

Making a difference to everyday lives



Making a difference to everyday lives



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Welcome

Welcome

Professor Elizabeth Treasure

Vice-Chancellor

We live in a time of change and uncertainty, in society and in the technologies we use. As a research-led university, we are actively engaged in working with partners, using our research to help address regional, national and global challenges. From sustainable food production to building more peaceful societies, from rural health to global health, and from climate change to artificial intelligence, our researchers are making a difference. Not only to the world in which we live today but the world we want in the future.

This brochure provides a snapshot of how research and innovation at Aberystwyth are contributing to society and the economy. The positive impact of our work was highlighted in the 2021 Research Excellence Framework, with almost all our research activity classified as being of an internationally recognised standard or higher. But we do not rest on our laurels.

As we celebrate our 150th anniversary as the first University College in Wales, we remain committed to driving innovation, discovering new knowledge and delivering real benefits to everyday lives in Wales and the wider world. We do not work alone but actively seek collaboration with business, industry and policymakers as well as academic partners. Read on to find out more about our research and how you can work with us to help tackle some of the critical issues of our time.



What is Impact?

“ An effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia ”

RESEARCH EXCELLENCE
FRAMEWORK 2021



Introduction

Introduction

Professor Helen Roberts

Director of Research Excellence & Impact

Undertaking research and contributing to the body of knowledge in our subject areas is an integral part of our work as academics. It keeps us at the forefront of our field and informs our teaching. It also enables us to reach beyond the boundaries of our institution for the benefit of the wider world. These benefits can be wide-ranging, affecting the economy, society, culture, policy, health, the environment and quality of life. The nature and extent of such benefits is how we measure the impact of our research.

In the following pages, you will find a series of case studies which demonstrate the contribution research at Aberystwyth University has made and continues to make. The text is taken from impact case studies we prepared for the Research Excellence Framework (REF) 2021, a process of expert review used in the United Kingdom to assess the quality of research carried out by higher education institutions.

By demonstrating the impact of the new knowledge we generate as academics, we can show how our work is being translated into real-world outcomes and leading to positive change. The impact of research can take many forms and can lead for example to:

- Improving quality of life, the health and wellbeing of people and animal welfare
- Enhancing creativity and cultural life
- Contributing towards evidence based policy-making and influencing public policies and legislation at a local, regional, national and international level
- Enhancing public understanding and awareness
- Shaping and enhancing the effectiveness of public services
- Improving social welfare, social cohesion and / or national security
- Changing organisational culture and practices
- Contributing toward environmental sustainability and protection
- Enhancing the research capacity, knowledge and skills of businesses and organisations

In taking our research outside academia, we are keen to work collaboratively and in partnership with communities both locally and globally to identify needs and conduct research which addresses those needs. Read on to find out more about how our research has been making a difference to everyday lives.



Case Study

Research Theme: Environment

Conserving and Protecting Global Mangrove Forests

RESEARCHERS

Dr Pete Bunting
Professor Richard Lucas

THE OVERVIEW

Thriving mangroves are key to the health of nature and effective climate action. They are a critical ecosystem, under significant pressure, providing a host of ecosystem services with an estimated value of US\$25 trillion annually.

Aberystwyth University's Earth Observation and Ecosystem Dynamics Research Group led the scientific development of and technical implementation for mapping and monitoring mangrove forests globally through the Global Mangrove Watch (GMW).

The GMW datasets form the reference mangrove extent for the UN Environment Programme (UNEP), tracking progress towards Sustainable Development Goal (SDG) 6.6.1, which aims to halt degradation and destruction of water-related ecosystems. The GMW mangrove extent maps have also been used by NGOs and governments to monitor mangrove extent, in turn informing mangrove restoration and protection.



THE RESEARCH

Since 2014, AU's Earth Observation and Ecosystem Dynamics Research Group has focused on quantifying, understanding, and addressing local to global environmental change through Earth Observation.

This research led to the Global Mangrove Watch (GMW) datasets, which focus on providing standardised and consistent global mapping of mangrove extent and change for multiple epochs to address a major global data and knowledge gap.

Globalmangrovetwatch.org is a free and openly available online platform that provides the remote sensing data and tools for monitoring mangroves necessary for this. It gives universal access to near real-time information on where and what changes there are to mangroves across the world, and highlights why they are valuable.



THE IMPACT

INFORMING PUBLIC POLICY

The GMW maps show changes in the extent of mangroves through time and have informed public policy and influenced decisions at many levels; internationally, through the UN SDGs, the actions of national governments, including Myanmar, Fiji, and Indonesia, non-governmental organisations including the World Wildlife Fund, Wetlands International and The Nature Conservancy, and Industry, for example, through the Proteus Partnership.

GMW DATASETS SUPPORTED NATIONAL GOVERNMENTS AND NGOS

Many countries have limited capacity to process satellite sensor data. The GMW datasets enabled all countries to benefit from such technologies, by providing up-to-date mapping information to inform their decision-making, which they would not have otherwise had access to.

MONTHLY ALERTS OF MANGROVE LOSS ACROSS THE AFRICAN CONTINENT USED TO MONITOR MANGROVE CHANGES AND TO TRACK SUCCESS IN DECREASING MANGROVE LOSS

From 1 January 2020, AU provided, in collaboration with Wetlands International (WI), monthly alerts of mangrove loss across the African continent. These alerts are being used by WI staff to monitor mangrove changes on the ground and to track their success in decreasing the spatial extent and frequency of mangrove loss.



Case Study

Influencing Bioenergy, Land Use and Net Zero Policy

RESEARCHERS

Professor Iain Donnison
 Professor John Clifton-Brown
 Dr Kerrie Farrar
 Dr Paul Robson

THE OVERVIEW

Research undertaken by the Institute of Biological, Environmental & Rural Sciences (IBERS) at Aberystwyth University (AU) has influenced UK Government policy on biomass cropping and land use for achieving net zero targets. AU researchers have contributed, through publications and advisory input, to the UK's Climate Change Committee (CCC) reports on Biomass in a Low Carbon Economy (2018) and Land use: Policies for a Net Zero UK (2020). Both these reports informed the CCC's 6th Carbon Budget (2020).

AU researchers have also continued to contribute to land use policy through their advice to the UK Government and the National Farmers Union (NFU) on biomass availability, and on meeting net zero targets.



THE CHALLENGE

In 2019, the UK Government and the devolved administrations committed to the Net Zero target as recommended by the Climate Change Committee (CCC). Reaching Net Zero requires extensive change across the economy, and expert advice and guidance to lead the way to a reduced exposure to climate risk. A specific goal is to develop sustainable sources of non-food biomass from land and sea.

THE SOLUTION

AU researchers have provided evidence on biomass crops and land use to help the UK Government develop a net zero policy. Examples include crop models, research papers and reviews, with 84 peer reviewed manuscripts on biomass crops in the reference period.

Our researchers were members of two Climate Change Committee (CCC) advisory groups and helped inform UK policy on the role of biomass crops in a low carbon economy, on the practical implementation of net zero involving land use, and its communication.

Our studies have been particularly valuable in providing measurements during the period of crop transition, for providing long term datasets in mature crops, and in the impact of changing biomass crops back to grassland agriculture. This has supported UK policymakers by significantly improving relevant information available on perennial biomass crops.

THE IMPACT

AU researchers have influenced UK Government policymaking on biomass crops, climate change and land use to achieve net zero targets, through:

IMPACT ON UK GOVERNMENT POLICY MAKING AND LEGISLATION

- Expert advisory group for the report on Biomass in a Low Carbon Economy (2018), which recommended the use of greenhouse gas removals and bioenergy with carbon capture and storage (BECCS) to achieve net zero.
- Part of a stakeholder group at a workshop on Steps to Scaling Up UK Sustainable Bioenergy Supply, which informed the CCC Biomass report.
- Publishing three research papers on the implications of land use transitions to perennial biomass crops, cited in the CCC Biomass report.
- Expert advisory group for the CCC report on Land use: Policies for a Net Zero UK (2020), which evaluates the opportunities for farmers and landowners to enable the UK to achieve its net zero target.

- Engaged with UK Government departments on future biomass availability. Contributing to the SuperGen Scoping Report that assessed the current state of knowledge around UK biomass resource availability for the bioenergy sector and Biomass Availability Modelling for the Department of Transport.

