: Tamara Dean*

AMID THE GRIT and grime of an auto graveyard in Sydney, Scientia Professor Veena Sahajwalla scans tonnes of cast-off metal, glass and plastic.

Her immediate interest in these end-of-life hulks is realising her goal of a 100% recyclable car, something, she says, that is "not far over the horizon".

More broadly, however, this is just the kind of environment that inspires the director of UNSW's Centre for Sustainable Materials Research and Technology (SMaRT@UNSW) in the pursuit of her ultimate aim: the routine "mining" of the world's overflowing rubbish dumps and landfills to reclaim resources for the manufacture of a new generation of "green materials".

This is not about expanding the conventional kerbside recycling that turns glass into more glass, or one type of plastic into more of the same. Nor is it about simply burning our vast mountains of waste to create energy.

It's about a revolutionary approach that harnesses the power of high-temperature reactions to transform waste at its most basic molecular level, opening up myriad possibilities for using waste materials and "re-forming" them to create new products.

It's a paradigm change in thinking about waste transformation that Sahajwalla has already demonstrated in her "green steel". First revealed in 2006 in a collaboration with OneSteel, green steel now absorbs millions of waste tyres in commercial electric arc furnaces around the world. By utilising waste tyres as a carbon source to replace a meaningful proportion of the non-renewable coke used in conventional steel-making, costs are reduced and pressures on virgin resources alleviated. Waste tyres also improve furnace efficiency and cut electricity use.

But green steel is manufacturing on a large scale. At the heart of Sahajwalla's newest endeavour are what she calls the "factories of the future" – micro-recycling plants deployed

locally at dumps or waste management facilities, or alongside the very industries able to absorb their various waste streams directly into their manufacturing processes.

Take these wrecked cars as an example, Sahajwalla says. Currently, their recycling converts them to high-value steel components that can be repeatedly re-used without their strength and performance deteriorating. Increasingly, the tyres are repurposed too, thanks to green steel.

But what about everything else? Those mixed plastics, electronics and automotive glass that can't be economically recycled make up about 20% of a vehicle by weight. Arrium Mining Consumables, Australia's largest manufacturer of long steel products, recycles large volumes of scrap steel from cars in electric arc furnaces. However, the company's Newcastle site alone is still left with 250 tonnes of automotive waste every day that is destined for landfill, at a cost of about $375,000 in fees each month.

What's being dumped are complex, high-performance materials, like windscreen safety glass, that can't be recycled traditionally because they're mixed with plastic.

However, Sahajwalla has shown that even automotive glass, which is mostly silica, along with waste plastic, such as Bakelite, and iron oxide can be transformed into something valuable without the need for separation when they are processed at high enough temperatures.

"The output you get is a valuable metallic alloy," Sahajwalla says. "What is so fascinating is none of the inputs were metallic. You have waste oxides, silica in glass and iron oxide, and plastic mixtures."

As the first person in the world to turn waste glass and plastic into metal, Sahajwalla, and her team at SMaRT@UNSW, recently published a paper describing the process in the prestigious journal *Materials Letters*. The high-temperature approach can be equally useful in transforming the mix of plastics, glass and valuable materials contained in our growing piles of electronic waste.

It's an achievement on par with green steel and confirms Sahajwalla's reputation as a modern-day alchemist.

Acknowledging the research's potential, the federal government has awarded Sahajwalla $2.2 million to create a "green manufacturing" research hub at UNSW. Industry partners – including Arrium, Brickworks Building Products, Jaylon Industries and Tersum Energy – will contribute a further $6.6 million in cash and in-kind support over four years.

"We've clearly had good success with green steel-making, and we could do so much more through green manufacturing. There are so many other opportunities. That's what drives me on," Sahajwalla says.

The key to both green steel and green alloys is the high temperatures – over 1,500 degrees Celsius – that trigger reactions which create new products by releasing the materials' elements from their original structures, enabling them to re-form. This process becomes the fourth R in Sahajwalla's new concept of Reduce, Re-use, Recycle, Re-form.

And while high-temperature reactions require significant energy levels, these transformations have saved energy and raw materials, as seen with green steel. Her vision for factories of the future is that they will be smarter: more agile, smaller and modular, and could be operated at a fraction of the cost of mining ore and putting it through multiple refining steps.

And since one tonne of e-waste, for example, contains copper around 10 times more concentrated than copper extracted from ore, recycling makes very good economic and environmental sense, Sahajwalla says.

In the not-too-distant future, she predicts, we will be able to put a whole mobile phone or that problematic leftover, mixed automotive waste into high-temperature furnaces and know precisely how to transform them into metal alloys.

"Think about how computers have evolved; we now have almost everything in the palm of our hand," Sahajwalla says. "Soon we will be able to transform resources locally in the same way – we won't have to rely on large-scale recycling plants at all. These micro-industries will be the factories of the future."

MORE THAN WORDS

Professor Megan Davis tells Natasha Robinson why "poetry" in a preamble is not enough in the push for Indigenous recognition in the constitution.

TRUTH, JUSTICE AND reconciliation are three words often spoken together by many of the countries that make up the United Nations. And though she represents a socially progressive, assured nation on the UN Permanent Forum on Indigenous Issues in New York, law professor Megan Davis is acutely aware that for Australia, truth and justice are often elusive.

"One of the problems as I see it is that Indigenous reconciliation in Australia emerged from a series of broken promises by [former] Prime Minister Bob Hawke and his government," Davis says. "It started as a political confection that had nothing to do with truth and justice.

"When you look at how other reconciliation processes work – really effective ones, like Canada's – they do require a ventilating of stories, of competing and contested narratives. You need to give everyone that space. There's so much that we haven't seriously engaged with."

For the past four years, Davis, the director of UNSW's Indigenous Law Centre, has been at the centre of efforts to lay the groundwork for constitutional recognition of our Aboriginal and Torres Strait Islander peoples.

"If we have any hope of getting this right the government should be listening to her," says Melbourne University's foundation Chair in Australian Indigenous Studies, Professor Marcia Langton. "I defer to Megan on all things constitutional. She has made an enormous contribution."

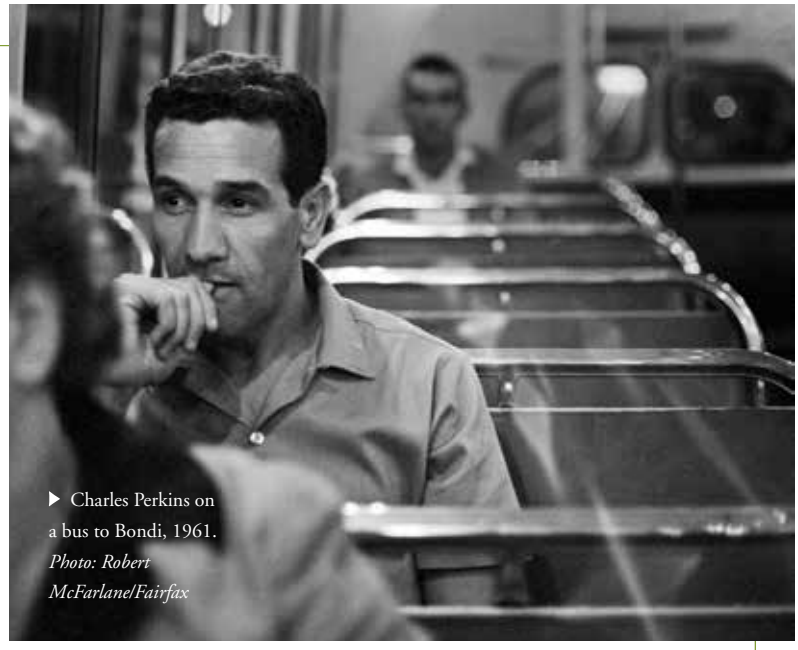
Change to Australia's constitution can only come through popular vote in a referendum. As Tony Abbott's government approaches a critical point in the process – the drafting of the referendum wording, due by the end of the year – it is clear recognition must amount to more than a feel-good celebration or wording in a preamble; after all Australian voters and Indigenous people rejected this approach to recognition in the 1999 referendum on the Republic.

Indigenous people strongly believe symbolic recognition in a preamble would hardly be worth the effort of a referendum. "I'm not interested in the poetry as much as the substantive changes," Davis says. "I hear a lot of people in the community say they don't need to be 'recognised' and I agree with that."

