TAKE. MAKE. RE-CREATE
How the circular economy is taking the world by storm

THE BUSINESS OF RESEARCH
The business sector’s role in high-impact research

QUANTUM LEAPS
Setting the pace for quantum computing
This month marks nearly 12 months for you at the university. Why UTS?
In 2005, I began a three-year term of the Australian Research Council College of Experts, where I met Professor Mary-Anne Williams from the university’s Faculty of Engineering and Information Technology (FEIT). This began a wonderful association with UTS, including research collaborations and participation in the FEIT and Vice-Chancellor’s Industry Advisory Boards. I really liked where UTS was heading and when the DVC(R) role opened up, I applied!

What are you most looking forward to achieving as DVC (Research)?
This is easy – I’m looking forward to celebrating the success of our researchers. There are a bunch of key performance indicators associated with research excellence, and we must strive to translate our research into impact. But, at the end of the day, if our researchers are getting recognised for being leaders in their fields of research, then everything else should follow.

How would you describe your management style?
Oh that’s tricky! For many years, I never had any aspirations, at all, to be a manager. One day, my manager at IBM (where I worked as a systems engineer) told me she wanted me to take over the team I was part of. This began a really steep learning curve as I quickly realised people didn’t see the world the way I did. After about 18 months, I got the opportunity to move to the USA and subsequently managed teams in Tucson, Arizona and Shanghai, China, before returning to Australia, where I was managing development and then research. All of these experiences helped me understand the importance of listening.

So, today, I really try to seek input from everyone in a meeting and to synthesise these views into a clear picture of what needs to be done. Some of my best moments at UTS have been working with colleagues where we vigorously debate and discuss a project, our research strategy or a proposal to a potential client. By listening, engaging and then making decisions, I’m convinced we get the best possible outcome.

What does ‘discover’ mean to you?
To me, ‘discover’ means learning. When I was a child, my parents said I always asked “Why?” and wanted to understand how things worked (apparently, this included pulling apart various things around the house – including a microscope, clock and an electric motor – and not putting them back together!). I cannot recall a day where I haven’t learned something new. I love reading science and technology journals. I’m absolutely fascinated by the complexity of the life sciences, and have recently been spending a lot of time thinking (and learning) about data science. So to ‘discover’ is to uncover new knowledge, to learn and make sense of the world.

What most makes you laugh?
Funny people! I’ve always thought that if you aren’t laughing and having fun at work, then it’s time to find another job. Fortunately, it seems that I am surrounded by people who enjoy injecting a bit of humour into my day.
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All U: articles are available to read online via newsroom.uts.edu.au
Send your story ideas, opinions and events to u@uts.edu.au

discover, engage, empower, deliver, sustain
Social media has revolutionised the way we access and share information online. Once considered frivolous and purely ‘social’, academics are now using social media as a fast and interactive way to develop deeper engagement with their audiences.

In a world where it’s ‘publish or perish’, the key to successful grant applications, promotions and conference invitations might be the number of Twitter followers you have or the hits on your blog.

Director of Postgraduate Nursing Studies Caleb Ferguson (@calebferg) says, “The changing role of an academic means there’s more importance being placed on community engagement and research dissemination.”

Ferguson uses Twitter to raise awareness of cardiovascular health by tweeting about his research and re-tweeting other important publications and news items, and to engage with like-minded academics in his area of expertise.

For Senior Lecturer in the School of Education Dr Nick Hopwood (@NHopUTS), using social media and blogging about his work is as much for his students as it is for himself.

“Anybody can come and look at my posts and take some value from them,” he says, “but if I’m doing a class or workshop on that subject, the post then becomes a tool for my students where I can incorporate a flipped learning component.”

Hopwood’s blog makes the research process transparent for early career academics and doctoral students through instructional articles, project updates and podcasts. With over 85,000 hits since 2013 and an average of 150 hits per day, Hopwood says it’s essential to keep his blog up-to-date because it’s the part of his work that’s publicly available.

“Self-promotion might be seen by some as dirty,” he says, “but if you’re not doing it, other people are. The more visible you make your work, the more impact you can have.”

Maintaining an online presence through Twitter, blogging or even writing for The Conversation acts like a digital resume for many academics; opening doors to collaborations and opportunities that would never have existed pre-internet.

Ferguson recently collaborated with a fellow academic from the Charles Perkins Centre in Sydney who works in a similar field after they met through Twitter at a research conference.

“There’s this ability to connect with someone you would never have had the chance to meet before,” he says. “Social media offers vital background conversation and critique during conferences, and it’s a great way to network.”

“Social media is breaking down physical barriers, geographic barriers, and cultural barriers as well – you can follow and tweet at highly credible, elite academics. Just putting something out there and joining that conversation is amazing.”

Hopwood agrees, “I get a lot of emails asking if I’m going to a certain conference, or invitations to universities to do workshops – all thanks to my blog.”

While social media has traditionally been considered a waste of time, the benefits of having a consistent online presence are becoming more tangible.

“Traditionally, we’ve looked at peer-reviewed literature as being the pinnacle of academic publishing,” says Ferguson. “But now people are looking at other platforms. Having good metrics around Facebook likes and who tweeted about your work is really important.”