IMPACT ON INDUSTRY TAKE UP AND ITS ENGAGEMENT

AU research is also helping to de-risk investment by industry. The Energy Technologies Institute (ETI) have estimated that the costs of the UK energy system would be up to £44 billion higher per year by 2050 without bioenergy. In other words, without negative emission technologies, the cost to energy consumers in the UK is likely to make industry uncompetitive and increase fuel poverty. Our engagement with industry through the NFU, and with other biomass supply chain actors, is helping to create an environment in which agriculture can become net zero by 2040. Farmers and landowners are already reporting progress and making pledges of changes to practice via the NFU website. The net zero commitments of the UK and NFU are in turn referenced within the Agriculture Bill 2019-2021.

AU researchers also support public engagement; for example by joining Radio Wales on the day of the publication of the CCC Net Zero Report to discuss and describe what Net Zero means for farmers and consumers. Another example was publishing an article for *The Conversation* on the challenge and opportunity of Net Zero targets for farming in Wales.

In June 2018, Prof. Donnison was invited by the Department of Business, Energy & Industrial Strategy (BEIS) and the Energy Systems Catapult as a technology expert, to participate in a workshop to discuss the interactive elements of The MacKay Carbon Calculator. This webtool provides a method to create pathways to Net Zero by 2050 and beyond, and raises awareness about what impact issues such as land use, biofuels and greenhouse gas have on climate change.



Clover Innovation Supports Sustainable Livestock Farming in Wales

RESEARCHERS

Professor Leif Skøt
 Dr David Lloyd
 Professor Michael Abberton
 Professor Athole Marshall
 Dr Rosemary Collins

THE OVERVIEW

Research and breeding programmes at Aberystwyth University's Institute of Biological, Environmental & Rural Sciences (IBERS), have successfully generated highly persistent clover varieties. Increasing the use of these varieties in grassland agriculture provides significant economic and environmental benefits. AberLasting, the first commercial white clover variety was developed by researchers at IBERS, and was added to the UK National List in 2016. Persistent red clover varieties have also been developed, notably AberClaret, which accounts for 15% of red clover seed sales in the UK.

THE CHALLENGE

White and red clover are two of the most important forage legumes for temperate sustainable livestock production systems. They offer natural nitrogen fixation, reducing the need for industrial nitrogen fertilizer. They are superior to grasses in nutritional value, with a crude protein (CP) content of 18-19%, and they improve soil structure and fertility.

However, greater use in the UK has been limited by its lack of persistence in swards (the grassy surface of land). Increasing persistency therefore, particularly in mixtures with grasses is an important breeding target.



THE SOLUTION

Innovation has been central to IBERS's breeding programmes, supported by BBSRC, the Welsh Government and Innovate UK, and funded significantly by our strategic partner Germinal Holdings Ltd. (the largest UK owned forage seed wholesale company).

ABERLASTING

A major breakthrough was made in the development of the variety AberLasting, the first white clover-Caucasian clover hybrid. This variety, combining the best qualities of both parent species, is able to persist in environments that are too harsh for conventional clovers, partly due to a greater root biomass at depth. AberLasting is in commercial production, and is now being sold in four continents.

ABERCLARET

Historically, some producers have avoided red clover, due to a tendency for yields to drop off over time. To solve that problem, IBERS scientists developed varieties which focused on better persistence and improved yields, notably AberClaret, which produces high yields in the third and fourth harvest years.

AberClaret gave the highest dry matter yield in mixed swards in Year 4 (61%) in an experiment comparing 12 red clover varieties. This resulted in greater CP yields on an area basis, highlighting the importance of red clover persistence to the feeding value of grass/red clover swards.

THE IMPACT

ECONOMIC AND COMMERCIAL IMPACT

Seed of the IBERS bred clover varieties is marketed through a strategic alliance between IBERS and Germinal Holdings Ltd. 40 tonnes of seed of AberLasting was produced in New Zealand in 2017, with a further 40 tonnes produced in 2019. Demand is increasing as the variety is very popular in New Zealand, and seed is returned to the UK for inclusion in Germinal mixtures. Trials are taking place in Japan, France and other countries. It is anticipated that seed of this and other varieties developed from this germplasm will be sold in many European countries.

Seed sales of AberClaret represented approximately 15% of the UK market in 2017. Further expansion continues, both domestically and in international markets including Switzerland, New Zealand, Australia and Canada.

The England and Wales Recommended List shows that among diploid varieties, AberClaret had the second highest yield in the second and third harvest years. Its high biomass yield, even in the fourth year, increases the

nutritional quality of the silage and persistence for the duration of many medium-term leys. At the farm level this equals a saving of £700 on imported soybean meal. Assuming a price of £350 per tonne, this is worth up to £7,000,000 for 10,000 tonnes. Growth rates of 1.3kg/head/day (growing ration) and 1.5kg/head/day (finishing) in beef cattle are being achieved, with no oil seed rape meal or soya required when red clover silage is available.

SOCIETAL AND ENVIRONMENTAL BENEFIT

White clover fixes approximately 150kg N/ha/yr (Nitrogen per hectare per year), some of which is utilised by the companion grass, providing an economic and environmental benefit to the farmer and society by reducing the need to apply mineral nitrogen fertiliser. White clover breeding programmes have focused on ensuring that the proportion of white clover in a sward is sufficiently persistent to be maintained at an optimal 30% in mixtures with grass. Such mixtures require 300 to 400kg N/ha/yr less Nitrogen fertiliser compared to grass monocultures to achieve the same yield. This reduction in fertiliser application reduces CO₂ emissions by approximately 1t/ha/yr, and provide a saving of £70 per ha for the farmer, assuming a cost of approximately £200 per tonne of Nitrogen. Furthermore, application of nitrogenous fertilisers accounts for the majority of N₂O emissions. For every 100kg of fertiliser Nitrogen added to the soil, on average 1kg of Nitrogen is emitted as N₂O, which is equivalent to approximately 600kg of CO₂.

Red clover contains high levels of the enzyme polyphenol oxidase which has beneficial effects on nitrogen utilisation in ruminants. It is also an excellent break crop allowing soil fertility to build up, and reducing weed problems, particularly blackgrass in cereal crops.

In addition to Nitrogen fixation, soil fertility and structure, clovers reduce the need for reseeding as they remain productive for 5 or 6 years, even under heavy abiotic stress. They continue to grow during drought periods (in contrast to grass) and provide more tangible benefits to the environment in terms of food and habitat for insect pollinators, thus maintaining the biodiversity in grasslands.



Case Study

New Genetic Methods Support Sustainable Fisheries Management

RESEARCHERS

Professor Paul Shaw
Dr Niall McKeown

THE OVERVIEW

Demand for seafood and advances in technology have led to fishing practices that are depleting fish and shellfish populations around the world. Conserving biodiversity and protecting threatened populations and species through sustainable fishing practices is critical.

Advances in DNA techniques have enabled Aberystwyth University (AU) researchers to produce genetic definitions of fished stocks and provide the scientific evidence required to improve accuracy and sustainability in the management of exploited wild populations.

Fishery managers, governments and NGOs have been empowered through knowledge transfer to implement critical changes to policy and guidelines, resulting in improved fishing practices and a greater understanding of the power of precise genetic information. This has had positive economic benefits to fishing communities and aided conservation of marine biodiversity, securing the future of multiple fish and shellfish species globally.

THE RESEARCH

Fishery management relies on accurate data-based definitions of fished stocks. Genetic methods of stock description are more accurate, and more biologically meaningful than historical, or geo-political delimitations of fished populations.

Led by Professor Paul Shaw and Dr Niall McKeown, and collaborating with fishery managers, government agencies and NGOs, the AU research group developed genetic approaches to improve stock definitions and management, and to provide DNA markers for testing the provenance of fishery products to help police fishery regulations. Stock definitions and advice were provided for finfish, shellfish and cephalopod fisheries in the Western Indian Ocean, NE Atlantic (including UK), North America, Chile, Brazil, South Africa and Angola.

Three relationships are provided as examples of impact resulting from this body of work: with the Indian Ocean Tuna Commission (IOTC) and International Commission for the Conservation of Atlantic Tunas (ICCAT) on yellowfin tuna; with fisheries managers in regional government in the Falkland Islands and Wales; and with artisanal fisheries managers in the Western Indian Ocean.

THE IMPACT

IMPACT ON INTERNATIONAL GUIDELINES AND POLICY

The research has resulted in changes to international organisation guidelines, and has influenced policy regarding the collection of data and its use in the management of global commercial fisheries. For example, our study on yellowfin tuna was used to inform changes to guidelines on fisheries data gathering and analysis by the Indian Ocean Tuna Commission (IOTC), and transfer to the International Commission for Conservation of Atlantic Tunas (ICCAT). As an invited External Expert, Professor Shaw put to the IOTC Working Parties that their international boundaries, and so landing statistics and management models, should be changed to reflect the biogeographic rather than geopolitical boundary between the two areas and their yellowfin tuna stocks. Changes to the IOTC and ICCAT boundaries from November 2019 will have significant impact on how tuna should be managed, particularly in the Indian Ocean.