It is now more than two years since the expert panel on constitutional recognition – of which Davis was a member – delivered its final report, and a referendum on the issue could happen as early as next year. There has long been bipartisan support on the concept of recognition, but how substantive that turns out to be is very much in question.

And as the federal government grapples with the referendum's wording, Davis is invoking the words of Aboriginal activist

▲ The protection era and the Frontier Wars are still alive in people's minds … Professor Megan Davis in New York. *Photo: Andrzej Liguz*



▶ Charles Perkins on a bus to Bondi, 1961. *Photo: Robert McFarlane/Fairfax*

Charles Perkins, who late in his life spoke with pessimism about reconciliation: "We wander through Australian society as beggars. We live off the crumbs that fall off the White Australian tables and are told to be grateful". If recognition amounts to throwing Aboriginal people crumbs, Davis says, it is worth little at all.

When it comes to constitutional change, there is broad consensus across the Aboriginal community and political class that section 25 – which permits states to disqualify people of a particular race from voting in state elections – should be repealed.

The expert panel also recommended repealing section 51(xxvi), which grants the Commonwealth the right to make laws for the people of any race. The expert panel has proposed a new section 51A, which recognises Australia's first people but also allows the Commonwealth to make laws for the advancement of Aboriginal people.

A new section 116A, prohibiting racial discrimination, was also proposed, and it is this point that has threatened to become an ideological battleground between proponents of recognition and conservative political forces.

Davis rejects any suggestion a non-discrimination clause, like section 116A, represents a "one-clause bill of rights".

"If you're going to recognise Aboriginal and Torres Strait Islander people, what do you recognise?" Davis askes. "You recognise they've been discriminated against for pretty much the entire time of this Federation. And the way you do that is by having a provision in your constitution that says the federal parliament can't discriminate against people on the basis of race."

But even as Aboriginal leaders warn only substantive recognition is worth pursuing, the first evidence of a "no" campaign has emerged. Last month, Indigenous man Wesley Aird, with former Labor politician Gary Johns, launched a website, Recognise What? advocating for "super minimalist" preambular change and cautioning against following the expert panel's recommendations.

The federal government–funded "people's movement" RECOGNISE, formed to drive support for constitutional recognition, believes Australians are ready to confront the race question. Joint campaign director Tim Gartrell says the calls across decades by successive Aboriginal leaders for constitutional recognition have "led us to this moment as a nation".

"We've got a responsibility to all of them to complete this task, as well as the basic responsibility we have to ourselves and to each other as Australians to do this," Gartrell says.

For Davis, as for many Aboriginal people, these matters are barely historical. In the year of her birth, 1975, her home state of Queensland had just rid itself of the last vestiges of the protection era, in which every aspect of Aboriginal people's lives was controlled by the state.

Davis' family holds paper files that demonstrate such history: the letters written by her grandfather and his brother to the so-called Protector of Aborigines asking for permission to marry; to open a bank account; and to be supplied blankets and lamps in the absence of access to wages.

"The protection era, even the Frontier Wars, they are really alive in people's minds," Davis says.

Davis was born in the town of Monto, in the Wide Bay–Burnett region, 500 km north-west of Brisbane. Her grandmother was a South Sea Islander brought to Australia through the "blackbirding" trade, where Islanders were kidnapped and enslaved. The other side of her father's family are Cobble Cobble people and were forcibly removed from their traditional country near the Darling Downs town of Warra to Cherbourg reserve in 1904.

After leaving the mission, Davis' grandfather and his brother bought land at Hervey Bay and, for Davis, it is this beachside town that is home.

However, it was not at the beach, but in a poor outer suburb of Brisbane that Davis' intellectual life blossomed. Her parents separated when Davis was still in primary school, and her mother, who is white, relocated with the five Davis children to Eagleby. Davis' mother Dawn, a trained schoolteacher and fluent French speaker, chose not to work and instead poured all her formidable energy into rearing her children. Davis has often publicly described herself as "a child of the welfare state".

"One of the first things Mum did when she moved away was take out a subscription to *Time* magazine and *The Australian*," Davis says. "Every [welfare] pay day she would come home with second-hand books."

One of those second-hand books was Sir John Kerr's autobiography, *Matters for Judgment*. Davis read it cover to cover and remembers being fascinated with the drama of the 1974 double dissolution.

After completing school Davis enrolled at the University of Queensland, where she completed a Bachelor of Arts and Bachelor of Laws. A masters degree in international law at the Australian National University followed, along with a doctorate exploring the lack of attention given to Aboriginal women in international human rights law.

In the final year of her undergraduate law degree, Davis was selected for the UN Indigenous Fellowship and then as a young lawyer joined a UN working group drafting the Declaration on the Rights of Indigenous Peoples. It was grounding that later led then Indigenous Affairs minister Jenny Macklin to nominate her for the UN Permanent Forum on Indigenous Issues. Davis was elected in 2010, and became the first Indigenous woman to represent Australia at a UN body.

"It was wonderful we had a woman of her calibre to nominate," Macklin says. "She is a leading scholar and has so much

experience. But she has also been a very outspoken advocate for women, particularly Indigenous women who are suffering from violence. I really admire that."

Last year, Davis was re-elected by the UN to the permanent forum for a further three-year term, securing 48 out of 54 votes.

Despite her international profile, Davis is relatively unknown in Australia. She is far more likely to be found delivering academically informed speeches than making statements in the press.

Close friend Louise Taylor, a Canberra prosecutor, says Davis' natural tendency is to listen rather than hold court.

"She was always one who didn't need to be the centre of attention, but when she makes a contribution, people stop and listen," Taylor says. "I am always struck by the breadth and depth of her knowledge. She is a ferocious reader, and her work ethic is quite something."

Despite the highly fractious nature of Indigenous politics, and the highly charged nature of the topics she examines, even close friends and colleagues cannot pin Davis to any political stripe.

"She is not political at all, in fact she is fastidiously apolitical," says Langton. "She is most concerned with taking into account all of the opinions on a matter and weighing each one carefully."

Constitutional law professor George Williams, a colleague, agrees. Williams was responsible for bringing Davis to UNSW from ATSIC in 2002 and is editing a book with her on the upcoming referendum for UNSW Press.

"Megan brings to the issues a sensitivity and an acute legal mind, a combination that explains a large part of her success," he says.

"Her work is accessible and can't be pigeonholed, which gives it effectiveness. It means she's someone people want to listen to because they know she's thoughtful and considered, qualities you want in a leading academic."

Given Davis' measured nature, it is significant she is now delivering strongly worded commentary on the progress of reconciliation and constitutional reform in Australia.

In a recent Senate occasional lecture, Davis spoke of the sharp contrasts between nations that have been willing to engage seriously with the legacies of colonisation, and the continual tendency in Australian politics to reject rights-based proposals.

"What is considered practical and concrete in other jurisdictions is pilloried as 'rights' in Australia," Davis said. "The notion of treaty is regarded as radical in Australia. It is kind of uneasy to sit there at the UN and hear Canada, the US, New Zealand, Guatemala, Norway, Finland – so many member states – talk matter-of-factly about constitutional rights, or treaties. This is common practice in the world, yet the fact remains we have never tried to do this properly."

And for all of Australia's emphasis on practical reconciliation, our record on Indigenous health and wellbeing is appalling.

In September, Prime Minister Tony Abbott will mark the first anniversary of his government by travelling to northeast Arnhem Land to fulfil an election promise to spend a week each year in an Aboriginal community. His host will be formidable Aboriginal leader Galarrwuy Yunupingu. It was Yunupingu who, in 2008, led a group of clan leaders to present then Labor Prime Minister Kevin Rudd with a bark petition that called on the government "to secure within the Australian Constitution the recognition and protection" of a series of "full and complete" rights: to way of life, property and waters, economic independence and control over destiny. The petition was the catalyst for the current recognition push.

> "Constitutional rights and treaties are common practices in the world, yet the fact remains we have never tried to do this properly."

Forty-five years earlier, a young Yunupingu assisted in translating the 1963 Yirrkala bark petitions, the earliest documented call for land rights and a precursor to the 1967 referendum.

Though Abbott wants the focus of his Arnhem Land visit to be on practical measures, constitutional recognition is sure to be discussed. There is perhaps no Aboriginal leader better placed than Yunupingu – who cannot be dismissed as an urban-based "rights advocate" – to influence Abbott on the importance of embedding Aboriginal recognition firmly within the constitution.

