University of
Strathclyde
Glasgow

Images of Research

Progress through partnership

Welcome

I am delighted to welcome you to **Images of Research 2020: Progress through partnership**. This year's exhibition launches in the midst of the greatest challenge the modern world has ever faced, and the significance of its theme has never been greater than now.

Providing just a glimpse of the wealth of innovative research being carried out across the University's four faculties, this year's images highlight the very collaborative nature of our work. Working together, whether with other institutions, companies or public service organisations, we aim to better understand societal and industrial challenges, and design the most effective solutions.

The competition categories draw inspiration from the University's Strategic Themes – our areas of strength which underpin the research, demonstrating not only the great diversity of our work but also its relevance on a local, national and international scale.

The Images of Research exhibition ordinarily forms part of our annual Engage with Strathclyde Programme – a week-long celebration of the University's partnership with the public, private and third sectors. With events unable to take place in person this year, we invite you to visit our online galleries for now, with the expectation that the print exhibition will commence its tour of venues across Scotland and beyond at a later date.

I hope these inventive images illustrate the spectrum and quality of research taking place at the University of Strathclyde, and encourage you to engage further with us.

Best wishes,

James McDonald

Professor Sir Jim McDonald
Principal and Vice-Chancellor

Contents

Images of Research 2020

Images of Research is an annual competition for staff and students, showcasing Strathclyde's innovative work through compelling images. The images form a print exhibition which embarks on a roadshow across venues in Scotland and beyond (details to be announced as they become available). This year's collection, as well as previous years, is also available to view on the competition website.

The 31 shortlisted entries – comprising an image and short story – illustrate the big societal issues being tackled by researchers across our four faculties – Engineering, Science, Humanities and Social Sciences, and the Strathclyde Business School.

The competition and exhibition is sponsored by Engage with Strathclyde and Strathclyde's Researcher Development Programme.

For more information and to view all of the competition entries in the online gallery please visit:

www.imagesofresearch.strath.ac.uk

Meet the Judges

Tim Bedford

Professor Tim Bedford is Associate Principal of the University, leading the Research and Innovation portfolio in the University Executive Team, working in close collaboration with the Principal and Deputy Associate Principals Professors Lowit, Kerr and McArthur.

Key responsibilities within his Associate Principal role are: representing the research and innovation interests of the University in discussions with Government and other public bodies such as research and innovation funders; convening the University Research and Knowledge Exchange Committee and, with colleagues, developing the University strategy in research and innovation; providing leadership to cross-faculty initiatives such as the Technology and Innovation Centre and the University Strategic Themes; engaging with external university research partners in business and government; chairing the Taskforce on Innovation for CESAER, and being a member of the Board of Directors.

Professor Bedford is a Fellow of the Royal Society of Edinburgh and a member of its Business Innovation Forum. In 2016, he was on the advisory board of the Reid Review of Scottish Innovation.

Julian Taylor

Julian is the University's Executive Head, International Business Engagement and works to help secure new industrial partners from overseas. He has recently joined Strathclyde after many years at Scottish Enterprise, where he was the Executive Director, Strategy and Economics. Latterly, he led the Asia Pacific team of Scottish Development International, living in Shanghai, China for six years. The team's priority was to attract investors from across the region to locate in Scotland, and assist Scottish businesses and universities to trade in new Asian markets.

Julian recognises the importance of Scotland's visual identity overseas and being a part of this year's judging panel, he recognises the key part the Images of Research exhibition plays in raising the University's profile, defining its modern, forward-thinking perspective.

Steven Allan

Following his studies in Graphic Design / Animation & Illustration at Glasgow School of Art, Steven side-stepped into photography (primarily portraiture at first), setting up his own studio, Steven Allan Images on the Southside of Glasgow. He has diversified in recent years, photographing across many genres professionally, as well as producing murals and artworks for private clients and businesses. He passionately believes that every job is an experience he can record and it's a privilege he never takes for granted.

Collaboration for impact

Life after conflict

Nestled among bombed buildings in Benghazi City, children play; life goes on. Documented stories of self-reconstruction confirm human resilience and a desire to return to normality quickly despite the losses. With such devastation, authorities face a mammoth task rebuilding cities following war. Working with Libyan academics and professionals, we are studying the impact of post-conflict, rapid urban development, to develop reconstruction models to assist authorities in overcoming the difficulties they face.