“It does require some investment in technological know-how and time to make your online profile meaningful,” admits Hopwood. “It doesn’t have to be up-to-date to the minute, but once it’s done it kind of ticks over, and it’s really being kind to yourself in the long run.”

“Even academic journals are employing dedicated social media editors now,” says Ferguson. “And they’re making investments to boost their reputation through these platforms which means academics will do so too.”

While many academics still blanch at the idea of engaging with social media, one look at the thriving Twitter communities around hashtags like #PhDchat or #acwri (academic writing) shows social media in academia isn’t a trend – it’s a necessity.

Says Hopwood, “You suddenly get that sense that globalisation is happening to academia as well.”

Tweet Ferguson (@calebferg) and Hopwood (@NHopUTS) or visit Hopwood’s blog at nickhop.wordpress.com

To register for UTS’s next (free) media training session on Thursday 11 June, email terry.clinton@uts.edu.au

Hannah Jenkins
Marketing and Communication Unit
Photographer (N Hopwood, C Ferguson): Joanne Saad
Tablet image: Thinkstock

Comment on this article at UTS:NEWSROOM newsroom.uts.edu.au/news/2015/06/visible-and-vocal
When you think about coral, invariably your first thoughts are of pristine waters and a colourful reef, buzzing with marine activity. But did you know there is coral right here in Sydney Harbour? And in fact, these corals could hold valuable information about the future of our reefs under the spectre of climate change.

“We’re not sure if they’ve been here for several hundred thousand years and cut off from coral communities further north by currents or if these are the offspring of corals from the Great Barrier Reef who have only arrived relatively recently,” says Associate Professor in UTS’s Plant Functional Biology and Climate Change Cluster (C3) David Suggett.

“If they’ve evolved a specific physiology to live in extreme environments, like Sydney Harbour, then they may die off because they’re adapted to cooler waters. But if they’re originating from the Great Barrier Reef, that indicates those corals have highly flexible physiology and may become far more abundant as water temperatures rise.”

Currently, we don’t know which is the case because so little is known about how, or if, corals can adapt to extreme environments. That’s the question underpinning Suggett’s current research (and will be the focus of a UTSparks public lecture he’s headlining on August 13, Coral at the Edge). His work will, for the first time, establish a baseline of coral biodiversity at its southernmost limit, here in the harbour, and compare the physiology of the local coral community to corals further north.

Suggett’s interest in coral in non-traditional conditions came about during a 2010 trip to the Seychelles, off the east coast of Africa, when he was called upon to conduct an environmental impact assessment on a proposed hotel site.

“Everyone had assumed it was a degraded ecosystem, but once we went a few metres below the surface we found this really beautiful reef. And what it suggested to us was that it had been buffered, or was a refuge against climatic impacts in the past, that had decimated other corals in the area.

“In the past these more turbid environments have been perceived to have low conservation value – we’d rather preserve the blue water sites like the Great Barrier Reef. But the turbid environments hold a store of genetic material that could be really important in terms of future change,” says Suggett.

“We don’t understand how corals can live in these environments but it’s critical that we find the answer.” The reason is corals, and in particular coral reefs, play a critical role in the marine ecosystem.

“Everything on a coral reef is either dependent on the physical structure corals make with their calcium carbonate skeleton – these beautiful architectures with lots of little places for fish and critters to live in – or it acting as a food source for things that feed on its living tissues.”

However, increased atmospheric carbon dioxide levels pose two huge threats to reefs worldwide.

“Firstly, the atmosphere traps more heat, so the waters warm. Secondly, oceans love to suck up carbon dioxide but as they do, they become more acidic – water plus carbon dioxide makes carbonic acid,” explains Suggett.

“Over geological history, there’s been enough neutralising power of seawater that we haven’t seen bubbling acidic oceans, but we’re currently putting so much carbon dioxide into the atmosphere so quickly that we’re exceeding the capacity of seawater to neutralise it.”

Importantly, corals in turbid environments seem to already have learned to cope with such extreme environmental conditions, making Sydney Harbour an excellent site for this research.

“You might argue you want to protect the most resilient species because they’re the strongest and most plastic – we should protect those ones because that’s the future. The counter argument is they’re the most resilient and don’t need as much protection so we should focus on the weedy ones.

“Right now, we’re not really sure which species are the weak or the strong. Our research will fill that gap so we can help governments decide on the best management strategy.”

Elizabeth Leslie
Research and Innovation Office
Photographer (D Suggett): Joanne Saad
Photograph (diving in turbid waters) supplied by: David Suggett
Photographer (typical coral reef): David Smith
Photographer (Coral polyp): Jean-Baptiste Raina

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UTS:NEWSROOM
newsroom.uts.edu.au/news/2015/06/what-lies-beneath
RESEARCH OPINION

The Business of Research

Business Council of Australia (BCA) President Catherine Livingstone AO says industry-driven research is key to an innovative Australia. So how can universities work better with industry to deliver on this vision?

There is no doubt Australia’s universities play an unequivocal role towards an educated, skilled and prosperous Australian society. Their contribution to our diverse workforce offers exciting job opportunities and, through applied research and innovation, a continuous cycle of new products and industries.