But Davis says there is a long way to go to secure community backing, despite polls showing some support in principle. "There hasn't been a lot of serious community engagement," she says. "I suspect most of the support people are giving is predicated on preambular recognition, on mere poetry.

"There's so much yet to play out. I have no doubt there is genuine desire for recognition based on truth and justice. But in Australia it is completely contingent on political leadership."

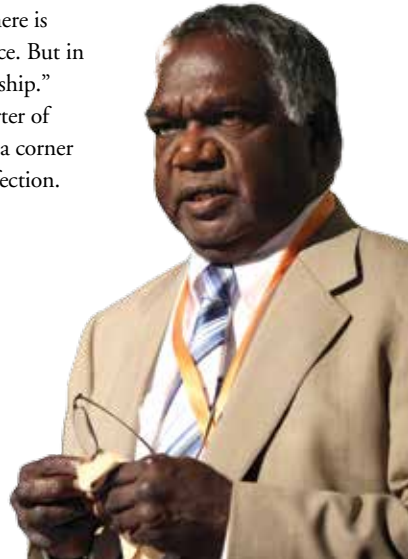
As Davis told the Senate: "I'm a fully fledged supporter of recognition, but what I don't want is mob backed into a corner where they feel obliged to accept another political confection.

"If that were to occur, there would be no revisiting constitutional reform.

"We would be the one state that had successfully executed assimilation in a way that the state never had to give an inch of space to the aspirations of its first peoples.

"And if that happens we really would be relegating Aboriginal people to living off the crumbs."

▼ Aboriginal leader Galarrwuy Yunupingu. *Photo: Stuart McEvoy/Newspix*



MAN AND MACHINE

Photo: digitalvision/ Thinkstock

Air traffic controllers are helping researchers build intelligent systems that seamlessly blend with the human mind, discovers Chris Sheedy.

IN AN AIR TRAFFIC control tower in France, a man watches electronic blips move across a screen, each dot representing a plane in flight. His job: to safely guide the planes across the crowded airspace to their destination.

It's work where a single lapse in concentration, a minor miscalculation or moment of misjudgement, could result in the deaths of hundreds of people.

But what if the controllers could super-charge their thinking by merging their brain with a machine that looks after, in real time, every calculation, forecast and analytical problem they face?

Their brain's "bandwidth" would then be freed up to look at the things that humans excel at – spatial awareness, holistic judgement, strategising and understanding human nature.

The air traffic controllers at the Eurocontrol Experimental Centre in Bretigny, France, have been participating in UNSW-led research that could lead to that outcome.

The controllers were put through their paces in a simulated environment with multiple sensors attached to and around their scalps to monitor brain activity during typical air traffic control challenges. The research was led by Hussein Abbass, professor of information technology at UNSW Canberra.

"Throughout my career I have been motivated to build an intelligent system that seamlessly blends with the human being," Abbass explains.

"Usually when people think of such a coming together, the machine is one component and the human is another. My specialisation is artificial intelligence so I want to see the two morphing into one. It is about what I call Cognitive-Cyber Symbiosis, or 'CoCyS' (pronounced 'cookies')."

Far-fetched? In fact CoCyS is far closer to reality than you might think, Abbass says. In certain industries such as education and training he and his team are ready to roll out systems that will work in unison with professionals to make them more effective and efficient.

Researchers at UNSW Canberra are now analysing the masses of data gleaned about aircraft movements, distance, altitude, speed and weather effects and then combining them with data from the human controllers, all with the objective of discovering how machines might complement the human brain to create better outcomes and a safer environment. A paper detailing the study is published in the *Journal of Air Traffic Control.*

Abbass admits there is still a huge amount of "noise" in the data collection process. For example, if you are speaking with somebody and they are distracted and look away, even for a split second, how do you figure out why they are doing that or what caused the distraction?

Modern-day computing and its ability to collect and analyse big data makes it possible to answer such questions, as long as enough data are collected.

"We build models to identify the causes of change and steer the environment towards the desired outcomes," Abbass says. "If you do it for long enough you can develop confidence in what the data are telling you.

"From a single sensor on a person's skull – and we can go up to 128 if needed – we receive and analyse 2,048 readings per second."

What can a machine do more quickly, reliably and accurately than a human? What can the human do better if they have a machine doing some of the thinking for them? This is what Abbass is looking into, and its application is far greater than in the field of air traffic control.

"In almost every industry we need to pay attention to the human and give people the technology and the support to make the right decision every time," says Abbass, who is keen to partner with researchers in cognitive psychology to expand the application of his work.

"This technology can help people do that in real time. And when things go wrong, as they sometimes do in aviation, it can be used to explain why."

Professor Abbass' book *Computational Red Teaming: Risk Analytics of Big-Data-to-Decisions Intelligent Systems* is published later this year by Springer.

THE PARENTING TRAP

How mothers bond with their babies may be connected to their own experiences as a newborn. Amy Coopes reports.

ONE-YEAR-OLD Jacob Nguyen is any new parent's dream – a solid sleeper, bright-eyed and inquisitive around people. His mother Linda considers him a blessing.

"I feel lucky, I know not every mother has a baby like that," she says of the euphoria of Jacob's early weeks and months. "It's like nothing I've experienced before. There's a lot of bonding, a lot of growing and learning."

Linda's own memories of childhood are equally happy, in spite of the circumstances – her parents were refugees who fled strife-torn Vietnam.

"I know when they had me things weren't so easy," she says. "But I learned from them, I've learned so much from their experiences."

Linda was one of 127 expectant mothers recruited from Liverpool Hospital into a UNSW study, looking at the links between a woman's own history of parenting, the hormone oxytocin and their level of attachment to their newborns.

According to Professor Valsamma Eapen, Chair of Infant, Child and Adolescent Psychiatry at UNSW and lead researcher on the study, Linda and Jacob are an "oxytocin success story".

"No matter the background, Linda's parents provided her with the right kind of nurturing," she says. And that strong bond is being replicated with Jacob.

Eapen says it's long been known oxytocin is the hormone governing social affiliation and trust. It is at work in most social interactions. Above all "it is the love hormone", she says. "Its job is to come out when you are in that special kind of intimate relationship, including the relationship between mother and child."

If the hormone fails to kick in at appropriate levels, or is absent altogether, it can have profound effects on the quality of the bond between mother and child.

In the latest study, funded by the Australian Research Council (ARC) Eapen and her team looked at not only the hormone's immediate effects, but its impact across the generations.

The researchers divided newly pregnant women into two groups: those who had difficult attachment and relationship patterns in their own childhood and those without. Oxytocin levels in the blood were measured midway through pregnancy and again at two months after birth.

Eapen says she was surprised by the results. There was an obvious difference between the two cohorts at the postpartum reading, with mothers who had experience of separation anxiety returning much lower levels of the hormone.

"The immediate postpartum results show what you yourself experienced from parenting, these formative experiences, are critical in wiring your response to the hormone."

Eapen explains that oxytocin triggers a dopamine reward response in the brain that promotes maternal bonding with your baby as a pleasurable activity. In the baby, this bonding sets lifelong oxytocin release pathways that, if compromised, will affect the child's own future attachment relationships.

"So we see this dysfunctional, or disrupted, relating as an intergenerational cycle, and just increasing oxytocin levels with an oxytocin puffer or spray alone won't change that," she says.

The study could be a breakthrough in identifying at-risk mothers and helping them break the cycle, Eapen believes.

"What we are now developing is attachment-based, cognitive behavioural therapy for mums to reframe their own perspectives and attitudes to overcome the separation anxiety problems that have been preprogrammed," she says.

Phase three of the project, which looks at anxiety response

▲ When it comes to children, intervening at the right time is critical … Professor Valsa Eapen. *Photo: Britta Campion*

in the child at one year of age, is underway in western Sydney at Karitane Services – a UNSW linkage partner in the research.

The one-year-old children and their mothers from the study's first phase are being put through a "stranger situation" to assess their response to separation.

Maternal oxytocin is measured before and after the women leave their baby with a stranger (a trained child psychologist), with researchers recording and observing the interaction from behind one-way glass.

When the oxytocin system responds well in the context of the mother–child interaction, the consequent oxytocin release provides a rewarding and joyful experience.

But when lower levels of oxytocin are recorded in those mothers with separation anxiety and depression the deficit can lead to feeding and settling problems and further bonding issues. Such difficulties, in turn, can land mother and child somewhere like Karitane, a residential treatment unit for some of the worst cases.

> "When the oxytocin system responds well in mother–child interaction, the release provides a rewarding and joyful experience."