Entrant: Saleh Almogrbe
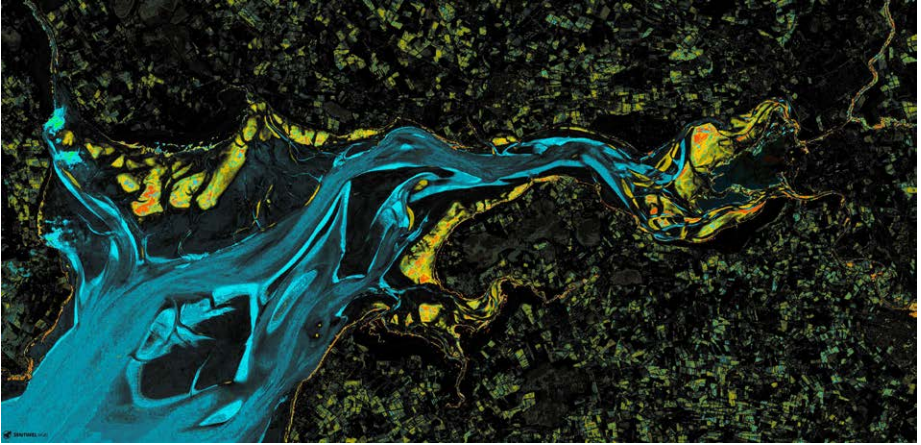
Charting change for rapid response

The world around us is in constant flux. Satellite images – such as those used to generate this image of shifting sands in the Solway Firth – reveal changes in the environment. We are developing tools to automatically detect and categorise landscape changes, such as after a natural disaster. Working with satellite manoeuvre and constellation experts, we aim to enable a more rapid and accurate emergency response that could ultimately save lives.

Entrant: Ruaridh Clark
© Sinergise, operator of Sentinel Hub

2019-Feb-11 12:48:00.053 PM
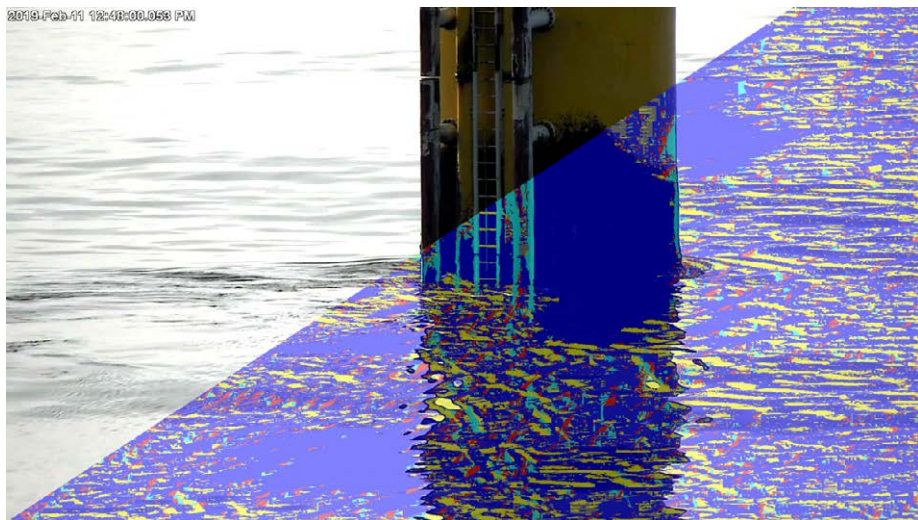
Navigating turbines and turbulent seas

Offshore wind power is vital in combatting climate change, however access by boat means turbine maintenance remains a dangerous challenge, both to staff and energy security. Collaboration with E.on and Reygar has enabled us to develop novel video processing tools to identify waves and turbines, achieving spatially accurate measurements of ocean conditions. Dramatically cheaper than other sensing technologies, it can be deployed widely to determine optimum maintenance windows

Entrant: Andrew Campbell

Collaborate…before it's too late!

Many are now realising the seriousness of climate change, of which one impact is unprecedented pressure on water resources. In developing countries, cross-border cooperation on transboundary aquifers – bodies of groundwater that extend across more than one country – is becoming increasingly crucial. As part of the Water Futures Programme – a collaboration between companies, government agencies and NGOs – we aim to assist countries to manage and protect their groundwater resources for a sustainable future.

Entrant: Christina Fraser

Sustaining sustainability

Just as a well-maintained car retains its value, wind farms can too. However, wind industry service records are often poorly recorded, leading to devaluation. Working with industry partners, Strathclyde researchers have developed an automated method of extracting key 'turbine MOT' information from these records. The resulting reduction in processing time – from five days to just three hours – could make wind energy more sustainable, both economically and environmentally.

Entrant: David McMillan

Behind the mask: identity fraud

How well can you trust the person in front of you? Are you sure the face you are looking at is genuine? Fraudsters are now using hyper-realistic silicone masks to conceal their identity or mimic another person (e.g. someone who's passport or identity document they have stolen). We are now developing partnerships with policing and border control agencies to enhance mask detection and reduce identity fraud attacks.

Entrant: David Robertson

Learning but lost

Accommodation is central to many students' sense of belonging and 'home', as is family contact and support. But for those who are estranged, student life can be quite isolating. Working with charity, Stand Alone, Strathclyde researchers aim to understand the challenges and discrimination faced by estranged students. Work is already informing policy discussions at the Scottish Parliament, to ensure these students feel as 'at home' and connected as their classmates.