IMPACT ON PRACTICE AND POLICY

Our research has also had impact on practice and policy regarding management of regional commercial fisheries. The Welsh Government commissioned studies of fisheries genetics of whelk, seabass, brown crab and razor clam populations in Welsh waters to inform their sustainable management of these resources. The data and advice from these studies have been used in preparation for post-Brexit negotiations on reopening of the seabass fishery, and in whelk fishery management through changes to policy and regulations on minimum landing sizes.

IMPACT ON PRACTITIONERS

A series of research projects for the Falkland Islands Government resulted in knowledge transfer and input to management of commercial fisheries resources vital to the Falklands economy. Based on earlier studies of toothfish that resulted in Marine Stewardship Council sustainable fishery accreditation of the South Georgia fishery, the aim has been to apply similar studies to wider areas and different species of finfish (e.g. Southern Blue Whiting, Rockcod) and cephalopods (Shortfin squid), to better define transboundary stocks across territorial waters of the Falklands, Argentina and Chile. As the Falkland Islands fisheries use a sustainable management method based on Total Allowable Catch linked to real-time catch data, it is vital that the geographical and demographic definition of fished stocks is accurate in the models used. The resultant knowledge transfer, data and advice have helped refine models for sustainable catch regulation for the Falkland Islands Government and fisheries managers, leading to increased sustainability and commercial value.

IMPACT ON THE ECONOMY AND BIO-DIVERSITY

The Rodrigues octopus fishery in the Indian Ocean had been in decline over many years due to over-exploitation. A study by the Aberystwyth group established that the octopus population of Rodrigues was isolated from other populations in the SW Indian Ocean, and therefore unlikely to be replenished by larval input from external sources if the Rodrigues population crashed due to overfishing. Consequently, the local administration implemented a change in policy through a series of closures to fishing. This management approach has resulted in both sustainable management and improved local incomes from artisanal fisheries.



Case Study

Research Theme: Environment

Improving the Quality Standards for Recreational Waters



RESEARCHERS

Professor David Kay
 Dr Mark Wyer
 Dr Carl Stapleton
 Dr Lorna Fewtrell
 Dr Cheryl Davies

THE OVERVIEW

Modelling the fluctuation of indicator bacteria and pathogens in places where people come into contact with them is important for the management of bathing waters.

Research conducted by the Centre for Research in Environment and Health (CREH) at Aberystwyth University has informed the development, implementation and improvement of global recreational water quality standards.



THE CHALLENGE

In environmental research and modelling, catchment (an area where water is collected by the natural landscape) microbial dynamics have been lower on the agenda than, for example the study of nutrients. Accurate, and publicly available information about water quality is important to enable bathers to make informed decisions about entering the water.

“ The CREH team are key members of the WHO technical advisory group on water quality. In this capacity, WHO has drawn on CREH experts to provide an updated review of evidence to inform revision of both EU BWD and WHO Guidelines and also to provide rapid technical advice to Member States as needed. ”

LEAD SCIENTIST, WHO BATHING WATER GUIDELINES, 2019

THE SOLUTION

Since 2000, CREH at Aberystwyth University has developed new risk-assessment methodology for bathing water exposures and implemented this at recreational bathing sites across Wales. CREH provided, for the first time, real-time and within-day predictive modelling, facilitating pollution forecasts that have driven notification procedures and permitted user choice. This improved public health amongst bathers and safeguarded Blue Flag status.

CREH’s work has supported a revision of World Health Organisation (WHO) and European Union (EU) water quality guidelines and the Environment Agency’s (UK-wide) Pollution Risk Forecasting system. CREH also served as technical adviser for the (world-wide) Blue Flag Awards and for bathing water quality at the 2016 Rio de Janeiro Olympic Games.



THE IMPACT

INFLUENCING INTERNATIONAL AND UK PUBLIC POLICY

CREH influenced the revision of the WHO ‘Guidelines for Safe Recreational Water Environments’ and, on behalf of the WHO, advised the EU on the revision of the EU Bathing Water Directive 2006/7/EU, which sets standards for EU bathing waters across more than 22,000 European beaches. This significantly benefited the EU coastal tourism sector, which contributes EUR 183 billion to the economy per annum.

IMPROVING IMPLEMENTATION OF AND INCREASING COMPLIANCE WITH ENVIRONMENTAL POLICY

Scientists from CREH oversaw the implementation of real-time water quality predictive modelling and water management advisory notification approach in Swansea Bay between 2013 and 2020. Between 2017 and 2020, this work extended to Cemaes Bay (Anglesey) New Quay North and Traeth Gwyn (Ceredigion) and Nolton Haven (Pembrokeshire). Following these long-term projects, both Swansea Bay and Cemaes Bay passed EU water quality standards and the latter achieved a ‘Excellent’ EU classification in 2021. This also protected and enhanced public health as bathers were told in real-time when recreational waters were safe to use.

BENEFITTING PUBLIC HEALTH, THE LOCAL ECONOMY AND ECOSYSTEMS

Part-funded by the European Regional Development Fund, Acclimatize (2017 - 2023) is a project being carried out by researchers in Wales (CREH at Aberystwyth University) and Ireland (University College Dublin (UCD)). The aim, in Wales and Ireland, is to work out how bathing waters at the seaside become polluted in a way that can impact on public health, and how climate change may affect the quality of these waters in the future. The Acclimatize project is further developing and implementing risk assessment methodology and has increased the modelled Welsh beaches to five including Swansea Bay.

Towards A Million Welsh Speakers? Language Policy and Planning in Wales



RESEARCHERS

Dr Huw Lewis
Dr Elin Royles
Dr Catrin Wyn Edwards

THE OVERVIEW

Reflecting the growing political significance of cultural diversity: public policy interventions that seek to revitalise the prospects of regional or minority languages have become increasingly prominent in many parts of the world. Recent research by Dr Huw Lewis, Dr Elin Royles and Dr Catrin Edwards at Aberystwyth's Department of International Politics has focused on analysing the different approaches to language revitalisation that have been adopted by sub-state governments across Europe and North America. Based on this research, between August 2016 and July 2017, they were able to inform and influence the policy discussion that fed into the preparation of the Welsh Government's ambitious national language strategy, *Cymraeg 2050: A Million Welsh Speakers*, published in July 2017.



THE RESEARCH

The research conducted by Huw, Elin and Catrin falls into the interdisciplinary field of language policy research. Specifically, their work has focused on analysing policy interventions by European sub-state governments aiming to revitalise regional and minority languages. Key findings from their research are that language revitalisation strategies need to:

- Strike a balance between the challenge of increasing the absolute number of minority language speakers and increasing social use of the language.
- Take greater account of the implications of social changes such as the increase in levels of personal mobility, the rise in networked forms of social interaction and the decline in significance of local and territorially based communities.
- Place more of an emphasis on regional level initiatives, alongside more familiar community-based ones.
- Promote a response to immigration that is based on partnership with current speakers of the minority language, as exemplified by the *voluntariat per la llengua* programme in Catalonia.

THE IMPACT

IMPACT ON POLICY AND PLANNING

Based on their research expertise, Huw, Elin and Catrin have developed strong links with public officials and other key stakeholders associated with policy efforts to promote the Welsh language. Consequently, when the Welsh Government embarked on the process of developing a new national language strategy, they were well-placed to contribute to the ensuing policy discussion.

They were able to inform and influence this process through close engagement with officials from the Welsh Government's Welsh Language Division, during the initial discussion phase, the public consultation and into the final drafting period (January-July 2017). During this period, they attended key meetings, delivered CPD training, drafted internal briefing papers, hosted a closed research briefing, and prepared a detailed submission to the official public consultation exercise for relevant government officials.

IMPACT AND PUBLIC RECOGNITION

Eluned Morgan MS, then Minister for International Relations and the Welsh Language, publicly acknowledged the contribution of Huw, Elin and Catrin to the work of developing the *Cymraeg 2050* strategy in a speech delivered in Aberystwyth in May 2019.