"Karitane wants to understand these bonding and attachment issues for its own work," Eapen explains.

Arriving at UNSW six years ago via the United Arab Emirates, the UK and India, Eapen is a world leader in her field. She has five books, 15 book chapters and more than 150 peer-reviewed journal articles to her name. She holds ARC and National Health and Medical Research Council grants and is a project leader in the Cooperative Research Centre for Living with Autism Spectrum Disorders (Autism CRC).

In her work with autistic toddlers, Eapen is pioneering the use of an intervention program known as the Early Start Denver Model (ESDM), adapting it for use in a group setting. The UNSW-partnered KU Marcia Burgess Autism Specific Early Learning and Care Centre at Liverpool was the first site internationally to introduce the group delivery model.

Eapen has published several papers about her work with the children at KU, demonstrating behavioural and cognitive improvements after 12 months of ESDM intervention.

Next year, researchers will use neuro-imaging to track changes in the children's brains resulting from the treatment, hoping to understand the neural pathways affected in autism and how intervention alters these pathways.

The imaging is part of a sub-typing project through the Autism CRC seeking to build a biological blueprint of the disorder.

"We are saying that 'autism' is in fact 'autisms' (plural) – there are sub-types within the autism – and different clinical and genetic profiles may respond differently to treatment," she says. "If we understand better what those sub-groups are we will be able to predict the outcomes of particular interventions and what would work for whom."

Eapen hopes the neuro-imaging tracking will provide vital clues about how those with a genetic vulnerability to autism progress through to clinical symptoms, and how best to maximise brain plasticity for better outcomes as delay in recognition and treatment can lead to lost opportunities to build neuro-cognitive connections.

Like maternal bonding, intervening at the right time and with the right approach is critical in helping children with autism develop and make strong connections.

Mother craft

When it first started out as mothercraft cottages in Randwick almost 100 years ago, Karitane's future at the vanguard of child development could scarcely have been imagined.

Today, CEO Grainne O'Loughlin proudly puts research at the centre of everything Karitane does. She says the collaboration with Professor Valsa Eapen "gives us the chance to provide that evidence base, and will lay the foundations for us to expand, over time, what it is that we do".

"For me partnerships with universities – that evidence base to our work – is really fundamental. It's the key to our sustainability going forward."

Families who are referred to Karitane for treatment may be the end result of the bonding or other issues that Eapen is exploring.

O'Loughlin says establishing a case for intervening earlier could have a significant impact.

"The research will allow a more holistic approach, enabling integration of programs or interventions at earlier, more critical stages," she says.

Quantum tern

Mother nature is giving researchers a lesson in weird physics, writes Deborah Smith.

IN THEIR PURSUIT of an endless summer, Arctic tern seabirds make an extraordinary journey each year, flying tens of thousands of kilometres from pole to pole. Many other avian species also undergo epic migrations.

It remains a mystery how these birds precisely navigate their way around the planet – a feat we could not emulate without the aid of a compass. But it may involve quantum effects usually only observed in the tightly controlled conditions of a physics lab.

It's thought light falling on a light-sensing molecule in the birds' eyes could produce pairs of electrons that are in a quantum "entangled" state – where changes in one affect the other, even at a distance.

The slightly different pulls on these paired electrons from the Earth's magnetic field could alter the properties of the eye molecules, creating a picture of the magnetic field the birds use to orient themselves.

Even more speculative is a suggestion that a sense of smell could depend on a quantum mechanism that allows the detection of the tiny vibrations of molecules. Both ideas are part of an emerging field known as quantum biology, which argues quantum phenomena are operating in nature.

The strongest evidence by far comes from photosynthesis – the vital reaction by which plants and bacteria harness the energy of the sun.

In this intriguing area, UNSW researchers, led by Professor Paul Curmi in the School of Physics, are at the forefront of international research.

In 2010 they showed a phenomenon called quantum coherence occurs during photosynthesis in single-cell algae that can survive in very low levels of light at the bottom of pools of water or under thick ice. In the weird quantum world, a system that is coherent – with all quantum waves in step with each other – can exist in different states simultaneously.

Curmi says the idea that quantum phenomena have a non-trivial role in living organisms challenges conventional wisdom, because the biological world

▲ It is a mystery how Arctic terns navigate their way around the globe. *Photo: David Foreman/Thinkstock*

is a warm, wet, messy place. "Molecules are vibrating, jiggling around and bouncing into each other," he says. Physicists usually have to employ vacuums, low temperatures and high-tech equipment to observe quantum effects such as coherence.

When it comes to birds, Curmi is "sceptical" of the sense of smell theory, and says there is no direct evidence yet for birds having an inner quantum-based compass.

"But photosynthesis is the area most likely to use quantum effects because it involves light and events that occur on very short timescales – in less than a picosecond," he says.

Quantum biology first hit the headlines in 2007 when two research teams showed quantum coherence was operating during photosynthesis in green sulphur bacteria and purple bacteria.

Then in 2010, Curmi and his colleagues, including Professor Greg Scholes from the University of Toronto, showed this phenomenon also occurs in the dark-dwelling algae, called cryptophytes.

While its function, if any, has not been determined, coherence may help the organisms harvest energy from the sun more efficiently.

"Once a light-harvesting protein has captured sunlight, it needs to get that trapped energy to the reaction centre in the cell as quickly as possible," says Curmi.

> "Photosynthesis is the area most likely to use quantum effects because it involves light and events that occur on very short timescales – in less than a picosecond."

"It was assumed the energy gets there in a random fashion, like a drunk staggering home. But quantum coherence would allow the energy to test every possible pathway simultaneously before travelling via the quickest route."

The team published its latest research in June, showing that in two species of cryptophyte a genetic mutation has changed the structure of the light-harvesting protein complex, switching off the quantum coherence – which just adds to the mystery.

Organisms like algae and bacteria have been evolving for billions of years and understanding their photosynthetic tricks could lead to the development of better solar cells or other devices.

"We can definitely learn from nature," says Curmi.

Photo: Thinkstock

Beautiful but a threat

TROPICAL FISH make for beautiful underwater photos, but their migration as a result of ocean warming poses a serious threat to kelp forests and seagrass meadows, a new study concludes.

Tropical fish are now common in Sydney Harbour during the summer months.

"The tropicalisation of temperate marine areas is a new phenomenon of global significance that has arisen because of climate change," says study lead author, Dr Adriana Vergés, from the School of Biological, Earth and Environmental Sciences.

"Increases in the number of plant-eating tropical fish can profoundly alter ecosystems and lead to barren reefs, affecting the biodiversity of these regions, with significant economic and management impacts."

As the oceans have warmed and the climate has changed, hot spots are developing in regions where the currents that transport warm tropical waters towards the poles are strengthening.

Increased flow of the East Australian Current, for example, has meant waters south-east of the continent are warming at two to three times the global average.

Japan, the east coast of the US, northern Brazil and south-eastern Africa are also strongly influenced by coastal currents that transport warm tropical waters.

"In tropical regions, a wide diversity of plant-eating fish perform the vital role of keeping reefs free of large seaweeds, allowing corals to flourish," says Dr Vergés, who is also a member of the Sydney Institute of Marine Science.

"But when they intrude into temperate waters they pose a significant threat to these habitats. They can directly overgraze algal forests as well as prevent the recovery of algae that have been damaged for other reasons."