Entrant: Yvette Taylor
© Samia Singh

The shape of sound

This novel brass trumpet bell was produced using Incremental Sheet Forming (ISF) – a digital process for manufacturing complex shapes in hard metal alloys, though rarely used for brass. Working with Taylor Trumpets, Matthew Parker Trumpets and Pascoe Engineering, we are exploring advanced digital manufacturing techniques applied in a traditional setting, to create bespoke trumpet bell shapes and sounds that reflect the personality of the player.

Entrant: Andrew Wodehouse

Transformative Technology
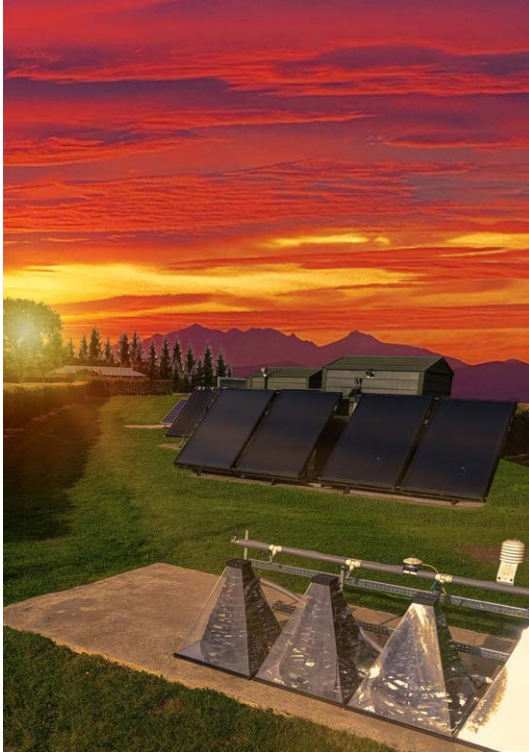
Fuelling the rise of solar

The image shows the progression of solar collection systems that harness energy from the sun to convert to power. The front-most system, invented in 2019, is able to be flat-packed for easy transport. Working with Soltropy and utilizing a test-rig at Heriot-Watt University, we are aiming to improve the performance of this solar collector, incorporating heat storage to extend availability of solar energy, thereby optimising supply to meet demand.

Entrant: Fatin Abdalla

5G RuralFirst: connecting communities

Rural areas have largely been left behind as national mobile operators improve connectivity in cities. Working with local and national partners, we sought to redress the balance, building a low cost mobile network in Orkney. The 5G RuralFirst trial demonstrated how shared spectrum techniques could be used to make coverage in rural areas affordable – a world-first! Our ongoing work aims to create a toolkit for local operators to build their own mobile networks.

Entrant: Kenneth Barlee
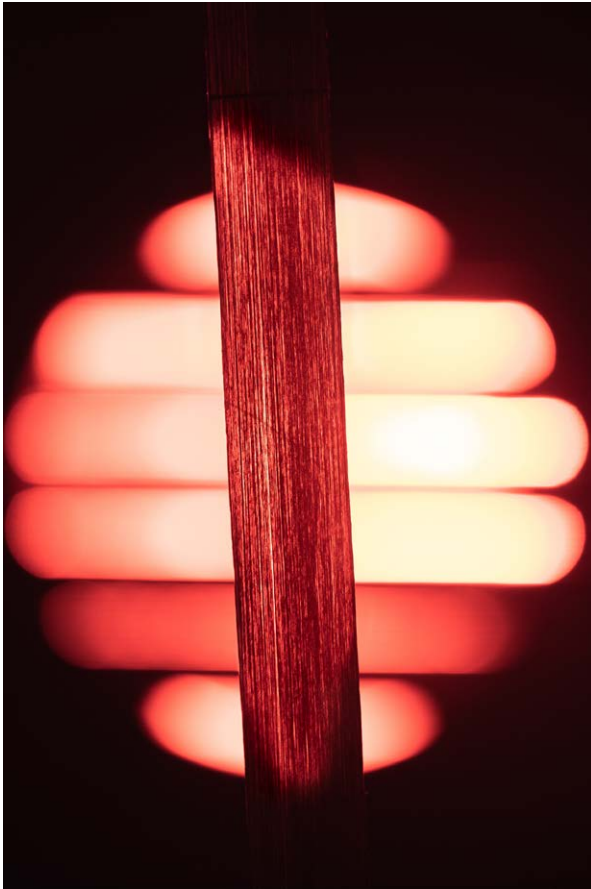
Smart skin: protect and detect

This strip of material, made from ply glass and carbon fibre strands 100 times finer than human hair, could revolutionise the engineering industry. We are developing this novel hybrid material, which is anti-corrosive and highly conductive, as a potential 'smart skin' for engineering structures. Applied to components and able to 'sense' faults deep within their structure, it could make maintenance much safer, quicker and more efficient.