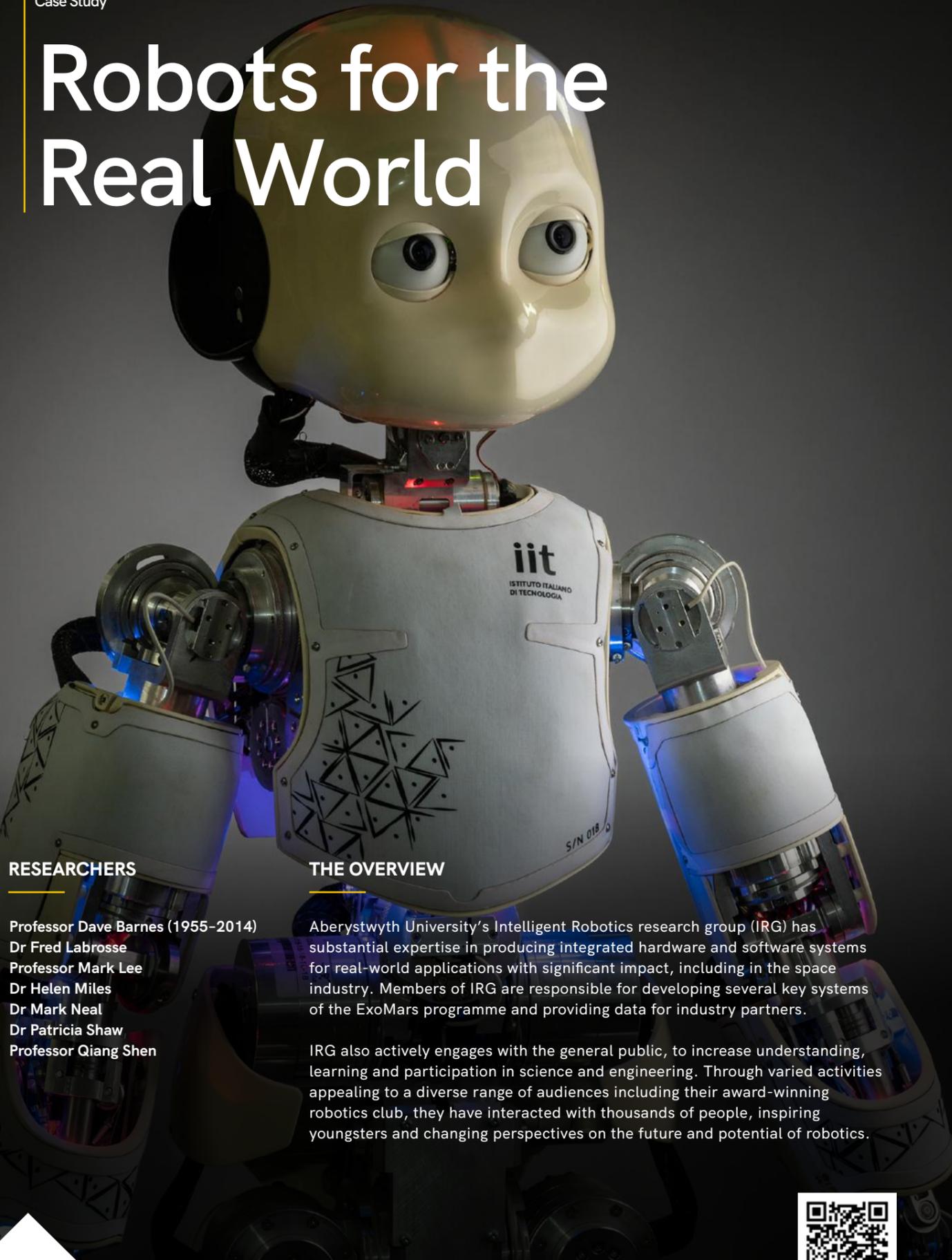
“ Dwi am weld y nifer o bobl sy'n gallu mwynhau siarad a defnyddio'r Gymraeg yn cyrraedd 1 miliwn erbyn 2050. Dwi'n gwybod bod yr Adran Gwleidyddiaeth Ryngwladol wedi chwarae rhan actif yn y broses o ddatblygu'r strategaeth Cymraeg 2050 a'ch bod chi'n dal i wneud gwaith ymchwil ar faterion cynllunio laith felly hoffwn ddiolch i chi am eich cefnogaeth ”

ELUNED MORGAN AS

“ I want to see the number of people who enjoy speaking and using Welsh reach 1 million by 2050. I know that the Department of International Politics has played an active role in the development of the Cymraeg 2050 strategy and that you are still undertaking research on language planning issues so I would like to thank you for your support ”

ELUNED MORGAN MS

Robots for the Real World



RESEARCHERS

- Professor Dave Barnes (1955–2014)
- Dr Fred Labrosse
- Professor Mark Lee
- Dr Helen Miles
- Dr Mark Neal
- Dr Patricia Shaw
- Professor Qiang Shen

THE OVERVIEW

Aberystwyth University’s Intelligent Robotics research group (IRG) has substantial expertise in producing integrated hardware and software systems for real-world applications with significant impact, including in the space industry. Members of IRG are responsible for developing several key systems of the ExoMars programme and providing data for industry partners.

IRG also actively engages with the general public, to increase understanding, learning and participation in science and engineering. Through varied activities appealing to a diverse range of audiences including their award-winning robotics club, they have interacted with thousands of people, inspiring youngsters and changing perspectives on the future and potential of robotics.



THE RESEARCH

The Intelligent Robotics research group (IRG) has an excellent record of success, with industry endorsement and international recognition. Their research has played a significant role in a wide variety of applications from sea all the way to space, with an overarching theme of operating in unconstrained environments, with strong interdisciplinary collaborations.

This has led to the development of survey robots, deployed to allow better and more frequent data acquisition, including the following projects:

- A survey boat to safely and accurately build 3D models of calving glaciers in Greenland
- A survey off-road vehicle to build 3D models of flooding riverbeds in New Zealand, made possible thanks to the automation of the data acquisition
- Our work on autonomous vision-based driving was integrated in QinetiQ’s solution to the Autonomous Last Mile Resupply project
- A planetary scouting rover was developed and tested, containing state of the art hardware and software systems, in an EU-funded international collaboration

Additionally, IRG has increased understanding, learning and participation of science and engineering through organising and regularly taking part in a variety of events to showcase current robotics research to the general public. As part of this objective, fundamental research on robot learning inspired by infant development was also carried out, with significant EPSRC support.

THE IMPACT

IMPACTS ON THE INTERNATIONAL SPACE INDUSTRY

IRG has played a key role in the development, calibration, and testing of the Panoramic Camera (PanCam) and Infrared Spectrometer for ExoMars (ISEM) instruments on the ExoMars rover. This has contributed to innovation and entrepreneurial activity in the UK and European Space Industry through the design and delivery of the AU PanCam Emulator (AUPE). This work has also led to impacts on practitioners and delivery of professional services. AUPE allows international industrial and academic collaborators to develop new processes and methods to analyse the data from PanCam, with IRG providing consultancy for a number of projects. IRG’s work has enabled industrial contractors to maintain their tight schedule and has contributed to the success of mission hardware and software development due to the results produced. This also enables public engagement activities centred around the mission.

ENGAGEMENT WITH ROBOTICS FOR STEM DEVELOPMENT

Aberystwyth Robotics Club was established for STEM engagement with local school children, teaching a wide range of skills for developing robotics systems and inspiring future generations of scientists and engineers. The Club has won national awards for STEM engagement. The Robotics Club has provided a template for the establishment of clubs elsewhere. International development funding enabled us to help form a robotics club with 20 local school children in Karbala, Iraq, engaging and addressing social and political divides.

IRG’s public engagement programme targets different audiences, with different levels of understanding and preconceptions about robotics.

The IRG has visited over **70** different schools and colleges across the UK engaging over **7,000** children, as well as speaking to nearly **30,000** members of the general public at various events and contributing to a national outreach programme which has reached over **310,000** visitors to science museums across the UK.

Public engagement activities range from traditional talks and Q&A sessions to Film and Panel discussions during the annual Robotics week. The IRG raises awareness of, and showcases, state of the art of robotics research and applications via actively participating in events such as Jodrell Bank’s Bluedot Festival, the National Eisteddfod of Wales Science Village and UKRI-organised science and engineering promotion activities. The long-term impact of these events is evident from the feedback attained.