Here in Australia, universities need to recognise themselves as being a critical part of the knowledge infrastructure that underpins Australia’s innovation system. Like physical infrastructure, knowledge atrophies if it is not maintained.

Research and development (R&D) should be seen not as a discretionary ‘cost or flow’ concept, but rather as an ‘investment in stocks’ concept.

We need to see tertiary education as a market – a market with students at the centre – and design it accordingly.

The tertiary education market has to be designed around students because it is their experience of it that will deliver on economic and social objectives. For government, it is a strategic investment in people’s capacity to establish prosperous, independent lives.

And to do that, one of the things we need is greater collaboration between the university sector and industry. This is not the sole responsibility of universities – we in business are equally accountable for driving a mindset shift around collaboration, and how we facilitate and exercise it.

We cannot afford to be having the same conversation in 10 years’ time about the mismatch between the people the education system is producing and the people industry needs. We need to be thinking about the application of knowledge from the day a person starts to acquire it.

Which brings us back to the knowledge infrastructure imperative.

It is a critical component of the innovation system on which the next decade of economic growth in Australia is predicated.

So what is knowledge infrastructure? It’s the research facilities, the institutions, the museums, the people, and the actual stocks of knowledge Australia holds through those institutions and those people.

In the face of major forces of change, the quality of our knowledge infrastructure will determine the rate at which we can adapt. In fact, it will determine whether we can adapt at all.

To ensure we do this, and do it fruitfully, we need to adopt changes in research funding policies.

There is a view that the incentive structure for publicly funded research in Australia has resulted in too great a weighting to investigator-led research, resulting in disparate knowledge creation, not necessarily aligned with adequately maintaining the critical mass of Australia’s strategic stocks of knowledge.

Both the accountability for, and the quality of, research outcomes are compromised by stop-start and short-term funding policies. This includes the cessation, restarting and rebadging of programs every time there is a change of government. We have seen far too much of this over the past 20 years.

Improving the alignment between funding arrangements and research time frames would increase the likelihood that we can attract and retain those bright and talented
people who are such a vital part of our knowledge infrastructure.

At the risk of over characterising the issue, there is a disconnect between the research sector, which assumes that policy makers, and the community, accept the fundamental proposition that research and knowledge creation are virtuous activities; and the funding arms who see R&D as a discretionary cost which can be varied on an annual basis.

The research sector, and the business community, must find a way of reframing our advocacy arguments to focus more specifically on the benefit of the outcomes from having a vibrant knowledge infrastructure; and policy makers have a responsibility to be, if not fully informed, at least better informed, and not rely on ideology and anecdote.

Turning to education policy – and the issue of digital disruption and the implications for the building of knowledge infrastructure: just as you can’t build physical infrastructure without civil and structural engineers, you cannot build knowledge infrastructure without software engineers and data scientists.

This now applies to every field of research. We need to reinforce the importance of STEM (science, technology, engineering and mathematics) in primary schools, and progress this in similar ways to Europe, the UK, Estonia and Greece, who already have integrated computer coding in the primary curriculum. If the market for labour is global, then we are effectively dealing generations of children out of their individual ability to participate in the digital economy, never mind the consequences for our national ability to maintain and build our knowledge infrastructure.

In my opinion, we need to push these governmental and educational changes to bring about a stronger higher education sector in Australia; one that produces high quality research with impact and longevity.

Catherine Livingstone AO
President
Business Council of Australia

Photograph supplied by: Catherine Livingstone
QUANTUM

Data may be king, but new research by the Centre for Quantum Computation and Intelligent Systems means we may soon see a coup. UTS’s team of computer scientists are leading the development of a new pattern of programming language that will underpin how we use quantum computers and how we process data.

In today’s deeply connected and informed society, data is everywhere. We collect digital information at an astounding rate, feeding data into enormous databases that monitor everything from genome sequencing, to astronomy and weather patterns, the rise and fall of global finance markets, even the social media accounts we manage on our hand-held smartphones.

Such technology enables society to accurately predict weather, prevent disease and manage consumer behaviour; but there are still many complex problems that cannot be solved by even the most advanced computers. And, as we continue to collect exponential amounts of data, this disconnect becomes even wider. Enter the world of the quantum computer – a new, and yet-to-be-developed, computer that promises faster, more secure and more powerful processing, with problem-solving capabilities far greater than any classical computer.

A team of researchers from UTS’s Centre for Quantum Computation and Intelligent Systems (QCIS) are at the forefront of developing a new pattern of programming language that will underpin how we use these quantum computers. They are Distinguished Professor Mingsheng Ying, and Professors Yuan Feng and Runyao Duan.

“The majority of research taking place in the quantum computing field at this moment is in building quantum computing hardware,” says Ying. “But once a quantum computer is available and purchasable from the market, then quantum software will play a key role.”

Ying says it’s the first but most important piece of the puzzle. “We are focusing on the theoretical foundations for quantum software. Once these foundations have been laid, software can then be created and implemented, and following that, used by engineers to develop something practical for industry, consumers and society.”