Entrant: Sheik Abdul Malik
© Michael Debernardo
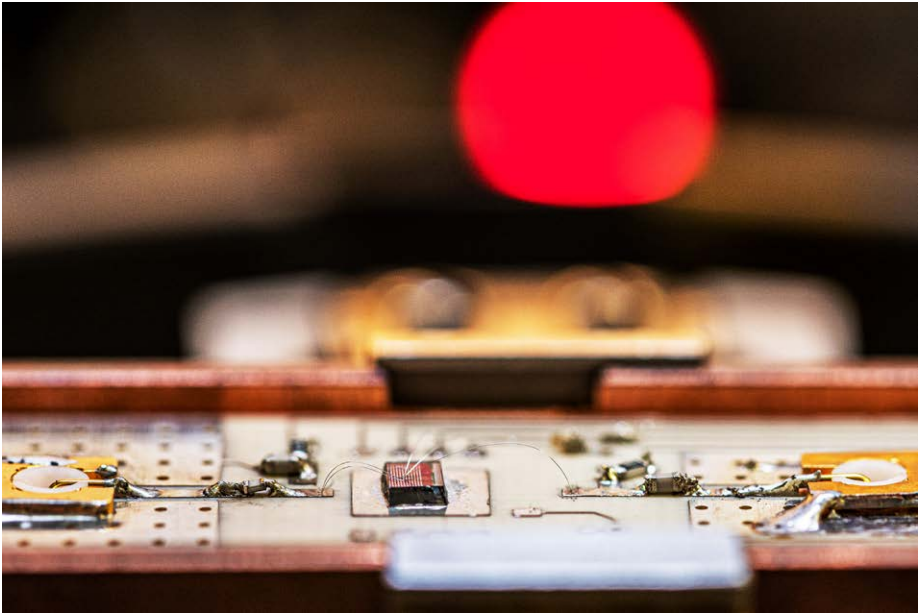
Dawn of the quantum age

Symbolising the dawn of a new age of computing, this silicon microchip represents the beginnings of accessible quantum computing, without reliance on exotic materials and ad-hoc manufacturing to produce. Working in partnership with University College London and Hitachi, Strathclyde physicists aim to develop a more cost-efficient and reliable platform. Enabling wider use of these 'super computers' could accelerate innovation in numerous fields, from drug discovery to data security.

Entrant: Alessandro Rossi
© Agnese Abrusci

The art of algorithms

The image demonstrates the application of deep learning algorithms for task automation, in this case, learning the difference between two images (top) to create a combined image (below). A form of artificial intelligence, this technology can be applied widely in industry, such as to perform maintenance. Working with subsea service provider, N-Sea, we are developing these algorithms to automate detection and repair of damage to undersea pipelines.

Entrant: Anastasios Stamoulakatos
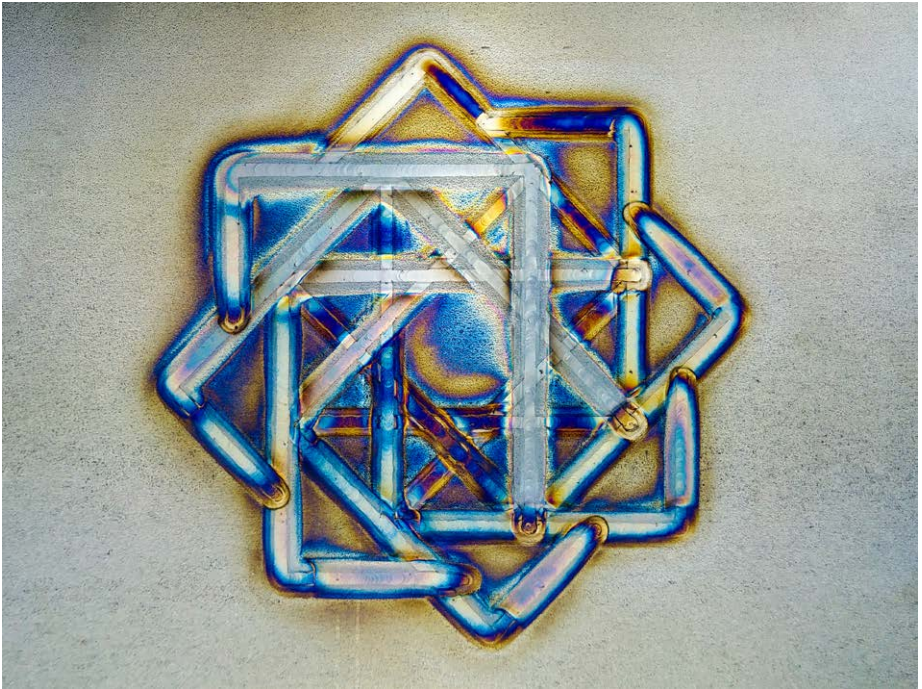
Manufacturing beauty

This artwork was not created by a human, but by an arc-welding robot, demonstrating its precision. However, work done by such robots still needs to be quality checked. Currently done by hand, it is the slowest link in the supply chain and subject to human error, but Strathclyde researchers are developing ultrasonic weld testing at the point of manufacture, enabling defects to be detected and repaired as they develop.