“ I attended the film and Q+A for the robotics week last year which initially sparked my interest in robots and artificial intelligence. I returned this year with a greater understanding... Both events significantly increased my interest in robotics and have inspired me to pursue my own research on the topic. ”

FEEDBACK FROM ROBOTICS WEEK



Case Study

Research Theme: Society

Supporting Victim-Survivors of Domestic Violence and Abuse in Later Life



RESEARCHERS

Sarah Wydall
Rebecca Zerk
Elize Freeman
Professor Alan Clarke
Professor John Williams

THE OVERVIEW

Research produced by Dewis Choice, an initiative run by Aberystwyth University, challenged previous responses to Domestic Violence and Abuse (DVA) which assumed gendered violence only occurs in women under 45 years old. The Dewis Choice Initiative improved access to justice and wellbeing for older victim-survivors of DVA across Wales, through the delivery of a unique co-produced service integrating justice and wellbeing, which safeguarded older victim-survivors; informed more effective provision and delivery of public services for older victim-survivors of DVA across the UK; and informed national guidance and campaigns within Wales on the protection and safeguarding of older people.



THE CHALLENGE

Domestic Violence and Abuse (DVA) occurring in later life sits under the umbrella term 'elder abuse' which serves to marginalise older victim-survivors. Research by Dewis Choice shows the discourse in this context can be ageist and sexist, contributing towards discriminatory responses by professionals.

It highlights the importance of framing the significant harms as DVA, not elder abuse, to ensure equality of opportunity, access to justice and improved quality of life for people aged 60 years and over.

THE SOLUTION

Dewis Choice, a groundbreaking initiative based in the Centre for Age Gender and Social Justice at Aberystwyth University, led by Sarah Wydall since 2018, is the first dedicated service in the UK for older people who have experienced DVA. The service provides client-led informed choice during all stages of the help-seeking and justice-seeking journey, during crisis incidents, safety planning and recovery.

The Dewis Choice Initiative has produced a grassroots intervention that has been designed by the community specifically to support older victim-survivors of DVA make informed choices about justice including civil, criminal and restorative and to ensure they are not treated differently on account of age, gender, sexuality or disability. The research is also the first of its kind to conduct a prospective longitudinal study examining decision-making in the context of DVA in later life.

“ [Dewis Choice is] changing the world and making a real difference...I personally value what you are doing to transform older people’s lives and it’s probably no exaggeration to say to save lives as well. ”

OLDER PEOPLE’S COMMISSIONER FOR WALES
FEBRUARY 2020

THE IMPACT

ON THE HEALTH AND WELLBEING OF PEOPLE

Dewis Choice provides a unique service across Wales, as the only route for older people experiencing Domestic Violence and Abuse (DVA). This addresses gaps in DVA services, and improves justice-seeking responses, which reduces the risk of DVA and future harm, and changes and enhances the lives of the older victim-survivors supported.

ON PRACTITIONERS AND DELIVERY OF PROFESSIONAL SERVICES

Dewis Choice informed more effective provision and delivery of public services for older victim-survivors of DVA across the UK.

ON PUBLIC POLICY, LAW, AND SERVICES

Dewis Choice contributed to Welsh Government committees, documents, and campaigns. Informing guidance and practice to help protect older people from DVA.



Influencing Law and Policy to Protect and Support Victims of Human Trafficking

RESEARCHER

Professor Ryszard Piotrowicz

THE OVERVIEW

Professor Piotrowicz's research has had significant impact on human trafficking law and policy in four areas:

- In monitoring states' compliance with their obligations under the Council of Europe anti-trafficking convention
- In informing state policy
- In embedding the principle of non-punishment of trafficked people in national legal systems
- In providing training and guidelines for states on the legal issues surrounding human trafficking

This resulted in changes to laws and policies on human trafficking. He also devised and contributed to training programmes on human trafficking for public servants, NGOs, and international organisations. Combined, these represent a sustained and significant impact on policy and practice.



THE RESEARCH

Piotrowicz's research focuses on the legal regulation of trafficking of human beings. This research clarifies the rights of people who have been, or are at risk of being, trafficked to legal protection, and the obligations of States to provide such protection. It also explains the duty of States not to punish those who have been trafficked for crimes they have been forced to commit.

“ [Piotrowicz's]...contribution and continued commitment in this field (modern slavery and human trafficking) has been hugely valuable. ”

UK HOME OFFICE'S DEPUTY DIRECTOR OF MODERN SLAVERY. FEBRUARY 2021



THE IMPACT

MONITORING STATES' COMPLIANCE WITH THEIR OBLIGATIONS UNDER THE COUNCIL OF EUROPE ANTI-TRAFFICKING CONVENTION

Piotrowicz helped to shape the agenda and decide priorities for the Council of Europe's Group of Experts on Action against Trafficking in Human Beings (GRETA). International guidelines and European policy informed by Piotrowicz's research are extensively referred to in GRETA country monitoring reports.

INFORMING STATE POLICY

Piotrowicz's country-monitoring work has directly impacted on States' anti-trafficking laws and policies. As a member of GRETA, Piotrowicz made eleven country monitoring visits from 2013 to 2020. The recommendations adopted after these visits have resulted in these countries amending their anti-trafficking laws and policies.

EMBEDDING THE PRINCIPLE OF NON-PUNISHMENT OF TRAFFICKED PEOPLE IN NATIONAL LEGAL SYSTEMS

Piotrowicz's report for the Special Coordinator for Anti-Trafficking of the OSCE on the non-punishment of victims of trafficking for offences they have been forced to commit was cited in guidance for States published by the UN, in policy statements by the UN Special Rapporteur on Trafficking in Human Beings, by the UK government, and by the UN Inter-Agency Coordination Group against Trafficking in Persons (ICAT). All GRETA country reports since 2015 also refer to the OSCE policy of non-punishment of trafficked persons as guidance for States.

PROVIDING TRAINING AND GUIDELINES FOR STATES ON THE LEGAL ISSUES SURROUNDING HUMAN TRAFFICKING

The UNHCR guidelines on entitlement of trafficked people to refugee status, informed by Piotrowicz's research, were cited by the UK government, and by the UN Inter-Agency Coordination Group against Trafficking in Persons (ICAT). They have also been used in UNHCR training packages on human trafficking. Piotrowicz also devised training programmes in human trafficking and migration law across Europe organised by numerous international organisations.

Case Study | Image Credit: Protection metaphor "Like a shady tree for those in trouble" by workshop participant, Kachin state, Myanmar, 2017

Research Theme: Society

Enhancing Civilian Protection Practices in Myanmar

RESEARCHER

Professor Berit Bliesemann de Guevara

THE OVERVIEW

A major challenge of international humanitarian and peacebuilding assistance has been how to develop programmes which are both context-sensitive and needs-based. In Myanmar, even before the recent military coup of February 2021, this was particularly evident. A lack of access, trust and the marginalisation of local voices in conflict zones made knowledge of local contexts and needs difficult to determine. Through collaborative research, Professor Berit Bliesemann de Guevara developed an adaptable, easily applicable drawing method, *DrawingOut*, and explored how it can help capture the everyday effects of violence on communities and better understand context-specific protection needs. Project partner Nonviolent Peaceforce (NP) adopted the new method with positive effects on their interactions with protection partners and beneficiaries.



THE RESEARCH

In Myanmar, 8.3 million people live amidst violent conflict and displacement. Knowledge about these communities' conflict experiences is essential to the needs-based programming of humanitarian international non-governmental organisations (INGOs) offering unarmed protection. Even during Myanmar's democratic period between 2011 and 2021, gaining this knowledge was difficult due to the Burmese authorities' access restrictions, low levels of trust after decades of military dictatorship and war, and entrenched power dynamics in local communities which can lead to the marginalisation of some local voices. This situation has only been exacerbated by the military coup of 1 February 2021.

In "Raising Silent Voices", a project funded by the Arts and Humanities Research Council (AHRC), Professor Bliesemann de Guevara and colleagues explored how local knowledge of conflict-affected communities in Myanmar can be accessed by INGOs to promote unarmed civilian protection.

Working in consultation with the INGO Nonviolent Peaceforce (NP), the research team adapted the metaphor-centred drawing method *DrawingOut* to enable users to better capture community experiences in an open and socio-culturally meaningful way.

THE IMPACT

Adopting the method designed through Professor Bliesemann de Guevara's research enabled NP Myanmar to address problems of limited physical, linguistic and cultural access to beneficiary communities in an effective manner by:

ENHANCING NP'S CONFLICT UNDERSTANDING AND PROGRAMMING PRACTICE

Implementing the *DrawingOut* method enhanced the INGO's knowledge about the violent conflicts in Myanmar by unearthing deeper, more authentic, and more sensitive information more quickly.

STRENGTHENING LOCAL OWNERSHIP OF PROTECTION PRACTICE

Adopting the *DrawingOut* method strengthened local ownership of the peace process, improved inclusion and equality, and levelled power differentials in NP engagements with and among partners. The method enabled diverse participants to set the agenda in engagements with NP and each other, which amplified marginalised voices and levelled power differentials.