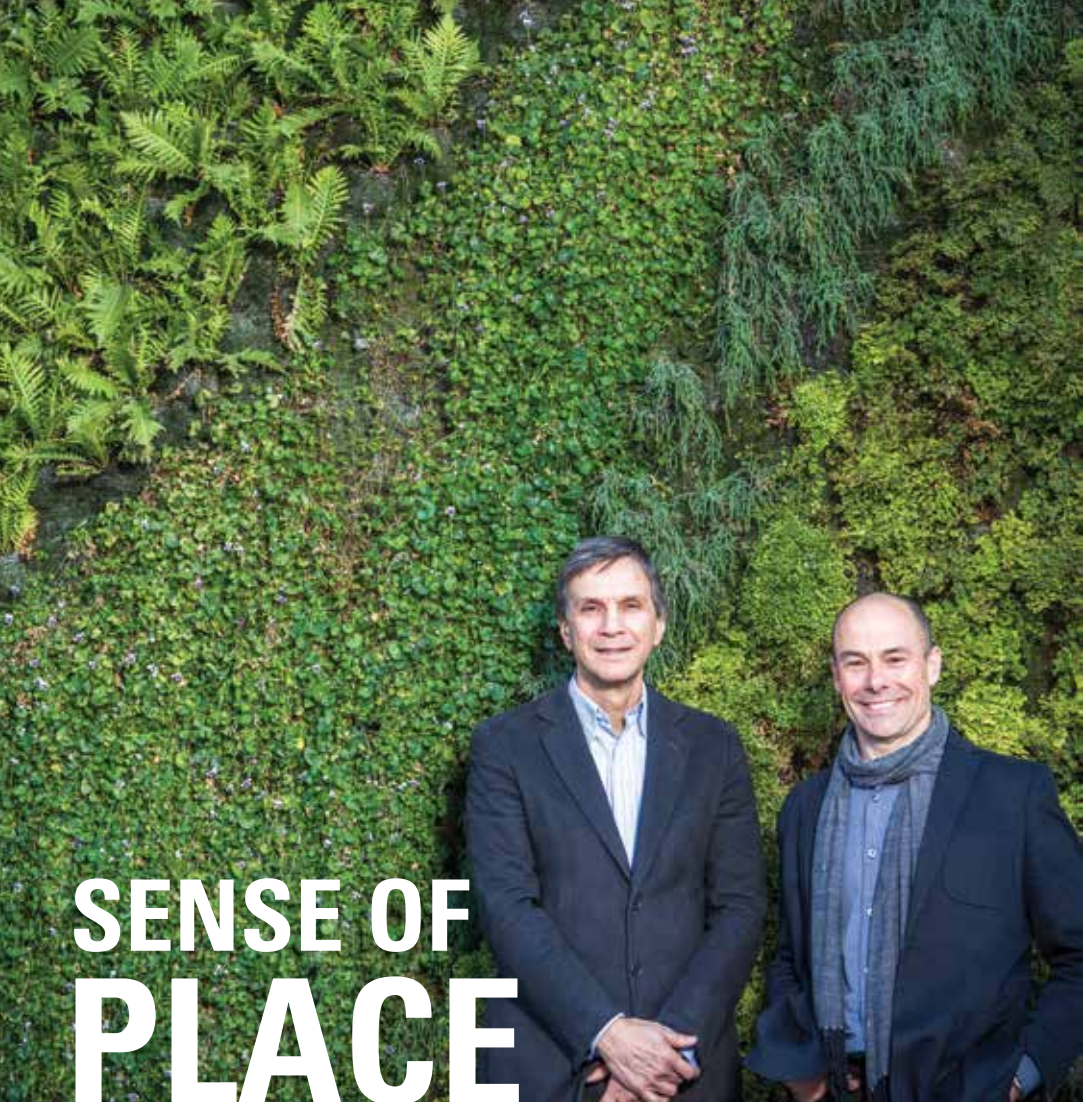
Tropical fish expanding their ranges into temperate areas include unicorn fish, parrot fish and rabbit fish.

In Western Australia, emerging evidence suggests that increases in the number of tropical fish are preventing the recovery of kelp forest damaged by a heatwave in 2011.

And in the US, there has been a more than 20-fold increase in the number of parrot fish in the Gulf of Mexico – a species that consumes seagrass at five times the rate of native grazers.

The study is published in the journal *Proceedings of the Royal Society B.*

– Deborah Smith



SENSE OF PLACE

Inspired design is the key to the popularity of Sydney's newest suburbs says Built Environment's newest recruit, Philip Graus.

ARCHITECT and urban planner Philip Graus stands on a penthouse balcony at Central Park on Broadway, gazing down at the complex's trademark vertical gardens and moving solar panels.

Masses of people are walking in sunshine around the apartment and shopping precinct.

"Central Park just wouldn't be so dense – and so popular – if the park didn't have any sun," Graus says.

In Sydney the debate about "density" is usually a negative one. "But population density really is a measure of how attractive we find a place," says Graus. "And popularity is the direct result of good planning."

Graus, whose firm Cox Richardson collaborated with Tzannes Associates to draw up the original master plan for the development, is the latest high-profile addition to UNSW's Faculty of Built Environment, where he's been appointed conjoint professor.

The new role will allow Graus to straddle professional and research interests, in much the same way Central Park straddles the city and the suburb of Chippendale.

Practising architect and Built Environment Dean Alec Tzannes well understands the importance of one role as a conduit to the other.

"I have studied the medical faculty to form my views, but I also have doctors in my extended family, graduates of UNSW, who have made me more aware of the benefits of conjoint roles," says Tzannes.

Tzannes says the FBE conjoint position is foremost a relationship between UNSW and Cox Richardson, which is an interdisciplinary, well-regarded company, incorporating planning, architecture and urban design, with a strong reach into Asia, particularly China.

Serendipity struck around seven years ago, when Graus realised he was interested in the same research questions being addressed by UNSW's City Futures Research Centre.

As the Chair of the Urban Development Institute of Australia's Urban Revitalisation Committee, Graus and his fellow members were looking at the commercial viability of the state government's Metropolitan Plan for Sydney, especially the renewal of the "infill" sites outside the major centres, where significant growth was planned.

Meanwhile, Professor Bill Randolph from City Futures was focused on the buildings that were to be part of the strategy.

"It was interesting," notes Graus. "We were doing very similar things: testing the government policy, but from slightly different perspectives.

"At the time, the industry was trying to improve engagement with government. Now, this conjoint appointment means the engagement will be much more powerful, strengthening the quality of practice-based research, which can be shared with government, industry, and more importantly, the community."

Graus says similar linkages are well established in the US. "In Chicago, a leading architectural practice, a university, a national research laboratory and the city government are building a spatial model of the city that they are going to test against climate-change scenarios, using big data. We hope to do the same here."

Up to 12 people in his practice are collaborating with researchers in City Futures and other areas of the faculty.

Graus has been conducting studio sessions to ramp up teaching of planning and urban design as an integrated process and it is hoped the research focus will lead to better outcomes for students.

"It means the students doing the research will be highly skilled when they graduate, and much more employable."

– Susi Hamilton

▲ Joining forces … FBE Dean Alec Tzannes and Philip Graus at Sydney's Central Park. *Photo: Brett Boardman*

SIGN OF THE TIMES

The ban on deaf jurors in Australian courts is a human rights issue, writes Fran Strachan.

SANDRA HALE still remembers the cruel taunts she endured at high school over her then poor English skills.

"I was made to feel stupid by the other kids, I had gone from the top of the class in Argentina to the lowest class in Australia," she says, recalling her arrival in the country as a 12-year-old.

A quick learner, Hale mastered English before her parents, and spent her first few years in Australia as an ad hoc "interpreter" on their behalf.

Now a professor in interpreting and translation, Hale's work has a direct link to her early experiences. "The main focus of my work is to help people achieve equal access to all services in the community, regardless of the language they speak," she says.

As a pioneer in the study of legal interpreting, Hale is one of the first in the world to conduct large-scale research of court-interpreted proceedings. Since graduating with the first PhD in court interpreting in Australia, Hale's research has covered issues relating to accuracy, ethics, standards and working conditions of interpreters, and she is frequently invited to advise judges and magistrates on how to work with interpreters in courtroom settings.

Her most recent Australian Research Council-funded research – with Mehera San Roque from UNSW Law, and professors David Spencer from the Australian Catholic University and Jemina Napier from Heriot-Watt University in the UK – aims to bring about law reform by proving that deaf citizens can capably serve as jurors when professional, trained interpreters are employed.

To date, only some states of the USA, and New Zealand have permitted deaf people to serve on juries. Earlier this year, a deaf woman was barred from a jury in Queensland.

Legal challenges to the rule have been dismissed based on the long-held common law principle that there cannot be a non-juror "stranger" (interpreter) as a 13th person in the jury room.

But in a world-first mock trial at the Sydney West Trial Courts at Parramatta, Hale challenged this premise through the re-enactment of a criminal trial. For the first time, two deaf jurors participated using Auslan interpreters.

"There is no evidence about the impact an interpreter has on the sanctity of deliberations," says Hale. "Interpreters abide by a professional code of ethics that requires strict confidentiality regarding any job they undertake."

Previous studies by co-researchers Napier and Spencer also found deaf jurors are not disadvantaged by relying on sign language interpreters, showing comparable levels of understanding to other jurors.

Alex Jones, one of the deaf jurors who participated in the mock trial, says he experienced no difficulty understanding the proceedings or the deliberation process.