Entrant: Momchil Vasilev

(Virtual) heads round the table

Client review meetings are critical to product design and engineering consultancy. Utilising virtual reality in the design process offers significant benefits in terms of visualisation. However accessibility remains a problem, with complex controls detracting from immersion in the virtual environment. Working with design clients, we are developing a 'mixed reality' interface where a physical table will operate in conjunction with the digital environment (shown) enhancing accessibility.

Entrant: Andrew Wodehouse
© Brian Louon

Picture of health

Curious crystals

This crystal is grown from glycine, an amino acid found in most proteins. Through better understanding of the crystallisation process, we aim to improve medicine manufacture, such as enhancing the effectiveness of drugs, benefitting patients, and advancing production, benefitting companies. Collaboration across universities and with industry enables us to understand real-world challenges, ensuring our work has impact where most required.

Entrant: Samira Anker

Pre-eclampsia: managing risk

Pre-eclampsia, in pregnancy, can be life-threatening. Magnesium sulphate can be used to manage the seizures it causes, however, availability is limited in low and middle-income countries. In collaboration with King's College London, we are comparing data from a number of earlier studies of the mineral's use across 33 countries. Modelling the data, we can pinpoint those at highest risk and in greatest need, enabling countries with scarcer supplies to save more lives.

Entrant: Tunde Csoban

Insights in autism: serious gameplay

Autism is a psychological disorder that affects 1 in 58 children. Early detection and support offer the best possible outcome, however, autism is not easily diagnosed and waitlists can be very long. Working with partner neuropsychiatrists, we are developing wearable technology and serious, but fun, iPad games for children. Using artificial intelligence, we can analyse their gameplay to identify autism, providing a new route to early detection for improved clinical and educational support.

Entrant: Jonathan Delafield-Butt
© Mariusz Radomyski

Contagious communication

Scientists are on the front line to find solutions to global threats, from disease and infection, to climate change. However, the spread of misinformation has led to parts of society shunning accepted science. Through the collaborative environment created by national and international partnerships, we aim to open a two-way dialogue so areas of research, such as our work in vaccine development, can be used effectively for the benefit of society.

Entrant: Rachel Donaghey

A window to wellbeing

Deteriorating health can leave people feeling a loss of control, however, a well-designed environment can offer independence, dignity, access to nature and a sense of purpose and belonging. Working with the Prince & Princess of Wales Hospice – which establishes a strong connection with nature through its building (pictured) and wider grounds – our research aims to establish the impact of environment on wellbeing to inform guidelines for future facilities.

Entrant: Joanne Kinloch

Bridging generations for healthier communities

With medical advances increasing lifespan, it is crucial that psychological wellbeing is maintained also. Working with West Lothian Council, primary schools and community organisations, and older adult volunteers, we are investigating the potential health, wellbeing and social benefits for older adults participating in activities with younger generations. The outcomes aim to inform public policies that respond to the challenges of an ageing society, as well as the child attainment gap.

Entrant: Anna Krzeczkowska

Mind trap: tackling unhelpful thinking

Each year over 800,000 people die by suicide globally. Strathclyde research is exploring the psychology of suicide, determining that feeling trapped by your own thoughts, more so than feeling trapped by your circumstances, is a particularly important risk factor for suicidal thinking. Although research is ongoing, some of this work is already informing treatment and prevention strategies to reduce the occurrence of suicidal behaviours.

Entrant: Susan Rasmussen
© Dougie Cunningham

Shaping the future of medicines

Working closely with pharmaceutical companies, we are using novel technologies to customize the structure and shape of tablets to tackle a range of issues. Making the surface area larger ensures the tablet can dissolve faster and therefore get to work quicker. We can also modify tablet shape to address physical and mental barriers, such as making them easier to handle for those with impaired movement, or making children's medication more appealing.

Entrant: Erin Walsh

Sustainable society

Taking renewables to new heights

Renewables are powering an increasing number of our homes. Wind power is the second most widely used renewable energy source, however, solar power is the fastest growing. Working with industrial partners, we are developing the latest solar technologies, and modelling their ability to meet domestic demand in comparison to other renewable projects, such as the London Array wind farm (pictured) that meets the energy needs of around 500,000 homes.