ENHANCING TRUST AND COLLABORATION BETWEEN DIVERSE LOCAL PARTNERS

The method enhanced trust and communication between NP's partners, which enabled new local collaborations for protection and peace. NP Myanmar used *DrawingOut* in training and workshops with partners from geographically and ethnically different, and often antagonistic, states and regions. This improved communication and inclusion and offered an opportunity for people to communicate, reflect and discuss difficult questions.

ENHANCING RELATIONSHIPS FOR THE FUTURE

NP's adoption of the method benefitted members of conflict-affected communities by improving NP's work with eight partner organizations and approximately 170 multipliers among protection and peace workers, civil society organizations and beneficiaries.

While the military coup of 2021 put a halt to both the democratic transition and the peace processes in the country, the relationships enhanced through the method are hoped to continue during this new time of civil resistance and remote protective accompanying of civilian actors in Myanmar.

As the NP Myanmar Country Director observed in 2020 about the future protection and peace work of their Burmese partners:

“Once there's empathy and understanding, it actually becomes the foundation of how people respond in the future. The changes may be very small, but they incrementally make a big difference.”

NP MYANMAR COUNTRY DIRECTOR



Kachin workshop participant printing leaves to reflect on the question "What makes my community peaceful?"
Credit: Raising Silent Voices - Myanmar research team, 2018.

The Kindertransport: History Informing the Future



RESEARCHER

Dr Andrea Hammel

THE OVERVIEW

The historical event of the Kindertransport 1938 - 1939 to the UK has received increasing public attention over the years. Dr Andrea Hammel's research corrects the myths that surround the Kindertransport, and the simplistic celebratory narratives that are often used by politicians and in the media. Providing a historically accurate account of the complexity of the Kindertransport by exploring under-researched areas, such as the diverse traumas the child refugees experienced and the ways these were mitigated, allows the public to gain a better understanding of historic child refugees and, in turn, allows for informed connections with the situation of present-day child refugees in the UK. It also enables policy makers to learn and encourage strategies and infrastructure for resilience.



THE RESEARCH

When the plight of an increasing number of people seeking refuge in Europe came to public attention in the UK in 2015, the Kindertransport was often cited as a shining example of the UK's past humanitarian attitude towards those fleeing persecution. Dr Hammel's research challenges this view. In her work she discusses the trauma the Kindertransportees suffered and critiques the overly celebratory narratives of the past. More specifically, she explores:

- How the Kindertransport was only partially supported by the British Government; most financial and practical support was provided by private individuals and charities.
- How it was not solely an English phenomenon. Kindertransportees also settled in Scotland, Wales and Northern Ireland and this influenced their sense of identity and belonging.
- How the paucity of research on the children's birth families has contributed to distorting views of the Kindertransport.
- How pre- and post-migration persecution, separation from parents and other family members, ill-prepared fostering placements, discrimination (and in some cases abuse), had a negative effect on the child refugees' mental and physical health. Adapting, coping and resilience were fostered by encouraging relationships with other refugees, a sense of belonging and purpose in the UK, and enabling the child refugees to make connections and communicate about their lives pre- and post-migration.

Providing a historically accurate account of the complexity of the Kindertransport by exploring under-researched areas, such as the diverse traumas the child refugees experienced and the ways these were mitigated, allows the public to gain a better understanding of historic child refugees and, in turn, allows for informed connections with the situation of present-day child refugees in the UK.

THE IMPACT

INFORMING PUBLIC UNDERSTANDING

By organising public talks and contributing to exhibitions, Dr Hammel has enhanced public understanding on aspects of Kindertransport history previously overlooked. She acted as lead academic advisor to a touring open-air exhibition, which started in Berlin in August 2019 and continued on to Rotenburg and Guldental, and also to a similar exhibition in London. Feedback from the events evidence the exhibition's impact on the public's understanding of the history of the Kindertransport.

Dr Hammel was also invited to speak at an Imperial War Museum (IWM) *After Hours* event with Lord Alf Dubs, Sir Erich Reich and Barbara Winton in London. The event focused on previously neglected narratives of the Kindertransport, and in particular on the history of the parents. The recording of the event continues to be viewed on the IWM website.

STIMULATING AND INFORMING POLICY DEBATE

The significance and reach of Dr Hammel's research is also demonstrated by her engagement with key policy debates, and in providing civil servants and NGO representatives with the historical context to contemporary challenges.

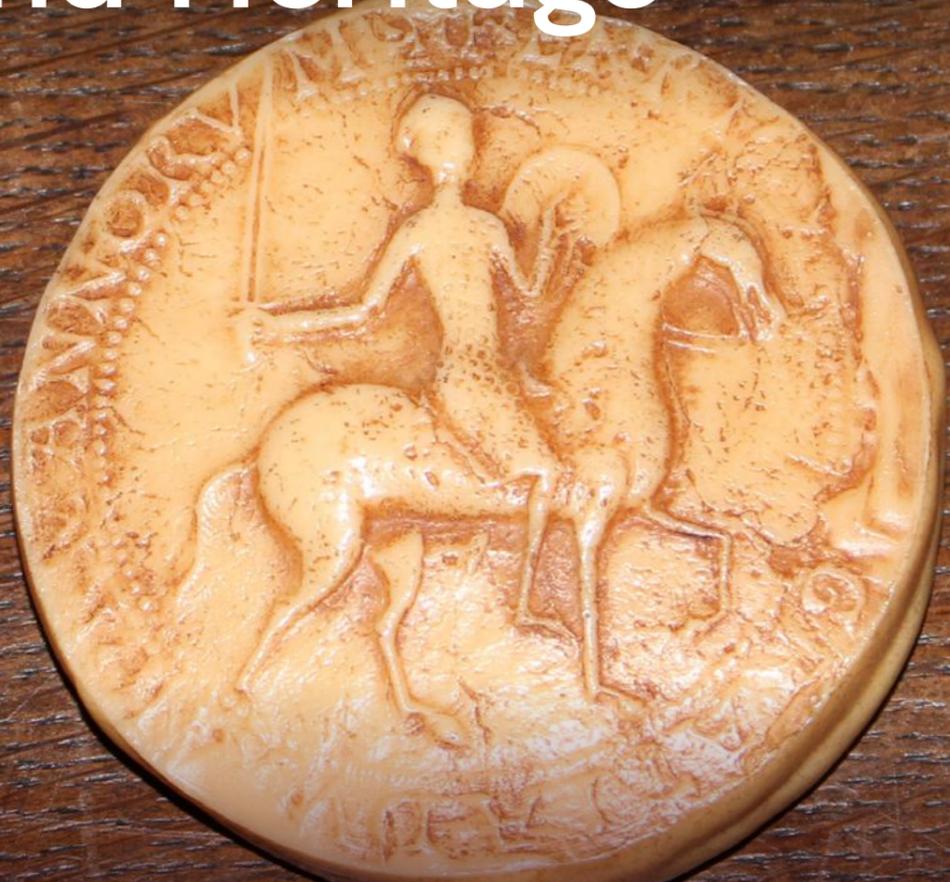
Funded by the ACE Support Hub at Public Health Wales (PHW), Dr Hammel published a report on Adverse Childhood Experiences (ACEs) and child refugees in the 1930s. The report examined the lessons of the 1930s for child refugee policy today and was launched during Refugee Week 2020 to a virtual audience consisting of health policy advisors, civil servants, Directors of Social Services and representatives of NGOs. It was described as an important example of how historical research can inform policy and practice. In June 2020, the report was presented to the Welsh Government Ministerial Task Force on Asylum Seekers and Refugees.

Dr Hammel also organised a key roundtable event on community sponsorship in Wales with the Home Office Wales Team in December 2017. The workshop was the first of its kind on the subject.



Case Study

Medieval History Informing Science and Heritage



RESEARCHER

Dr Elizabeth New

THE OVERVIEW

The *Imprint* project used innovative scientific techniques and historical research to bring the past alive in new ways, and to contribute to key developments in forensic investigation. Funded by the Arts and Humanities Research Council (AHRC), the project led to new discoveries about the practice of sealing and its implications for ideas of personal identity.

By informing practices in archives and conservation, it expanded heritage preservation and interpretation. This pioneering analysis of medieval finger and handprints has also contributed to the development of cutting-edge forensic equipment and furthered forensic science practice.



THE RESEARCH

Impressions of seal matrices in disks of wax, deliberately preserved with their parent documents as part of the legal process of authentication, survive in great numbers in British archives.