"The interpreters did an outstanding job, remaining impartial while communicating complicated ideas and the emotions of witnesses," he says.

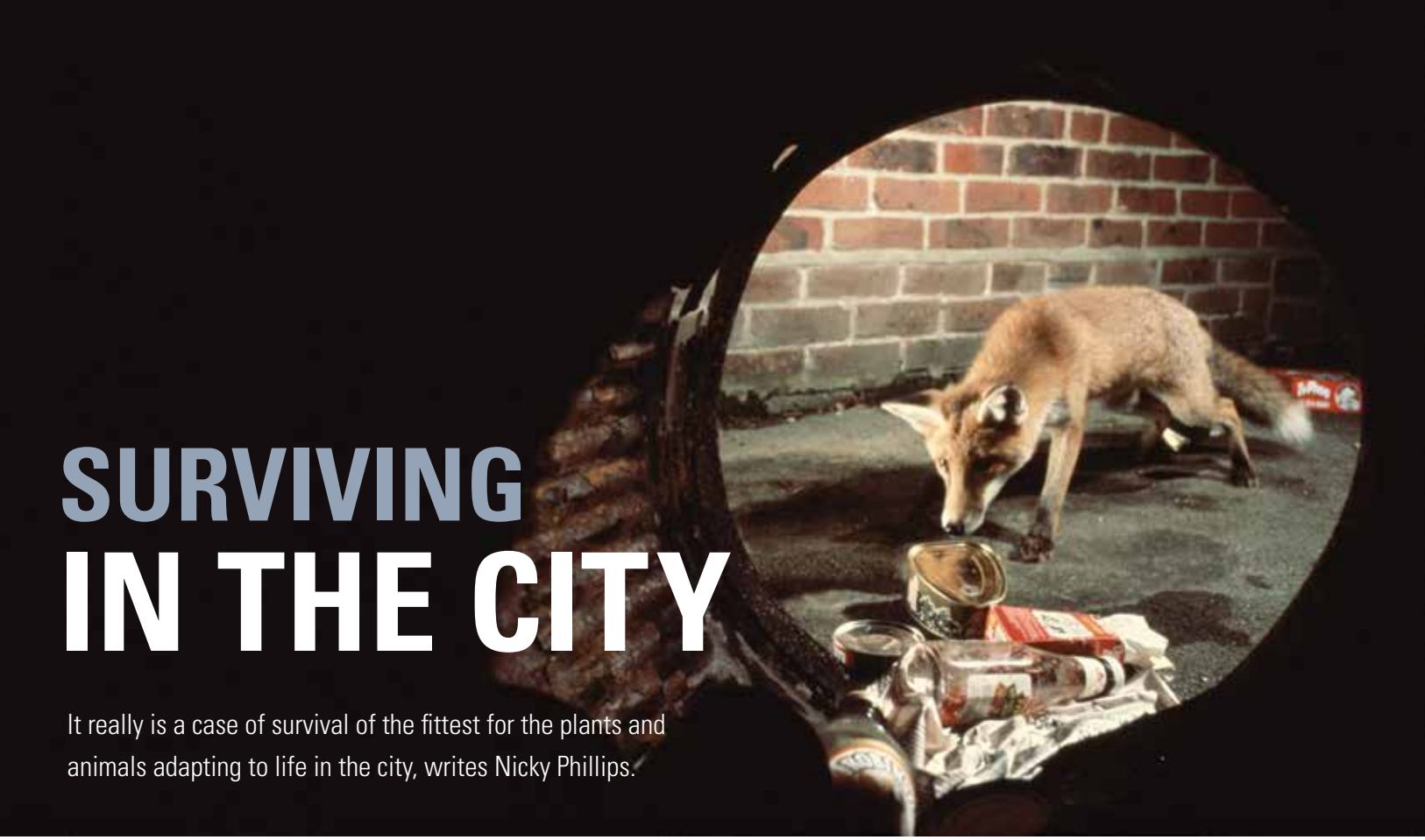
In interviews after the trial, all of the jurors said they were in favour of allowing deaf people to serve, provided the interpreters were as professional and competent as the ones who participated in the trial.

"There is a need for specialist training, not only for signed language interpreters, but for all court interpreters who currently interpret for witnesses, the accused or defendant," Hale says.

For Jones, the experience of taking his oath in sign language was a "civic duty and an honour". He says stripping away the right of a deaf person to serve on a jury effectively makes them a second-class citizen.

"Deaf people, or any other person with a disability, should be able to share their perspectives, values and beliefs as much as any other juror – their contribution is invaluable and valid to any decisions made during jury processes," he says.

▲ Ensuring equal access to all services in the community … Professor Sandra Hale with trial participants Alex Jones, interpreter Jasmine Rozsa and retired judge Chris Geraghty. *Photo: Grant Turner/ Mediakoo*



SURVIVING IN THE CITY

It really is a case of survival of the fittest for the plants and animals adapting to life in the city, writes Nicky Phillips.

MOST MORNINGS a dozen or so sulphur-crested cockatoos flock to a large tree outside my inner-Sydney apartment to feed. They frolic in the tree's canopy, the more adventurous ones swinging around overhanging wires like gymnasts on a bar. At times, their squawks are so loud they drown out the Darlinghurst traffic.

But venture back to a Sydney before white settlement and the same species would have been a rare sight. In the early 1800s the British naturalist and explorer George Caley wrote of a flock he encountered near the Nepean River. "They are shy and not easily approachable," he wrote. A few pairs were reported closer to the city in the Royal National Park in 1945, but large numbers only began to frequent the inner suburbs in the 1960s. Now, ecologists at the Royal Botanic Gardens and the University of Sydney are partway through the first study to track the birds' movements. It appears they're true city slickers.

The sulphur-crested cockatoo is one of a number of species that have relocated to Sydney. White ibis, noisy miner birds, green ants and golden orb weaver spiders have also taken advantage of their new surrounds. But it hasn't been easy for everyone. As their bushland home was transformed into human habitat, local but less mobile species of mammal, reptile and plant have been forced to develop strategies to cope in the remaining pockets of remnant bushland, urban parks and backyards.

Ecologists often prefer to study plants and animals in exotic locations, but a growing number have turned their attention to the wildlife that inhabit concrete jungles. Inner-city Sydney is the laboratory of choice for these urban ecologists.

The research is timely. More than half the world's population resides in cities, and urban development continues to stretch across the Earth. By 2030 the United Nations projects five billion people will call a city home. "We need to understand how cities are changing the ecology of the systems they are built on, and how plants and animals are adapting to them," says Dieter Hochuli, a biologist at the University of Sydney.

For the most part, plants and animals adapt to their urban surroundings using the traits that help them survive in their natural habitat. But some scientists predict there may come a point when the pressure of the city, especially from pollution, becomes so great evolution will intervene.

"We've created this whole new habitat that never used to exist here," Professor Angela Moles, a UNSW plant biologist, says. "There will be some species living here that are not doing so well and there will be selection for individuals who can do better in an urban environment."

If any species has learned to thrive in an urban environment, it's the native white ibis. Known as the "tip turkey", the bird's reputation for scavenging has not endeared it to the public.

The white ibis began its move to the big smoke in the 1970s when large parts of its natural habitat, inland wetlands, became degraded or drought affected. "The species is a wetland forager," says wildlife officer John Martin, from the Royal Botanic Gardens. "Now it forages in inland parks and landfill." During the peak of its spring breeding season, more than 9,000 of the birds call Sydney home.

Specimens at the Australian Museum show the city's bird life has changed dramatically over two centuries. Prior to urban development the native shrubs and bushland were populated by large numbers of small insect-eating birds such as the superb fairy-wren and the eastern yellow robin. Today, homeowners landscape their backyards with tall trees and manicured lawns, an environment that provides little protection for small avian

▲ A growing number of ecologists are turning their attention to the wildlife that inhabit concrete jungles. *Photo: Getty Images*

species. Yards filled with flowering plants and fruit trees encourage omnivorous birds such as currawongs, bowerbirds and the despised noisy miner. "They're a real winner in cities," Australian Museum ornithologist Richard Major says. "The predominant driver in the decline of small birds is that we've made a suitable environment for native noisy miners. They're so aggressive they push out smaller birds." But their disappearance has thrown a lifeline to the many insects that would have ended up as small-bird tucker.

Hochuli says many invertebrates such as the golden orb weaver spider and the blue triangle butterfly relish living in the city. The golden orb spiders in Sydney are fatter and fitter, he says. "We're trying to tease out whether it's more food or the urban heat island effect, as it's up to 4 degrees Celsius warmer in the city."

