Annual Report
2021

EPSRC Centre for Enhancing Human Interactions and Collaborations with Data and Intelligence Driven Systems (EPIC)

Swansea University
Prifysgol Abertawe

Computational Foundry
Ffowndri **Gyfrifiadol**

UKRI
Engineering and Physical Sciences Research Council

Introduction

What a strange year! For much of our second year as a community, many of our members have been unable to meet in person (for obvious reasons), with the majority of our training and research activities being carried out in Zoom exile. Some of the activities we - pre-pandemic - took as essential for a nurturing Doctoral programme, such as travel to conferences or other research labs, have simply not been possible. On the other hand, opportunities such as our diverse and rich International Seminar Series might not have been possible without the motivation and camaraderie the pandemic fostered.

Despite the constraints, the sense of togetherness and purpose has, if anything, increased significantly this year - the now two cohorts have supported each other over zoom, discord and WhatsApp to supplement in-person gatherings that were possible. It has been a joy to see this happen and my thanks go to all in our community - the Faculty, Professional Service staff, Stakeholders and Advisory Boards - for the extra work put in to mentor, train and encourage.

This second year saw the intake of a new cohort of talented colleagues with diverse experiences and disciplinary perspectives. Meanwhile our first cohort began their in-depth PhD work having successfully completed the preparatory Masters year. Already that work is showing both strong intellectual and impact promise and more details are given later in the report.

We were delighted too to welcome the members of the Community Accountability in the Research Environment (CARE) panel. We selected this group after an open call to our local region and they have helped to steer and shape our first "side projects" carried out by Cohort 1,

projects that aimed at having direct benefit to society, enriching our cohort's understanding of people and place.

So, what a strange year. In experiencing an event (if that's the right word) that has impacted the entire world, we have all seen profoundly how important the things that make us human are: physicality, connectedness, relationship, kindness, vulnerability and hope. We have also seen, of course, a range of stark inequalities that have surfaced as the pandemic progressed.

As we enter this third year, our commitment as Centre, as a movement for good, is to double down on our people first ethos: driving our discoveries, innovations and inventions with the singular desire to develop AI approaches that celebrate and amplify the most important of all technologies - we, the people - in all of the glorious diversity it represents.

After a year of much darkness, then, we look forward to a year focused on bringing hope, helping to build a more productive, safer, sustainable, healthy and joyful world.

Matt Jones

Director, EPIC

November 2021

Home of the Centre

The EPIC Centre is based on the Bay Campus in the Computational Foundry building. This £32.5million world class facility, opened in October 2018, offers bespoke laboratories for each specialism of computational research (maker lab, theory lab, security lab, user experience lab, biometrics and vision lab, visualisation lab, IoT lab), and quality teaching and training spaces. The EPIC Centre has a dedicated (271m2) of space for the Cohort including collaboration and interaction spaces, as well as an allocated desk and storage space for each member of the Cohort.

The EPIC Centre also had its own dedicated formal meeting space (36m2); however, following consultation with our students, it was decided that this space would be better used as a social breakout space. The students are still able to access formal meeting spaces throughout the Foundry when required.

A number of actions have been undertaken in the Computational Foundry building to make it as Covid secure as possible (e.g. one-way systems implemented, room capacities calculated and seating reconfigured to ensure compliance with social distancing). Due to the capacity of our dedicated space, we were able to accommodate all of Cohort 1 and Cohort 2 in the space during the pandemic, without the need to introduce a rota system. The space has been used continuously throughout the pandemic, although some of our Cohort did continue to choose to work from home.

From a physical perspective, the space has proved an enormous success in building and strengthening our people-first movement, not only because the Cohorts are located together, but because the space facilitates impromptu conversations, which has already generated innovative research ideas and solutions. The space also provides a unique training experience for our Cohorts.

The Team

There have been no major changes to the management and leadership of our Centre. Matt Jones (PI) continues to be the EPIC Centre Director and Co-I Markus Roggenbach (Deputy Director) continues to lead the theoretical computer science elements of the Centre and deputises for the Director as needed.

Prof Jeff Giansiracusa, one of our Co-Is at the Centre has joined Durham University. Jeff will still remain connected as an adjunct to our Centre, linking us into Durham University and the wider region. Jeff's duties have been reassigned within the team.

All other Co-Is have dedicated 5% of their time to the EPIC Centre, and have provided extensive experience to support its delivery. Since the inception of the EPIC Centre, the Co-Is have provided the following: ensured that key scientific agendas emerging in their respective fields are reflected in the Centre; assisted the Director in leading the Sandpits; assisted in the recruitment of Cohort 1, Cohort 2 and Cohort 3; and been active advocates for the Centre and liaison points of contact for relevant stakeholders and partners.