Since, by the thirteenth century, institutions and individuals across society owned and used seals, their motifs and text provide invaluable evidence about identity and representation. The back of the wax on which such seal impressions are found often retains handprints (finger, thumb or palm) but these have previously been neglected as a source of information. *Imprint* (www.imprintseals.org) analysed 1000 images of such prints and discovered that assumptions made about the links between seals and the identities of matrix owners - that an individual needed to impress their own matrix into the wax which they also held - were only part of the picture. Instead a third party sometimes held the wax into which they or the seal owner impressed the matrix. This also suggests that the authentication and the performance of the exchange itself was becoming separated in terms of sealing.

Prior to *Imprint*, there was no way to investigate handprint evidence on wax seals. The need for combining specialist forensic, historical and palaeographical skills made them a closed book not just to the general public, but even to specialists.

To remedy this situation, the project produced a database of approximately 1500 seals, including high quality images of the handprints on the wax made with cutting-edge forensic equipment and colour photographs of both the matrix impressions and the documents. These are all connected through a relational database which provides detailed information about the wording and motifs on the seals, and the nature and quality of the handprints. It also links impressions of the same matrix and of the same handprints, drawing on forensic techniques. Research which was once impossible can now be completed in a matter of minutes. Unlocking the information in this pioneering way has democratised the use of seals in all their elements for everyone interested in medieval history.



THE IMPACT

INFLUENCING THE DEVELOPMENT OF FORENSIC EQUIPMENT AND PRACTICE

As a result of the research, the forensic partners on the *Imprint* project, Forensic Focus, discovered new information about the way in which prints survive, and can be identified, upon wax mixed with different chemical components.

Imprint's use of the multispectral Crime-lite Imager (CLI) - designed for crime-scene analysis - in unusual circumstances also allowed the equipment's creators, Foster & Freeman Ltd, to discover more about the way the equipment worked in different environments and make significant improvements to both the hardware and software of the CLI.

EXPANDING HERITAGE PRESERVATION AND INTERPRETATION

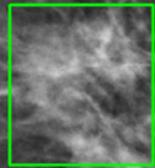
Imprint worked with its partner heritage institutions to expand professional knowledge of their collections. The project ran a series of knowledge-transfer and training workshops for heritage professionals (some of which were open to the general public). Feedback from the events evidence *Imprint's* impact on professional practice and ways of working with medieval seals.

Work with Exeter and Hereford Cathedrals also led to impact on heritage preservation. During *Imprint* the CLI was used to uncover new information about significant cultural items including the Exeter Book (which has UNESCO Memory of the World status), the Exon Domesday (one of the most informative surviving documents of the Domesday Inquest), and the Hereford Gospels (the oldest surviving manuscript produced in Wales), enabling a recalibration of key archival material and otherwise obscured text to be revealed.

Imprint also worked with The National Archives (TNA) at Kew informing their practices relating to their wax seal collections, which has also greatly expanded heritage conservation.



Medical Image Analysis: Improving Patient Outcomes



RESEARCHERS

Professor Reyer Zwigelaar
Dr Chuan Lu
Dr Yonghuai Liu

THE OVERVIEW

Medical image processing allows for in-depth, but non-invasive exploration of internal anatomy. It has become one of the key tools leveraged for medical advancement in recent years. Research on medical image analysis within the Vision Graphics & Visualisation (VGV) research group at Aberystwyth University (AU) has led to a wide range of developments in healthcare informatics.



THE RESEARCH

Research conducted by the VGV research group has led to a significant number of healthcare developments, particularly around commercial orthopaedics' segmentation software, the International Deep Endometriosis Standard, Multiple Sclerosis (MS)/stroke segmentation and stroke rehabilitation, and retinal disease treatment. It has improved patient outcomes, from individual cases through to a group of hospitals. It has resulted in changing practices with newly introduced international standards in the relevant healthcare sector, and has benefitted the commercial sector with improved tools that in turn enhance patient outcomes.

THE IMPACT

IMPACT ON MS/STROKE IMAGE ANALYSIS AND STROKE REHABILITATION

MRI/PET data has predominantly been used for breast/prostate research. The VGV research group extended the data use into the area of brain segmentation, with an emphasis on Multiple Sclerosis (MS) lesions. Concurrently, the group collaborated with the University of Girona, as a main contributor to two significant MS lesion-driven projects. These projects led to new pre-processing techniques, established by the VGV research group, and directly contributed to the creation of Tensormedical, a medical company who provides lesion analysis in clinical environments. This not only helps clinical experts but also contributes directly to patient well-being. In recognition of this research, the VGV research group has received significant grants to extend it to dealing with the rehabilitation problems of stroke patients from NHS Wales and Health and Care Research Wales.

IMPACT ON THE INTERNATIONAL DEEP ENDOMETRIOSIS STANDARD

The International Deep Endometriosis Analysis (IDEA) group statement is the first international consensus on nomenclature and measurements in endometriosis imaging. Methodologies developed by the VGV research group have been included as sonographic steps for endometriosis diagnosis, published as a consensus opinion by the International Deep Endometriosis Analysis Consensus Group, significantly impacting clinical practice in endometriosis. Methodologies include a preoperative Ultrasound-Based Endometriosis Staging System (UBESS), developed to predict the level of complexity of laparoscopic surgery for endometriosis, and the development and evaluation of Transvaginal Sonography (TVS) techniques for diagnosis and management of endometriosis.

The research has also provided underlying evidence for the National Institute for Health and Care Excellence (NICE) guideline on the standard of using ultrasound imaging as cost-effective tools for endometriosis.

IMPACT ON THE COMMERCIAL SECTOR

Research on segmentation techniques in medical image analysis has been used extensively in the development of computer-aided diagnosis (CAD) techniques. Over the years this has had a strong emphasis on mammographic and prostate-based applications, where the segmentation techniques formed the essential pre-processing step before further analysis/classification and clinical recommendation might be possible. Such pre-processing steps enable the establishment of novel mechanisms that can exploit texture and intensity topology natures of image data. This research has resulted in, and subsequently benefitted from, extensive academic collaboration with international research groups including the University of Girona, University of Pennsylvania and Manchester Metropolitan University. The main impact in this area has been the translation of mammographic image analysis techniques to a range of applications in the commercial sector. Typical examples for this are the orthopaedic segmentation tools developed at Synopsys, a major software company, and the CT Liver analysis software developed at Toshiba Medical Systems, which are being extensively used in the clinical domain. These commercial tools significantly contribute to clinical reporting and improving patient outcomes.

IMPACT ON RETINAL DISEASE TREATMENT

The original retinal work is based on Retinex research developed within the VGV research group. Through exploiting novel 2-D / 3-D symmetric filters, the process of detecting vascular and other structures is automated, improving understanding of the mechanism, diagnosis, and treatment of many vascular pathologies. This research has been conducted in close collaboration with a group of clinical end-users tackling a range of retinal specific clinical challenges, which include lesion and vascular segmentation/classification. The work on retinal images is directly based on an earlier investigation into linear structures in medical images. The incorporation of automated segmentation for the tortuosity of corneal nerve fibres has provided a consistent approach to the assessment of dry eye disease and diabetic neuropathy. At the same time, it has significantly accelerated the processing time of the staging of patients, increasing the volume of patients being treated by 10%. This has meant that for a single hospital (Peking University Third Hospital) 200 more patients can be assessed and treated each year, with similar effects in the Royal Liverpool University Hospital. This also led to a recent collaboration with Hywel Dda University Health Board where retinal scans can be linked to neurological and mental health diseases.

In recognition of their research, the VGV research group has received significant grants to support the rehabilitation problems of stroke patients from NHS Wales and Health and Care Research Wales.

Supporting the Psychosocial Needs of Palliative Care and Cancer Patients through the Use of Telehealth

RESEARCHERS

Dr Rachel Rahman
Dr Joseph Keenan
Dr Martine Robson

THE OVERVIEW

Aberystwyth University's Centre for Excellence in Rural Health Research (CERHR) informed the development of a new telehealth service from 2014 which delivers support to palliative care patients in Mid-West Wales. This is significant for the region as it supports the Health Board's response to the recommendations set out in the Mid Wales Healthcare Study (Longley et al., 2014). Impact is evidenced by changes to the Health Board's palliative care strategy ensuring the ongoing delivery of telehealth services; personal testimonials from patients demonstrating improvement in wellbeing and daily functioning; and evidence of improving efficiency and access to services for staff and patients.



THE RESEARCH

Aberystwyth University's CERHR, led by Dr Rachel Rahman, has examined the use of telemedicine to improve rural access to health services. Collaborating with Hywel Dda University Health Board's Palliative Care Team, a telehealth psychosocial support service for rural palliative care patients was established. Prior to the Covid-19 pandemic, telehealth was not part of routine service provision, and this was one of the first UK services to provide home based support for palliative care patients in this way.