Hochuli has also found some varieties of ant more at home in the city. The green ant, known for its painful bite, will build a nest where there is space and food, regardless of whether it's your backyard or a sports oval.

While insects can survive in areas no bigger than a nature strip, mammals have been confined to patches of bushland scattered around Sydney and the national parks. But in the northern beaches, the rabbit-sized, long-nosed bandicoot has discovered the advantages of venturing out of Sydney Harbour National Park and into backyards.

"They forage for invertebrates in the grass and like the surrounding shrubs to nest and escape from predators," says Catherine Price, a research associate with the University of Sydney. Price is trying to understand what encourages the small mammal into urban environments.

Despite the remarkable ability of some species to fit comfortably into Sydney's sprawling landscape, Martin says the city's wildlife is far less diverse than it used to be. "We are talking about a handful of species that have thrived, many more have lost out," he says.

It's not just native wildlife that has sought comfort in city living; invasive species such as black rats, cockroaches and foxes have developed survival strategies too. But the pests that have gained the most advantage are the weeds.

"In residential Sydney there would not be a single area of remnant bushland not infested by introduced plants," says Michelle Leishman, a Macquarie University plant biologist.

Over 20 years Leishman and her colleagues have shown how the city's impermeable concrete coupled with the stormwater system have helped weeds such as lantana and the small- and large-leafed privet infiltrate pockets of bushland.

As rains wash over backyards and roadways they collect chemicals such as nitrogen and phosphorus that enter the stormwater system where they are piped to the edges of bushland. The nutrient-rich water seeps into the soil and creates the perfect environment for the many exotic species that "live fast, and die young", Leishman says.

Native plants prefer low-fertility soil and struggle to cope with the nutrients.

But development has encroached beyond land. The erection of piers, wharves and sea walls in and around Sydney Harbour, the country's largest urbanised estuary, has provided perfect conditions for invasive marine species, according to UNSW Professor Emma Johnston from the Sydney Institute of Marine Science. Artificial structures that block sunlight and are positioned vertically favour weedy species transported into the harbour by ships, she says.

"It's not just native wildlife that has sought comfort in city living; invasive species such as black rats and foxes have developed survival strategies too."

Laboratory experiments have also shown that some invasive species, such as lace coral, have huge potential to evolve tolerance better than native varieties to pollutants in the ocean.

Over two to three generations many invertebrates will increase their tolerance to contaminants by five to ten times, Johnston says. "Rapid evolution is not uncommon, especially to contaminants."

Johnston has noticed a similar trend in the offspring of native barnacles. Offspring whose parents were collected from Port Kembla or Port Botany showed a greater tolerance to copper than the young of Clyde River barnacles. "But we need multiple generations to express the same traits to show there has been rapid evolution," she says.

When Charles Darwin wrote *On the Origin of Species*, he thought evolution would be a process that occurred over tens of thousands of years, says UNSW's Moles. "Now there are lots of examples of proven evolution happening within 10 generations."

Moles' student, Joanna Buswell, has shown that 70% of introduced terrestrial plant species in NSW have changed their morphology, altering their leaf or stem size to become more suited to Australian conditions.

Now Moles is trying to determine whether these changes are underpinned by genetic mutations that would suggest they were becoming new species. "I absolutely think that's where they're going to go," she says. "Whether they are there yet, we don't know."

This is an edited extract from *The Best Australian Science Writing 2014*, edited by Ashley Hay (NewSouth), RRP $29.99. "Survival in the city" by Nicky Phillips was originally published in the *Sydney Morning Herald*. The winner of the Bragg UNSW Press Prize for Science Writing will be presented by Chancellor David Gonski on 6 November.

SONIC BOOM

A singer, songwriter and sound artist is spearheading a new discipline in Sonic Arts at UNSW, writes Tracey Clement.

A SIMPLE QUESTION doesn't always elicit a simple answer. Ask Dr Miriama Young to sum up what she does and she replies, "I am a composer and a sound artist." She pauses. "And a writer."

The New Zealand–born artist won several prizes for composition while still studying her undergraduate degree in History and Music at Victoria University in Wellington. In 2000, she travelled to the US on a Fulbright scholarship to Princeton University.

Since then Young has refused to be pigeonholed. She has joined the Faculty of Arts and Social Sciences at UNSW to develop Sonic Arts, one of four streams within the new Bachelor of Music degree.

How does Sonic Arts differ from everyday music? "I think of it as being very interdisciplinary by nature; it's not necessarily dots on paper. It could be anything from sound installations to film soundtracks or interactive artworks where sound is the principal element."

Young has composed music for dance, radio and film and her career highlights include the premiere of a work for Scottish Opera, the commission and broadcast of a radio-specific work for National Public Radio in the US, collaborating on a massive interactive artwork in last year's Vivid Sydney festival and composing the soundtrack for a new feature film, *Speechless: The Polar Realm.*

She composes with a number of instruments, including saxophone and harmonium, and writes and sings her own pop songs, which featured on Talking Heads frontman David Byrne's personally curated radio playlist.

Young has also been invited to write a chapter for the *Oxford Handbook of Voice Studies* and her book, *Singing the Body Electric* (Ashgate), is due out next year.

Before joining UNSW, Young completed a PhD in Music Composition at Princeton in 2007, lectured at the University of Aberdeen and was a Post doctoral Research Fellow at the University of Sydney Conservatorium of Music.

Sonic Arts, which will be offered for the first time next year, gives an innovative practical and theoretical approach to the field.

Through three core courses: Creative Sound Technologies, Audio Culture, and Synergies in Sound and Technology, students will learn technical skills in audio recording, processing and post-production; investigate the aesthetics, history and culture of sound as a discipline; and explore the creative applications of technology in purpose-built sound studios.

Students are also invited to join Sound Lab, a dynamic, music-technology ensemble, and to work closely with the Bachelor of Media (Screen and Sound Production) students.

As Young explains, the Sonic Arts stream encourages cross-fertilisation and is driven by the key question, "How can we use technology in creative ways?"

An interest in the collision of technology and creativity also informs the research for Young's *Singing the Body Electric*.

"The book provides a philosophical approach to the human voice through the past 150 years of recorded sound," Young says. "It's concerned principally with the human voice, technology and the place where these meet. I begin with early attempts to represent the voice in the phonograph, and look at how this has determined the way the mediated voice is apprehended to the present day.

"The introduction of recording technology changed the way in which people were entertained. So instead of performing music together in the evenings they would listen to recordings. With technology, we went from being music producers to being consumers."

And now, thanks to technology, we have come full circle. "The digital age has helped democratise the music production business," she says. "You can create your own album in your bedroom. We have become producers again."

▲ Helping to democratise music production … Dr Miriama Young. *Photo: Grant Turner/ Mediakoo*

Museums of the future

Immersive museum displays are bringing ancient images to life. Lissa Christopher reports.

A WOMAN ENTERS an exhibition space that looks as if someone obsessed with triangles has covered it in graffiti. She holds a small tablet computer towards the wall and on its screen the geometric shapes transform into an image of three faded Buddhas.

It's as if she is peering into an ancient gallery: the Buddhas are briefly infused with fresh colour, demonstrating how the picture might have looked 100 years ago, and then fade again as the woman passes her "window" across the wall.

Welcome to the museum experience of the future: immersive, interactive, high-tech and compelling.

The installation is *Pure Land: Augmented Reality Edition*, a digital representation of Cave 220, one of the 492 World Heritage–listed, mural-covered caves at Dunhuang, in China. The virtual representation is life size and relies on digital-laser scanning and ultra-high-resolution photography.

Pure Land, along with its sister production – a 360-degree, 3D, animated installation that offers an even more immersive experience – was devised by Professor Sarah Kenderdine from UNSW's National Institute for Experimental Arts.

She and her team lead the world in the field of interactive and immersive experiences for museums and galleries, and Kenderdine knows her way around some of the most advanced imaging gadgetry on the planet.

She is also head of special projects for Museum Victoria and director of research at the Applied Laboratory for Interactive Visualization and Embodiment at the City University of Hong Kong.

▲ Reinventing heritage as a sensory experience … Professor Sarah Kenderdine. *Photo: Quentin Jones*

"My passion is rediscovering and reinventing tangible and intangible heritage as sensory experiences, and I do this through a combination of art and new technologies," she told an audience of 1,800 at a recent TEDx event in Mumbai.