Entrant: Fatin Abdalla
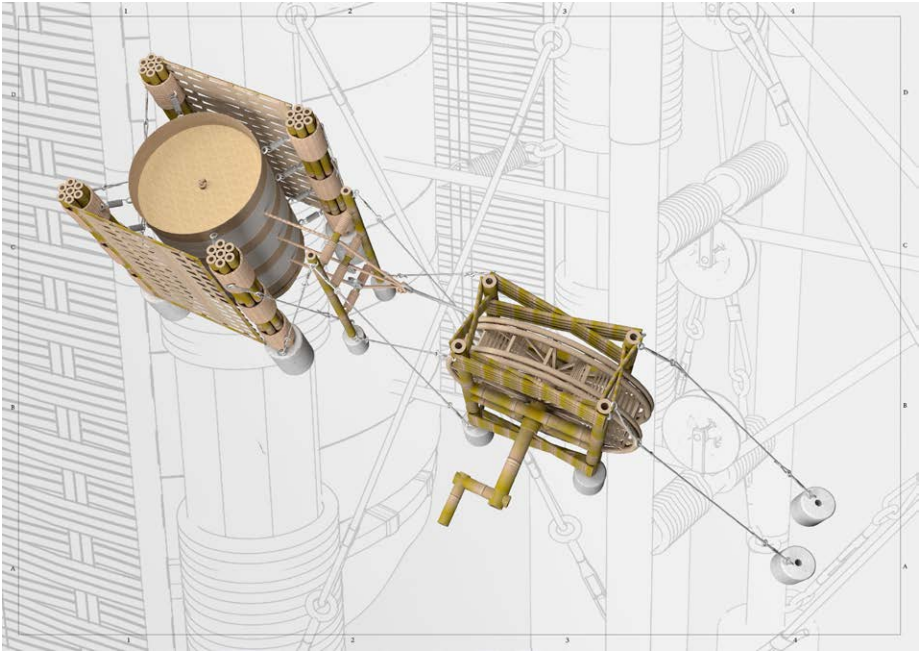
Sustainable technology inspired by tradition

Transitioning to sustainable construction and manufacture is a challenge facing countries around the world, however, sometimes history provides the answers. Working with local people and scholars in Thailand, we took inspiration from traditional food processing methods, to design a machine (pictured) to aid the production of interlocking bricks. Made from bamboo, the machine will sieve local, natural materials – like seashells – ensuring building construction is sustainable from end to end.

Entrant: Runda Aduldejcharas

Calculating capability: powering the future

Renewable power generation is often intermittent and hard to predict with accuracy. However, mathematical modelling is increasingly being used to plan and operate power systems with greater reliability and efficiency. Working with National Grid ESO, we are developing modelling capabilities to assist electricity transmission companies in making informed judgments and planning decisions, improving the appraisal process of future investments, which will result in better value to the end customer too.

Entrant: Waqquas Bukhsh

Sustainability without sacrifice

Whilst ship recycling in places such as Indonesia (pictured) may be considered environmentally beneficial in a wide context, it actually has significant negative impacts to worker health and the local environment. Health and environmental safeguards are often viewed as costly to profit, however, working with Newton Fund – British Council and RISTEKDIKTI, we are developing an integrated framework to enhance both safety and productivity in the industry, whilst also benefitting the environment.

Entrant: Siti Fariya
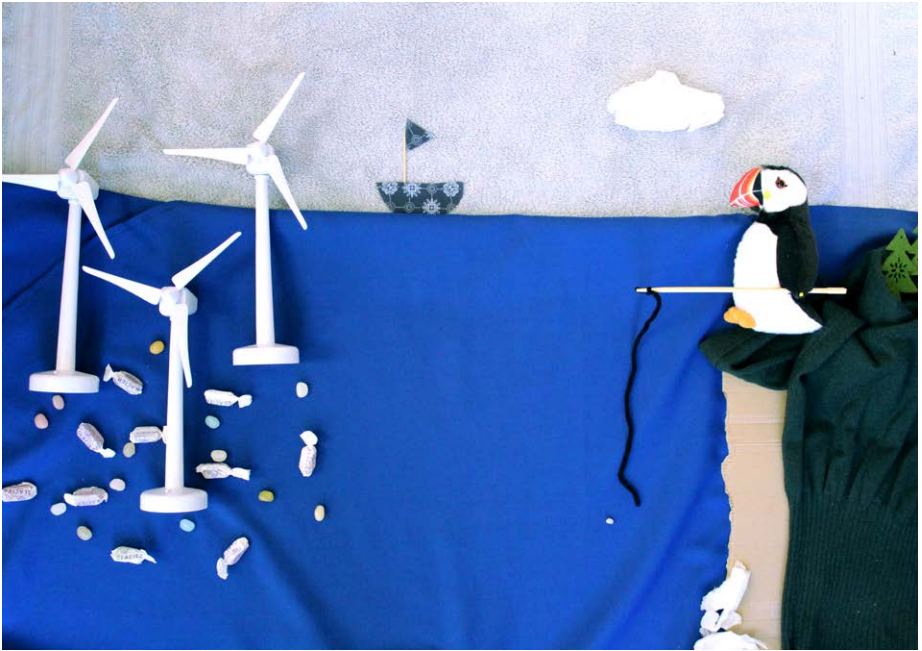
Sustaining co-existence: wildlife and windfarms

Whilst wind farms can provide protective havens for fish, they can prevent seabirds from reaching crucial food supplies. In collaboration with the Joint Nature Conservation Committee, we are studying the impact of offshore wind farms on the environment and wildlife. Through increased understanding of bird movements around wind farms, new wind farm developments can be designed such that wildlife is protected and sustainable energy needs can be met.