“Patients have fed back to us that they have felt empowered by not having to make the journey but be able to have that support and service from the comfort of their own home.”

**GUDRUN JONES, ART THERAPIST,
HYWEL DDA UNIVERSITY HEALTH BOARD**

THE IMPACT

SHAPING POLICY, STRATEGY AND THE IMPLEMENTATION OF TELEHEALTH FOR PALLIATIVE CARE

AU research influenced, and led to the inclusion of telehealth into the Health Board's palliative care service. A proposal, presented by the Health Board's Telemedicine Manager, was supported by Hywel Dda's palliative care strategy group, who agreed to include telehealth as part of the Health Board's strategy for service delivery.

IMPROVING PATIENTS' ACCESS TO PSYCHOSOCIAL SUPPORT AND SUPPORTING ACCESS TO CARE CLOSER TO HOME

The telehealth service provided vital psychosocial support for palliative care and cancer patients. The service subsequently enabled convenient access to multidisciplinary staff, including consultant led services, nursing, and occupational therapy. Patients reported how the service improved their ability to manage their daily lives, adapt to a terminal diagnosis, and minimised the need to miss appointments.

BENEFITTING THE WORKING PRACTICES OF HEALTHCARE STAFF

Health board staff who used the telehealth service saved travel-time which increased the efficiency of their clinical work. The service also improved staff access to patients, who were otherwise hard to reach either because of geography or psychological barriers.

“Health board staff who used the telehealth service saved travel-time which increased the efficiency of their clinical work. The service also improved staff access to patients, who were otherwise hard to reach either because of geography or psychological barriers.”

**GUDRUN JONES, ART THERAPIST,
HYWEL DDA UNIVERSITY HEALTH BOARD**

Research Hubs & Centres

Research

RESEARCH HUBS

The University has three main Research Hubs which connect researchers and practitioners from multiple disciplines who share a common goal. The aim of the Hubs is to provide a focus for increased knowledge exchange between academics from different subject areas, foster collaboration on complex contemporary challenges facing societies and stimulate scientific innovation.

1. RURAL FUTURES HUB

wp-research.aber.ac.uk/rural-futures-hub

The Rural Futures Research Hub brings together diverse expertise across natural sciences, social sciences and humanities to address future challenges facing rural areas in Wales, the UK and globally. The Hub aims to set new agendas for rural research, contributing to the social, economic, environmental and cultural wellbeing of rural communities and landscapes. Inspired by its setting in the rural environment of Mid Wales, the Hub will contribute to understanding local and broader countryside issues. Bringing together academics, policy makers, industrial and community partners and utilising the excellent research resources of Aberystwyth University to work towards addressing a number of Global Grand Challenges, as represented through the UN Sustainable Development Goals and will focus on 5 key rural themes including: Community, Connectivity, Environment, Health and Wellbeing and Rural Enterprise.

2. THE WORLDS WE WANT HUB

theworldswewant.net

Based within the Faculty of Arts and Social Sciences, The Worlds We Want Research Hub provides administrative and outreach support for researchers and research centres focussing on Creativity, Community, Materiality and Mobility. It helps celebrate the achievements of research in humanities, arts, and social sciences at Aberystwyth in collaboration with all disciplines. It seeks to support connections and collaboration between the Faculty and the wider community beyond the University and helps individual researchers and research teams in delivering funded research projects. The Hub's support for the Faculty's existing research centres includes assisting with outreach, marketing, knowledge exchange and with key post-award grant support. It offers a focus to researchers who are assessing the crises that impact our society, culture and environment, both locally and globally. It provides a platform for research which displays a desire to rearticulate new visions of what matters and how best to engage with planetary realities and relationships - human and non-human.

3. OUR AI ENABLED WORLD HUB

Artificial Intelligence (AI) touches every level of society with almost half of humanity now using internet technologies. Advancements in AI range from robotics and machine learning, health prognosis, drug discovery, and future foods while applications range from leadership and decision-making algorithms, through to advances in arts practice. Our AI Enabled World Research Hub brings together researchers and practitioners from multiple disciplines to set new agendas for the advancement of AI and research involving the use of AI. Supported by the University's excellent research resources, the group is developing collaborations with academic partners, policy-makers, agencies, industry, and communities, and building on existing networks and connections locally, nationally and internationally.

INTERDISCIPLINARY RESEARCH CENTRES

The University also has a range of Research Centres which focus on specific areas of study, with researchers often working together in interdisciplinary groups. The list below highlights the scope and breadth of work undertaken by these centres but is not exhaustive. For further information about the University's research, see aber.ac.uk/research.

- Aberystwyth Behavioural Insights
- Aberystwyth Centre for Media History
- Barrett Centre for Helminth Control
- Centre for Creative Wellbeing
- Centre for Excellence in Rural Health Research
- Centre for Responsible Societies (CRiSiS)
- Centre for Material Thinking
- Centre for the Movement of People
- Centre for Transport and Mobility (CeTRAM)
- Centre for Welsh Politics and Society

THE DIALOGUE CENTRE

November 2022 saw the launch of the first in a programme of events and activities to be held under the banner of Aberystwyth University's newly-established Dialogue Centre. Led by Dr Jen Wolowic, the Dialogue Centre coordinates, supports and promotes the University's Knowledge Exchange (KE) activities by:

- strengthening engagement between the University and external businesses, decision-makers and communities.
- using innovative research and multiway conversations processes to explore solutions to local and global problems
- offering training and skills development which meet the needs of local communities and businesses

“The Dialogue Centre embraces the fact that research exists as part of larger community, economic, and political systems. We support and create opportunities that bring these systems together for positive impact.”

DR JEN WOLOWIC, PRINCIPAL LEAD, DIALOGUE CENTRE

To get involved or to find out more about events and activities organised by the Dialogue Centre, please email dialogue@aber.ac.uk or visit aber.ac.uk/dialogue.



FORMER ARCHBISHOP OF CANTERBURY, PROFESSOR ROWAN WILLIAMS, AND AWARD-WINNING POET AND PROFESSOR OF WELSH & CELTIC STUDIES, MERERID HOPWOOD, IN CONVERSATION AT THE DIALOGUE CENTRE'S LAUNCH EVENT IN NOVEMBER 2022.

The Department of Research, Business & Innovation

Innovation

Helen Jones

Director, Department of Research, Business & Innovation

Researchers at Aberystwyth have been making new discoveries and sharing knowledge for 150 years. Their work has made a difference to the lives of people in Wales and beyond. Varieties of grass bred here have led to improved crops for farms while bringing environmental benefits too; our computer scientists are exploring the use of deep learning algorithms to help improve the early detection of prostate cancer, breast cancer and diabetes; our social scientists are at the forefront of work to safeguard the elderly from domestic violence and abuse.

Taking our research outside the lab and applying our findings to real-world problems are core to our mission as a university. As Director of Research, Business & Innovation (RBI), it is my role to nurture and facilitate this important flow of expertise and knowledge exchange between our researchers and external communities, ensuring appropriate systems and professional support are in place to promote innovation and develop partnerships.

Based on the Aberystwyth Science Park, RBI's Knowledge Exchange and Enterprise Hub provides a gateway to the University for external organisations interested in collaborating with our researchers or using our facilities. We offer practical help and expert advice to the University's researchers and academics on Intellectual Property (IP) and collaborative research contracts. We also support researchers setting up start-up or spin-out companies based on University IP. Examples of recent spin-outs include ARCITEKBio which produces natural, sustainable sweeteners from waste streams, and PhytoQuest which develops quality-controlled cosmetic, food and animal health ingredients.

As a professional support service, our aim is to provide guidance to research staff and equip them with the tools they need to help find funding, develop applications, cost proposals, manage grant awards and advance collaboration with academic partners, business and industry. We also monitor and record research impact and offer professional development opportunities, including workshops and sandpit events for developing inter-disciplinary projects.

If you're interested in discovering more about how you can work with us to harness the power of research and bring about positive change, please visit our website or email us at drbi@aber.ac.uk. We look forward to hearing from you.

www.aber.ac.uk/rbi



The Fractal Clock is the work of Richard Downing, from the Department of Theatre, Film and Television Studies. Over the course of 60 minutes, a total of 81 rotating triangles of glass make a delicate journey of shifting patterns towards a moment of resolution, offering a mesmerising re-encounter with time, space, place and perspective.

Making a difference to everyday lives

Impact Report
Making a difference to everyday lives

Prepared by:

Department of Research, Business & Innovation
Aberystwyth University
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