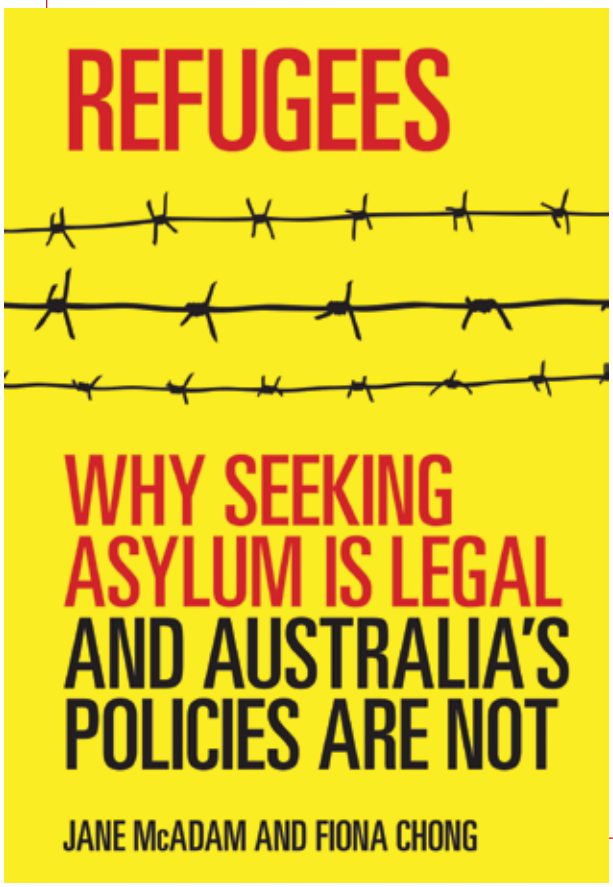
Technological advances – particularly ultra-high-resolution 2D and 3D imaging – are playing a growing role in museology, Kenderdine says, partly because they can be used to create profound sensory experiences that keep us engaged with the wonders of the past, but also because much of the world's cultural heritage, including the Dunhuang caves, is under threat from climate change, looting, warfare and the relentless footfalls of mass tourism.

At Dunhuang, the vast majority of caves, including Cave 220, are closed to the public. Despite this, thousands of people visit the site every year and the 45,000 square metres of murals in the grottoes can't cope. But this high-fidelity digital imaging is helping to protect and re-create the fragile past. The *Pure Land* installations travel extensively and their artistry and technical wizardry have allowed hundreds of thousands of people from around the world to experience Cave 220. They have also provided scholars unprecedented access to its interior details.

While the visual is central to the immersive experiences Kenderdine creates, the other senses are also important. "We also do a lot of work on 'ambisonics', capturing a 3D architecture of sound."

Kenderdine is delighted to see digital productions gaining recognition as dynamic artefacts in their own right.

"It is widely assumed that the digital is a tool to enhance the real," she says. "However, we have entered a time where, due to its high fidelity, the digital object can generate a powerful experience in its own right."



REFUGEES: WHY SEEKING ASYLUM IS LEGAL AND AUSTRALIA'S POLICIES ARE NOT: JANE McADAM, UNSW LAW, AND FIONA CHONG

IF YOU LISTEN to some politicians and voices in the media, you might well believe asylum seekers are "illegal". You might think they should wait their turn in the so-called "queue". You might think they pose a potential threat to our national security, and the government is right to keep them from our shores. Or you might take a humanitarian stance, believing drastic border protection policies, though harsh in effect, are necessary to deter asylum seekers from endangering their lives on risky boat journeys to Australia.

However logical these conclusions might seem, the problem is they are based on widespread misunderstandings about why and how people seek asylum, and what Australia's international legal obligations are.

Refugees rejects spin and panic to provide a straightforward and balanced account of Australia's asylum policies in light of international law. Written for a general audience, it explains who asylum seekers and refugees are, what the law is, and what policies like offshore processing, mandatory detention and turning back boats mean in practice. Using real-life examples, this book reminds us of the human impact of Australia's policies.

It shows there is a gap between the rhetoric and the legislated rights of refugees (who have been resettled from camps abroad) and asylum seekers (who arrive by boat). It shows why our asylum-seeker policies, developed over decades, are at odds with the legal obligations we have signed up to. And using examples, it reminds us that we're talking about real people and their children. *UNSW Press*

BOOKS

THE ARMS RACE IN ASIA: TRENDS, CAUSES AND IMPLICATIONS: ANDREW TAN, UNSW ARTS AND SOCIAL SCIENCES

The global trade in arms is, to a large degree, underpinned by the strong demand for arms in Asia and the Middle East – the two largest arms export markets in the world. Of these Asia has become particularly significant, led by the emergence of China and India as major powers. This arms race is leading to three distinctive blocs in the emerging geostrategic landscape: a loose bloc of US allies; a counter-bloc of potential US adversaries; and a neutral bloc of states with industrial-age armed forces. *The Arms Race in Asia* concludes that if left unchecked, Asia will increasingly become a region of instability, marked by conflicts and interstate wars. *Routledge*

INTERCHANGING: FUTURE DESIGNS FOR RESPONSIVE TRANSPORT ENVIRONMENTS: HANK HAEUSLER, BRIEDY MAHAR, TIM TOMPSON, ALEC TZANNES ET AL, UNSW BUILT ENVIRONMENT

With consideration of a range of social trends, but also emerging responsive and sustainable technologies, the material presented in *Interchanging* reimagines a public transport interchange of the future that is better suited to address the complexities and conditions of 21st century urban digital life. The book brings together a collection of design projects and interdisciplinary perspectives on policy, planning, design and management issues that are shaping and influencing our experiences of urban public transport environments. *Spurbuchverlag*

MOVING IMAGES: NINETEENTH-CENTURY READING AND SCREEN PRACTICES: HELEN GROTH, UNSW ARTS AND SOCIAL SCIENCES

This book examines how the interplay between nineteenth-century literary and visual media paralleled the emergence of a modern understanding of the ways reading, viewing and dreaming generate moving images in the mind. Reading between these histories of mind and media, Groth reveals a dynamic conceptual, aesthetic and technological engagement with the moving image that produces a new understanding of the production of the works of key nineteenth-century writers, such as Lord Byron, Walter Scott, Lewis Carroll, Charles Dickens and William Makepeace Thackeray. *Edinburgh University Press (NewsSouth Books)*

TURBO-FOLK MUSIC AND CULTURAL REPRESENTATIONS OF NATIONAL IDENTITY IN FORMER YUGOSLAVIA: UROŠ CVORO, UNSW ART AND DESIGN

Turbo-folk music is the most controversial form of popular culture in the new states of the former Yugoslavia. This book offers a new account of the popular music that has been at the centre of national, political and cultural debates for over two decades. Beginning with 1970s Socialist Yugoslavia, Cvoro explores the cultural and political paradoxes of turbo-folk. Described as "backward" music, whose misogynist and Serb nationalist iconography represents a threat to cosmopolitanism, turbo-folk's iconography is also perceived as a "genuinely Balkan" form of resistance to the threat of neo-liberalism. Cvoro analyses key songs and performers in Serbia, Slovenia and Croatia. *Ashgate*

"I WAS STRUCK BY HER BEAUTY AND HER PRESENCE,"

Fiona Lowry says of her Archibald Prize–winning subject, architect Penelope Seidler.

Lowry, a UNSW Master of Fine Arts student, won the Archibald, Australia's most popular portrait prize, for her airbrush painting of Seidler surveying the iconic Killara home she designed with her late husband, Harry Seidler.

"At one point, Penelope looked back at the house towering over us and reflected it had been some time since she had seen it from this angle. It was that reflection I wanted to explore with this portrait."

Penelope Seidler *by Fiona Lowry, acrylic on canvas, 225 x 185 cm. Photo courtesy of the Art Gallery of New South Wales.*

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FOREWORD BY IAN LOWE

EDITED BY ASHLEY HAY

Published by NewSouth in November, $29.99
(ePub/Kindle also available)

The Bragg UNSW Press Prize for Science Writing is an annual prize for the best short non-fiction piece on science written for a general audience. It is named in honour of Australia's first Nobel laureates, William Henry Bragg and his son William Lawrence Bragg. The shortlisted entries for the 2014 prize are included in the anthology. On November 6, the winner will be announced at an event hosted by UNSW Press and the Faculty of Science, UNSW.

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