It only takes one look at the classical computer market, where the need for hardware pales in comparison to the multi-billion dollars generated by software sales, to understand how important this will be.

Laying the theoretical foundations for quantum computers is a sizeable research challenge, but Ying’s research breakthrough – the establishment of a fully-fledged Floyd-Hoare logic for quantum programming – has assisted with bringing the team one step closer.

Floyd-Hoare logic was invented by computer scientists Robert Floyd and Tony Hoare in 1969. It describes the set of logical rules that underpin all of the computer programs being used today. Ying explains, “when you press the power button, hit the keyboard or run software updates on your computer, you are giving your computer a command. These commands rely on programs, or sets of instructions, to execute your task successfully.

“The Floyd-Hoare logic provides the basis of reasoning the correctness of these programs – to verify that your commands are executed exactly as you request it. This logic is the precursor to all classical computer programs in existence today.”

Ying’s adaptation of this logic to quantum programming has solved a notoriously difficult computer science problem – and signified a landmark achievement in the theory of quantum programming languages.

Building on the success of these findings, the team are pursuing research in other areas to better understand the possibilities of quantum computing. One of these areas is quantum entanglement, described by Duan as “one of the weirdest things to happen in quantum mechanics”. Quantum entanglement is, by its simplest definition, a correlation between two systems, much stronger than any classical correlation. Transcending the physical boundaries of time and space, its very weird nature is also what makes it so useful. Duan believes unlocking quantum entanglement will revolutionise the way we use next-generation information technologies.

“By exploiting the characteristics of quantum entanglement, we can create state-of-the-art techniques for super-reliable communication and build 100 per cent secure, unbreakable cryptographic systems. This will provide game-changing security technologies for banks, business, finance, police and counter-terrorism.”

However, being able to quantify entanglement as a resource is not easy. “There are lots of technical challenges that occur in entanglement. It’s fragile, it needs to be stored in very good quantum memory, and there’s a lot of environmental noise to contend with,” says Feng. “However, we realise the power of entanglement, and its potential real-world applications – and that’s what motivates us to continue our research.”

There is no doubt the work of Ying, Feng and Duan will prove to be powerful tools when large-scale quantum information processing becomes a reality – which leaves us to beg the question: how close are we to developing a quantum computer?

“That’s a question you should ask a physicist, not a computer scientist!” Ying laughs. “While we are still at the very early stages of quantum computing, there is an international race led by companies such as Google, IBM and Microsoft, as well as research teams including the Australian Centre of Excellence for Quantum Computation and Communication Technology, to build a large-scale quantum computer. With their money and resources, the answer is hopefully soon.

“And this is crucial to us because without the hardware, it’s very hard to see the impact of our work.”

Elizabeth Kuo
Research and Innovation Office
Photographer (R Duan, M Ying, Y Feng): Shane Lo
Computer image: Thinkstock
This research is funded by: Australian Research Council
“WE ARE FOCUSING ON THE THEORETICAL FOUNDATIONS FOR QUANTUM SOFTWARE. ONCE THESE FOUNDATIONS HAVE BEEN LAID, SOFTWARE CAN THEN BE CREATED AND IMPLEMENTED, AND FOLLOWING THAT, USED BY ENGINEERS TO DEVELOP SOMETHING PRACTICAL FOR INDUSTRY, CONSUMERS AND SOCIETY.”

Professor Runyao Duan, Distinguished Professor Mingsheng Ying, Professor Yuan Feng
Your fridge breaks down. As is the case for most white goods and electronic devices, friends, repairers and retailers advise you to buy a new one. There is a general feeling in today’s throwaway culture that products just aren’t ‘built like they used to be’ and should be tossed on the tip after a finite amount of time.

But what if there was a viable alternative? What if the parts could be re-tooled or remanufactured back into the original product at an attractive cost?

Planning for re-use and remanufacturing of consumer products is key to the concept of a circular economy – the theme of this month’s World Resources Forum Asia-Pacific hosted by UTS. And it’s set to turn business on its head.

“The circular economy is about unleashing innovation to find new ways of using resources in society,” explains Research Director at UTS’s Institute for Sustainable Futures (ISF) Associate Professor Damien Giurco. “We must go beyond the model of take-make-dispose to embrace take-make-re-create.

“It’s this re-create dimension that really makes people think about the lifecycles of a resource. Thoughtful design, the way we use resources and products themselves, needs to be higher on the agenda. Design shouldn’t be just for a single life of a product – it could be re-used as is, dismantled in a way for use in another product, or used to extract valuable materials.”

Giurco says the circular economy model is much more than recycling. “It’s a supply chain powered by clean energy with a clear focus on products that improve the wellbeing of people. And at the end of the day, that’s what is most important.”

According to Professor of Sustainable Enterprise in the UTS Business School Suzanne Benn, this isn’t a new concept; it has been advocated by architects in Europe for more than 20 years. However, “It’s the badging of ‘circular economy’ that has made more sense to people. For our students – the younger generation – they get it straight away: why throw stuff away when you can re-use it?”

The need to constantly create new products and the effort required for remanufacturing has meant change has been slow for most industries.