Entrant: Rebecca Hall

Lessons from legacy housing

The global housing crisis has revealed structural failures in how governments approach housing provision for the masses. Belgrade (pictured) in the former Yugoslavia is no exception, however, when founded in the 1950s, it pioneered a radical new approach, developing high-quality housing production shaped by its unique system of self-management. Our research of this understudied example aims to identify lessons and investigate the potential of social ownership in finding solutions for today's urban settlements.

Entrant: Donagh Horgan

Lighting up lives in Gambia

600 million live without electricity in Sub-Saharan Africa, where almost 90 percent of children go to primary schools that lack electricity; often relying on harmful kerosene lamps to study at night. Strathclyde's Gambia Solar Project has installed solar systems in 13 schools to date, 'powering' education in these schools and benefitting almost 5,500 children, whilst providing our own students with a transformational learning experience that demonstrates their 'useful learning'.

Entrant: Scott Strachan

A remedy for rubble

Mounds of waste concrete mar the coast of Ayrshire, in historic dump sites. As the world's second most consumed resource, concrete manufacture comes at a high economic and environmental cost. Working with a number of industrial partners, to explore a range of challenges posed by degraded concrete infrastructure, we are developing new biotechnology-based methods for concrete repair, generating clear benefits to industry and the environment.

Entrant: Ronald Turner

Researcher Development Programme (RDP)

The University of Strathclyde's Researcher Development Programme (RDP) is delivered by Faculties, Professional Services and external bodies to offer research students and early career academics a range of opportunities to continue their personal, professional and career management skills development.

Aligned to the national agenda supported by Research Councils UK (RCUK) and Vitae, courses, resources and events aim to help researchers enhance their transferable skills and competencies, and widen their scope for future employability both inside and outside academia.

Please visit **www.strath.ac.uk/rdp** to find out more.

Entry Information

Collaboration for impact index

Life after conflict
Submitter: Saleh Almogrbe
Department: Architecture
Funder: Libyan Government scholarship

Charting change for rapid response
Submitter: Ruaridh Clark
Department: Mechanical and Aerospace Engineering
Collaborators: Malcolm Macdonald, Ciara McGrath

Navigating turbines and turbulent seas
Submitter: Andrew Campbell
Department: Electronic and Electrical Engineering
Collaborators: Robin Rigg (e.On), Reygar
Funder: Strathclyde Impact Acceleration
                Account, grant ref: EP/R51178X/1

Collaborate...before it's too late!
Submitter: Christina Fraser
Department: Civil and Environmental Engineering
Funder: Scottish Government

Sustaining sustainability
Submitter: David McMillan
Department: Electronic and Electrical Engineering
Collaborators: Bruce Stephen, Erik Salo, Giogio Zorzi,
                Eleanor Harflett, Scottish Power
                Renewables , Onyx Insight
Funder: Innovate UK / KTP

Behind the mask: identity fraud
Submitter: David Robertson
Department: Psychology
Collaborators: Rob Jenkins, Mike Burton, Alice Towler,
                Jet Sanders, Josh Spowage, Radek
                Rudnicki, The London Science Museum
Funder: Economic and Social Research Council
                (ESRC), grant no: ES/J022950/1 (AMB)

Learning but lost
Submitter: Yvette Taylor
Department: Education
Collaborators: Stand Alone
Funder: Carnegie Trust and Society for Research
                into Higher Education

The shape of sound
Submitter: Andrew Wodehouse
Department: Design, Manufacture and Engineering
                Management
Collaborators: Daniele Marini, Taylor Trumpets
Funder: DTI Route to Impact

Transformative technology index

Fuelling the rise of solar
Submitter: Fatin Abdallah
Department: Design, Manufacture and Engineering
                     Management
Collaborators: Soltropy, Heriot-Watt University

5G RuralFirst: connecting communities
Submitter: Kenneth Barlee
Department: Electronic and Electrical Engineering
Collaborators: Ofcom
Funder: UK Government, Department for Digital
                     Culture Media and Sport (DCMS) 5G
                     Testbeds and Trials programme

Smart skin: protect and detect
Submitter: Sheik Abdul Malik
Department: Mechanical and Aerospace Engineering
Collaborators: Advanced Materials Research
                     Laboratory; Michael Debernardo Studio
                     (photographer)

Dawn of the quantum age
Submitter: Alessandro Rossi
Department: Physics
Collaborators: Agnese Abrusci (photographer)
Funder: This project has received funding
                     from 'European Union's Horizon 2020
                     research and innovation programme
                     under grant agreement no. 688539 /
                     Winton Programme for the Physics of
                     Sustainability

The art of algorithms
Submitter: Anastasios Stamoulakatos
Department: Electronic and Electrical Engineering
Collaborators: N-Sea
Funder: University of Strathclyde, Research
                     Excellence Award and N-Sea

Manufacturing beauty
Submitter: Momchil Vasilev
Department: Electronic and Electrical Engineering
Funder: Engineering and Physical Sciences
                     Research Council, Grant no:
                     EP/R2096858/1

(Virtual) heads round the table
Submitter: Andrew Wodehouse
Department: Design, Manufacture and Engineering
                     Management
Collaborators: Brian Loudon, Karyn Ross, Alejandra
                     Aranceta Garza, Loud1Design
Funder: InnovateUK (23078)

Picture of health index

Curious crystals
Submitter: Samira Anker
Department: Chemical and Process Engineering
Collaborators: Jan Sefcik, David McKechnie
Funder: Engineering and Physical Sciences
                Research Council, Grant no
                EP/P006965/1

Pre-eclampsia: managing risk
Submitter: Tunde Csoban
Department: Mathematics and Statistics
Collaborators: King's College London
Funder: STRADDLE (Strathclyde Diversity in Data
                Linkage) funded PhD

Insights in autism: serious gameplay
Submitter: Jonathan Delafield-Butt
Department: Education
Collaborators: Phil Rowe, Ivan Andonovic, Christos
                Tachtatzis, Szu-Ching Lu, University
                of Glasgow: Helen Minnis and Alex
                McConnachie, University of Gothenburg:
                Chris Gillberg, University of Aberdeen:
                Phil Wilson, University of Southern
                California: Lisa Aziz-Zadeh, Nanyang
                Technological University: Domenico
                Campolo, Uiniversity of Warsaw: Anna
                Anzulewicz,and Krzysiek Sobota.
                Mariusz Radomyski (photographer)
Funder: Strathclyde Impact Acceleration
                Account, grant ref: EP/K503861/1

Contagious communication
Submitter: Rachel Donaghey
Department: Strathclyde Institute for Pharmacy and
                Biomedical Sciences
Collaborators: Neil Forbes, Breige McLaughlin
                (co-artist)

A window to wellbeing
Submitter: Joanne Kinloch
Department: Architecture
Collaborators: Prince & Princess of Wales Hospice
Funder: Jointly funded by the Prince & Princess
                of Wales Hospice and Engineering and
                Physical Sciences Research Council
                (EPSRC), Grant no: EP/N509760/1 and
                EP/R513349/1

Bridging generations for healthier communities
Submitter: Anna Krzecskowska
Department: Psychology
Collaborators: West Lothian Council, West Lothian
                primary schools, Generations Working
                Together
Funder: Research Excellence Award, University
                of Strathclyde

Mind trap: tackling unhelpful thinking
Submitter: Susan Rasmussen
Department: Psychology
Collaborators: Dougie Cunningham (photographer) /
                Rebecca Moodie (model in image)

Shaping the future of medicines
Submitter: Erin Walsh
Department: Strathclyde Institute for Pharmacy and
                Biomedical Sciences
Collaborators: Daniel Markl, Natalie Maclean
Funder: Engineering and Physical Sciences
                Research Council (EPSRC), grant no
                EP/P006965/1 and the Royal Society,
                grant no R180668

Sustainable society index

Taking renewables to new heights
Submitter: Fatin Abdalla
Department: Design, Manufacture and Engineering Management
Collaborators: Soltropy

Sustainable technology inspired by tradition
Submitter: Runda Aduldejcharas
Department: Architecture
Collaborators: David Grierson, Niyom Apornram, Ratana Niroram, Boonyaporn Nachoengram, The Energy and Technology Centre for Community (Thailand)

Calculating capability: powering the future
Submitter: Waqquas Bukhsh
Department: Electronic and Electrical Engineering
Collaborators: National Grid ESO
Funder: Network Innovation Allowance (NIA) fund

Sustainability without sacrifice
Submitter: Siti Fariya
Department: Naval Architecture, Ocean and Marine Engineering
Collaborators: Rafet Emek Kurt, Sefer Anil Gunbeyaz
Funder: PhD funded jointly by British Council Newton Fund and Ministry of Research and Technology, Indonesia

Sustaining co-existence: wildlife and windfarms
Submitter: Rebecca Hall
Department: Electronic and Electrical Engineering
Collaborators: Joint Nature Conservation Committee
Funder: Engineering and Physical Sciences Research Council (EPSRC), grant no: EP/L016680/1

Lessons from legacy housing
Submitter: Donagh Horgan
Department: Architecture
Funder: BRE and University of Strathclyde

Lighting up lives in Gambia
Submitter: Scott Strachan
Department: Electronic and Electrical Engineering
Funder: University of Strathclyde

A remedy for rubble
Submitter: Ronald Turner
Department: Civil and Environmental Engineering
Collaborators: Cavendish Nuclear, Magnox Ltd
Funder: Engineering and Physical Sciences Research Council (EPSRC), grant no: EP/R004889/1, Cavendish Nuclear and the TRANSCEND Consortium

The research presented in this
exhibition is funded from a variety
of sources including, but not limited
to, UK and international research
councils, government, public and third
sector organisations, as well as private
sector support.

_____