“However, a number of very innovative, smaller organisations, which are designed to manage waste and organise that waste so that it can go into other products, are emerging,” says Benn. Their successful business models, within the IT and hospitality industries, adds Benn, are beginning to implement the circular economy in Australia.

Giurco agrees. “The circular economy has got the ear of businesses that are minded towards innovation for sustainability. But, I’d love to see more of an impact in Australia; for us as a nation to grow the value of our future industries and develop restorative products and services for our resource-constrained world.”

One business looking to get ahead of the game is Telstra. As part of a wider industry partnership with UTS, Telstra has engaged ISF to assist with a new electronics re-use and recycling strategy.

“Telstra is a member of the Global e-Sustainability Initiative (GeSI), which has afforded us many benefits, including networking with best-practice leaders in the Information and Communications Technology (ICT) industry and world-class research institutions,” says Telstra’s General Manager – Environment Pauline Gregg. “In conjunction with GeSI, our work to really understand the global electronic waste challenge and the risks and opportunities presented to Telstra, led us to an opportunity to work with UTS.

“We were particularly attracted to their applied research and industry partnering approaches to solving some of the most important sustainability challenges today.”

With leading companies beginning to adopt new, more circular approaches to using resources, Gregg believes ICT and digital technologies can be an enabler of a circular economy.

“The unique ability of mobile technology to be everywhere, at increasingly affordable prices, makes it ideal,” she says. “By enabling ‘dematerialisation’ such as replacing site-based IT hardware with shared cloud computing infrastructure, and changing how people interact with physical and virtual assets, Telstra’s digital technologies can transform value chains so they no longer need additional physical resources to grow.

“Our StayConnected swap, replace and restore service mostly dispatches refurbished mobiles or tablets to replace our customer’s device when something goes wrong; and the facilitation of collaborative consumption apps and websites through our network already promote sharing and circular economies.”

Giurco agrees telecommunications hold much promise. For example, an old mobile phone contains 1000 times the concentration of gold found in many gold mines. “We have a great opportunity right now to leverage all the know-how in Australia from the mining boom and growth of our mining equipment, technology and services sector and apply it to new industries,” he says.

“Instead of focusing solely on extracting virgin metals and other resources in nature, let’s apply those skills and knowledge and work out ways to extract value from the growing tsunami of e-waste in global cities.”
In a first for Australia, the World Resources Forum Asia-Pacific will be held in Sydney from 1 to 3 June. The forum, co-hosted by UTS’s ISF and SMaRT@UNSW and building on research in the Wealth from Waste Cluster, represents a singular opportunity for government, industry and research leaders from the Asia-Pacific region to focus on the opportunities for resource and productivity innovation in the digital economy.

The three-day program, held at the Aerial UTS Function Centre and the Australian National Maritime Museum, features keynote presentations and interactive workshops on the circular economy, product stewardship, breakthrough innovations for resource recovery and new business models that provide social and environmental value from waste.

Follow all the updates at wrfasiapacific2015.net
CIRCULAR ECONOMY PRINCIPLES APPLIED TO A CAR

1. Restorative design:
   - Cars become designed to clean rather than pollute clean air as they drive
   - Lightweight materials (for example, aluminium, magnesium, carbon fibres) reduce energy used to drive
   - Design to last; and for parts to be easily disassembled and remanufactured if they wear out
   - 3D printing can accelerate innovation prototyping and make-on-demand replacement components
   - Balance using high-performance, complex-to-recycle materials versus non-toxic components which are easy to re-use and recycle

2. Responsible inputs:
   - Built from responsibly sourced metals, materials and/or recycled inputs
   - Powered by renewable electricity or biofuels made from waste

3. New models of consumption:
   - Consumers can access cars without ownership via car share or use-on-demand schemes
   - Digital technology can support behaviours which discourage overconsumption

4. New business models:
   - Leasing high-value lithium for use in car batteries (for hybrid and electric vehicles) provides an incentive to recover the lithium for recycling at the end of the battery life

5. Think in systems:
   - Electric vehicles integrated with renewables in distributed energy systems by providing energy storage capacity when parked at home, at the office or at the shopping centre
   - Enabled by digital technology, real-time data and sensors can support optimal use to minimise energy inputs
   - Future opportunities exist to integrate personal transport systems with public transport via the development of driver-less vehicles

Jen Mansell
Marketing and Communication Unit
Photographer (D Giurco and S Benn): Joanne Saad
Images by: Hoc Ngo and Thinkstock

“The issues are very complex, they’re very diverse as well, so depending on the business configuration or the issue in their value chain, the responses are going to be different. So it’s difficult to design hard law to deal with these problems.”

While many countries, like the UK, France, Germany, the US and Malaysia, are making progress by developing National Action Plans on Business and Human Rights to guide companies’ conduct, Australia has a long way to go. “There’s very little knowledge of this framework, which is emerging as the authoritative understanding of corporate responsibility on the international stage,” explains O’Brien.

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“For O’Brien, the foundation of her research is simple: “Globalisation has outpaced the development of laws to deal with its consequences.

“We’ve seen a pattern of dissipation of responsibility for human rights impacts through contracting, subcontracting and corporate group structures and there is no effective international regulatory system that deals with this complexity.”

What we do have are international guidelines, which O’Brien is using to uncover patterns and trends that will help businesses develop “a sophisticated understanding of corporate human rights responsibilities and impacts throughout all the different configurations of global business.”
LIVING IN A MATERIAL WORLD

A pop-up, waterproof, solar-powered shelter. It sounds like science fiction, but a new multi-disciplinary research team is making this dream a reality. The ‘Architextile’ project combines architecture, textiles and material science and has the potential to revolutionise on-the-ground services in conflict and disease-affected areas.

Medics parachute out of a transport plane; their supplies follow, lightweight and durable. Within minutes, they’ve erected a series of temporary shelters, which are already using their in-built solar panels, made possible by conductor thread woven into the textile’s external skin membrane to produce their own light and power.

The architectural design of the temporary shelter is formulated through the meshing of 3D modelling, weaving and knitting techniques. The shelter, waterproofed through coatings and additives laid into the fibres of the textile, is able to withstand wind, rain and harsh elements in both hot and cold climates. The design is flexible so the shelters can be packed up and shipped out as quickly as they are erected.

"Conceived for natural disaster relief, war zones and commercial applications, the shelter positions new technologies in textiles and architecture through analogue and digital design," explains UTS’s Professor of Spatial Design, and leader of the Architextile project, Benedict Anderson.

Known as Architextiles, the project aims to build an interactive, self-sustaining and waterproof shelter from textiles that can be flown to a disaster zone, assembled by non-skilled people and, within minutes, generate its own power.

It was born out of a workshop held at the CSIRO’s Future Manufacturing Flagship, Materials Science and Engineering in Geelong last year. The ideas that have combined to create Architextiles were developed during the stay of textiles designer Ursula Wagner and leading interactive textiles expert and Professor at the University of the Arts Berlin and a Vice-Chancellor’s Distinguished Visiting Scholar with UTS’s Centre for Contemporary Design Practices Gesche Joost. Their expertise, along with that of CSIRO scientists and fellow academics from the Faculty of Design, Architecture and Building encompass textiles, textile coatings, wearable computation and architectural design.

"During the workshop, we developed a number of concepts and eventually settled on this idea of Architextiles," explains Anderson. "We explored the tectonic or structural properties of textiles and how we might apply them architecturally."

This premise has spawned the current Architextile project, which has been funded by an ATN-DAAD (German Academic Exchange Service) Joint Research Co-operation Scheme grant. The project now includes the expertise of the University of the Arts Berlin textile specialist Ebba Waldhör; UTS Senior Lecturer in Architecture and advanced modelling expert David Pigram and CSIRO’s materials scientist Dr Louis Kyraziis. Together, they hope to develop a world-class product.

"Textiles in architecture has been around for decades – we’ve seen flowing sails in building design for many years," says Pigram. "However, recent advances mean the prospect of using textiles as the primary construction material is now within our reach."

The team’s research will focus on three fields of investigation in textile fabrication: fibres and yarns, weave structures and 3D architectural modelling. The first step will be modifying the physical and chemical properties of fibres using polymers and graphite coatings to develop ‘smart’ yarns that can double as construction materials.

Waldhör explains, "My role in the project is to investigate the material properties such as water and air permeability, flexibility, durability and appearance. By integrating conductive yarns and fibres into the textile we can achieve flexible and lightweight energy sources that can provide light, warmth and communication."

Next, methods for creating three-dimensional shapes through new weaves and bindings will need to be developed.

"From a textile perspective this project is very intriguing," continues Waldhör. "The possibility to turn a two-dimensional textile into a three-dimensional shape in the manufacturing process opens up new ways of thinking about surface in relation to form. The limitations of conventional machines are a challenge however – most knitting machines, for example, are built to make garments, not houses."

The final step will see the team write programming protocols between the 3D modelling software and the looms, effectively translating architectural and design principles into textile tectonics.

The project aims to have a prototype structure, measuring around three-square meters, ready by the end of this year, with a view to getting more potential partners on board to refine and improve the model.

Anderson acknowledges that’s particularly ambitious. "First, we’ll be undertaking small-scale tests to work out the best textile and fabric structure and then we’ll figure out how we can make it self-supporting..."
It requires designing through a parametric system where all the parts – the weave, joins and structure – work together to affect the form of the shelter.

“For example, weaving with conductor thread is a challenge textile-wise, but also in transferring power sources. The flexible battery and solar panels have been invented by Dr Louis Kyratzis but we’ll need to work out how best to integrate them to come up with a construction that’s reliable, sustainable and durable.”

While Anderson concedes the old-fashioned tent isn’t about to become obsolete any time soon, the impact of developments in this newly evolving area shouldn’t be underestimated.

“Dropping a canvas tent is always going to be cheaper, but the way this project allows such seamless integration with technology opens up so many more applications. Not only do we have a structure that’s self-sustaining, constructing it from textiles offers a zero waste production process whilst maximising flexibility.”

The inherent insulation properties of textiles, like wool-polymer, means these structures can both retain warmth in cold climates and deflect heat in hot climates.

“This opens up applications not only for disaster relief sites but also remote communities and mining sites in Australia and worldwide,” Anderson says.

Elizabeth Leslie
Research and Innovation Office
Photographer: Joanne Saad

This research is funded by: ATN-DAAD (German Academic Exchange Service) Joint Research Co-operation Scheme grant

“DROPPING A CANVAS TENT IS ALWAYS GOING TO BE CHEAPER, BUT THE WAY THIS PROJECT ALLOWS SUCH SEAMLESS INTEGRATION WITH TECHNOLOGY OPENS UP SO MANY MORE APPLICATIONS.”
Next year, the Summer Olympic Games are held in Brazil and because Paris is located in the Northern Hemisphere, it’ll be wintertime; so when it’s eight degrees there it could be 28 degrees in Rio de Janeiro. Thus, it is very important for French athletes competing at next year’s Olympics to experience what it’s like to train in the heat. How their bodies cope, adapt, and recover will underlie their overall performance.

On the upside, we know there are many benefits to training in the heat. Numerous sport and exercise studies have shown training in the heat facilitates a positive physiological response in athletic performance. This means you can tolerate heat and pain better, retain more fluid in the blood, and run a more efficient cardiovascular system.

But we also know there are many risks, including overheating, heat stroke and dehydration. The thing about training in any stressful environment is that you shouldn’t actually go and do more training. Despite this, it is not uncommon to see athletes training harder – attempting to increase their training load because they think they will get fitter. The only thing it is guaranteed to do is increase their chances of injury or illness.

The smart way to train in a stressful environment is to keep your training load the same, but increase your physiological and psychological stress. It’s a theory we put to the test in this collaboration with INSEP. Essentially, the objective of this study was to learn the best ways to use the environment to help prepare for competition. This was important to INSEP, which has a long history in training elite athletes including Olympic medalists. It’s been a joint partnership right from the inception of the idea through to the research design and the implementation and interpretation of our findings.

In the Caribbean, there is a French island called Guadeloupe; it experiences consistently warm temperatures of around 30 degrees every day and it’s only an eight-hour flight from Paris. To us, it was an ideal location to use as a base for Rio de Janeiro. What we did was train a group of French triathletes for a baseline period of one month in their home city. We then split the group into two – one travelled to Guadeloupe (the heat group) while the other stayed in Paris (the control group). For the next two weeks, both groups continued their normal training programs. We monitored everything – their physiological, perceptual, psychological, sleep and nutritional responses, and of course, the athletes’ wellbeing.

When the heat group returned home to Paris, we followed both groups again for a number of weeks to compare results. It was a large project spearheaded by me and Associate Professor Rob Duffield from UTS, and Professor Christophe Hausswirth and Senior Physiologist Yaan Le Meur from the research department at INSEP.
CHRISTOPHE HAUSSWIRTH

Heat is a hot topic in the world of sports; but for us in France, it was never a key consideration—until recent times. Since then, we’ve learned that to prepare for global competitions we need to pay attention to the role of heat in sports and exercise performance. In this Guadeloupe study, we engaged with UTS because we wanted to work with the best. I hoped UTS researchers would be able to provide scientific insight into helping our French athletes prepare for next year’s Olympic Games, and they did not disappoint.

Using real athletes, doing real studies—this is applied sports science research. Our study sent a group of French triathletes to the Caribbean. When they returned home to Paris (which was around 10 degrees at the time), we continued to monitor their performance, paying specific attention to how they maintained their performance benefits, and what mechanisms underlined those benefits. For example, five days after the athletes landed in Paris we observed a moderate increase in performance, and 12 days after they landed we recorded a large increase in performance. So, from this study, we’ve learned a lot about designing future heat training camps. And because it was so applied, the research can be translated directly into training programs right now.

Later this month, UTS and INSEP are co-hosting a conference where the findings of this study will be released. The 2015 INSEP Heat Conference will bring together leading sports scientists, high performance centres and universities, coaches, athletes and students from around the world to share the latest developments in heat stress and performance. We’re going to present the practical applications of this study here, and in doing so, we’ll deliver this information straight to the user as quickly as we can.

I am now an Adjunct Professor at UTS; this came about following a Memorandum of Understanding (MoU) signed between UTS and INSEP in 2013, but we’ve been publishing and collaborating together for closer to four years. Having an MoU in place means we can approach future collaborative projects with more formality, engage in PhD student exchange opportunities and promote stronger academic linkages.

This MoU was the first INSEP signed with a research department from another country; now we have 11. Having the first MoU partnership with UTS was deliberate—our teams work across very similar areas of applied sports performance and we’ve developed a lot of trust and confidence over the years. This formal agreement will only encourage further research collaboration, and I’m looking forward to what the future will bring.

Elizabeth Kuo
Research and Innovation Office
Photographer [A Coutts]: Fiona Livy
Photograph [C Hausswirth] supplied by: Christophe Hausswirth
Photographs [athletes training] supplied by: Aaron Coutts

This research is funded by: French National Institute of Sport, Expertise and Performance (INSEP)
It's called the ‘cocktail party effect’. And it's a phenomenon that describes our ability to focus our auditory attention on a particular stimulus. For example, our conversation partner while filtering out other sounds like music and clinking glasses. It may even extend to our ability to switch focus when overhearing something important, like our name, in someone else’s conversation.

It's something we, as humans, are able to do with relative ease. But for robots, understanding environmental sounds and human speech are often very challenging, explains PhD candidate Maani Ghaffari Jadidi. "Robot audition is a challenging area due to the background noise, reverberation, ego-motion noise of the robot, and even the diversity of accents and languages we speak."

Ghaffari, a student in the Centre for Autonomous Systems (CAS), has just returned from a six-month research collaboration with Honda Research Institute Japan Co Ltd (HRI-JP). The internship came about after Dr Tomonari Furukawa, a Professor of Mechanical Engineering at Virginia Tech, in the USA, who has links to HRI-JP, visited UTS in 2013. Ghaffari and his PhD supervisor Associate Professor Jaime Valls Miro then spent the next 12 months establishing the exchange – a first for UTS students, and not the last.

For Ghaffari, his resulting project is aimed at developing the framework for simultaneously localising and tracking multiple sound sources. "We’re trying to use advances in robot audition for autonomous navigation. We hope to be able to develop a robot which is able to perceive and analyse surrounding sound signals and make decisions based on their type or content."

The aim is to develop robots that can enter an environment where there are multiple sound sources, analyse them in real-time and then, based on that analysis, make decisions about what to do next. This means the robot could discern spoken instructions in a noisy environment, which has particular applications for disasters and dangerous situations.

Of course, using robots for search and rescue in disaster zones is nothing new. They were deployed in the wreckage of the World Trade Center, where the thick dust and asbestos, as well as unstable rubble, made it dangerous for humans and search and rescue dogs. More recently, robots were deployed into the Fukushima Daiichi nuclear plant to help engineers assess damage inside the reactors and gather data which will be used to decommission the facility in the years to come.

Autonomous robots, like the famous Rosie and Sandy who were also developed by CAS and work on the Sydney Harbour Bridge, have the added benefit of being able to operate without a human at the helm. They can be deployed in an unknown environment, scan it to create maps and use information collected via a number of sensors to avoid obstacles and make decisions about tasks on the fly.

"The focus of this work is developing state-of-the-art algorithms which can learn from analysing large amounts of complex sensory information, quickly and accurately."

Ghaffari came to UTS after meeting Miro via the international robotics competition, RoboCup. Now in the fourth year of his PhD, Ghaffari feels this collaboration sets him up well for the future.

"I would definitely recommend visiting other research centres and companies to research students during their candidature. Working in a research centre which is part of an internationally renowned company like Honda differs from the university experience. The research is more practical, as are the expected outcomes."

"After I finish my PhD project next year, I hope to continue working as a researcher and looking for opportunities to work with high-tech companies to learn from their experiences and develop new technologies."

Elizabeth Leslie
Research and Innovation Office
Photographer: Joanne Saad

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already uncovered some unexpected findings. For instance, in results published in journal *Health Expectations* earlier this year (for which Kenny was lead author), CHERE found most people were comfortable with traditional, low-tech ways of accessing their doctors.

De Abreu Lourenco explains. “Even in this digital world where our lives are synced with our smartphones and computers, our survey revealed many people were happy to continue contacting their GP via the traditional method of picking-up-the-phone and calling the doctor’s office. They weren’t concerned or interested in booking services online or getting internet and email reminders.”

The same survey revealed insights into the range of services consumers would like offered at GP practices. “While having services such as x-rays and blood tests available onsite and pharmacies close by were important, there wasn’t much interest in having allied health services like physiotherapy or podiatry,” says De Abreu Lourenco.

But above all, when asked about the most important factor when visiting the GP, the answer was unsurprising.

“What really, really matters is quality,” says Haas. “People want to go to a GP who knows what they’re doing – who treats them well, listens to them, acknowledges what they want, and involves them in the decision-making process. That’s what people are really concerned about.”

Haas, De Abreu Lourenco and other project members were also involved in a study (led by De Abreu Lourenco) published in February’s *The Medical Journal of Australia*. That study revealed no association between bulk-billing by GPs and shorter consultation times.

The results from these and other studies to be conducted over the next three years will assist the team in gaining a broad understanding of the different aspects that would improve primary health care in Australia. These will range from the highest level of government funding, financing and reimbursement right through to the GP practice experience.

Says Haas, “It is hoped that by the end of our research, we will be able to provide recommendations to support the rollout of an excellent primary health care service in Australia.”

Elizabeth Kuo
Research and Innovation Office
Photographer: Shane Lo
Computer image: Thinkstock
This research is funded by: Australian Primary Health Care Research Institute (APHCRI)

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High resolution data visualisation of a large water pipe with a ‘through-wall pit’ (red and black sections). The data was obtained by researchers Associate Professor Jaime Valls Miro and Dr Bradley Skinner for their project with Sydney Water. The visualisation was created by Ben Simons at the UTS Data Arena using Houdini.

For more information visit criticalpipes.com

Creation of the visualisation render: Ben Simons