Dr Jennifer Pearson
co-Director of the MSc first year programme

Professor Markus Roggenbach
Centre Deputy Director

Professor Matt Jones
Centre Director

Tashi Gyaltsen
Business Engagement Officer

Dr Matt Roach
Strategic Stakeholder Lead

Dr Simon Robinson
co-Director of the MSc first year programme

Dr Sherryl Bellfield
Centre Manager

Making a Difference

There have been numerous success stories and impacts arising from our award in the last 12 months. One of our major success stories relates to the gender balance of our third Cohort, whereby 55% of the offers made were to females. This is a significant improvement in comparison to the offers made during our first year of operation.

Anna Carter's project work with Swansea Council led to the deployment of 'The Lookout' (digital binoculars with a viewing screen, which gives people the opportunity to view interactive visuals that combine current images with how the city will look following its regeneration) in Swansea City Centre. Since its deployment, Anna undertook several interviews with users of 'The Lookout'. Users reported that they wanted to see more technology in the city for children. Anna completed eight online workshops with Technocamps (an outreach programme designed to inspire, motivate and engage people with computational thinking and promote Computer Science as underpinning all aspects of modern society), connecting with over 200 children. They each created a sketch of technology they hope to see within the future of Swansea City Centre. These outputs are currently being analysed, with the aim that some of these ideas will eventually be realised.

As part of their studies, Cohort 1 worked in teams to undertake a 20% project. One of the teams investigated how mental health charities have been affected by the Covid-19 pandemic and in particular, how they have been able to deal with the uptake of digital systems as the majority of their services prior to the pandemic were in person. The team held workshops with several charities and have written a report and set of recommendations, which are being reviewed by the charities and their supporting stakeholder (Barclays). This project carries great potential to make an impact and we will endeavour to realise these in the coming months and years.

Another success story results from the partnership we have formed with the UK Hydrographic Office (UKHO). UKHO has reported that the Centre has helped to expand their network. They have also stated that the relationship we have formed has challenged those outside of the data science team to learn computer vision and machine learning concepts, which has been valuable. Further, by presenting the work they are doing with the Centre regarding the computer vision projects at various autonomous vessel for navigation forums they have widened the interest in our people-first approach.

Anna Carter, our 3rd year PhD student with the Lookout devices. She will present the case study "Rethinking Public Technology in a COVID-19 Era" in the conference on Human Factors in Computing Systems 2022.

Centre PhD Researcher	Publication Details
Connor Rees	AVERT (Addressing Violent Extremism and Radicalisation to Terrorism) International Research Symposium – Violent Extremism at the Crossroads: Persistence, Change and Dynamism 20 years after 9/11. Islamic State's Exploitation of File-Sharing Sites: Which Platforms and Why? (2021, November 3–5). Symposium, Melbourne, Australia - Conference Presentation
Anna Carter	Alan Dix, Anna. R. L. Carter and Miriam Sturdee. 2021. Where, Who, Why? Tools to Encourage Design In Context. In EduCHI 2021 Workshop, part of CHI 2021; May 15, 2021, Yokohama, Japan. https://educhi2021.hciliving-curriculum.org/wp-content/uploads/2021/04/educhi2021-final90.pdf
Anna Carter	Jennifer Pearson, Gavin Bailey, Simon Robinson, Tom Owen, Chi Zhang, Thomas Reitmaier, Cameron Steer, Anna. R. L. Carter, Matt Jones, Deepak Ranjan Sahoo, Dani Kalarikalayil Raju.l 2022. Can't Touch This: Rethinking Public Technology in a COVID-19 Era. InCHI '22: ACM CHI Conference on Human Factors in Computing Systems,April 30 – May 06 2022, New Orleans USA.ACM, New York, NY, USA. https://doi.org/http://dx.-doi.org/10.1145/3491102.3501980
Anna Carter	Anna. R. L. Carter, Gavin Bailey, Jennifer Pearson, Matt Jones, Simon Robinson, Dani Kalarikalayil Raju, Jonathan Hicks, Spencer Winter. 2022. Designing and Embedding a Tangible Public Interface in the Covid Era. InCHI '22: ACM CHI Conference on Human Factors in Computing Systems Extended Abstracts,April 30 – May 06 2022, New Orleans USA.ACM, New York, NY, USA, 7 pages.https://doi.org/10.1145/3491101.3503556
Anna Carter	Anna. R. L. Carter, Miriam Sturdee, Alan Dix, Dani Kalarikalayil Raju, Martha Aldridge, Eunice Sari, Wendy Mackay, Elizabeth Churchill. 2022. InContext: Futuring User-Experience Design Tools - CHI '22: ACM CHI Conference on Human Factors in Computing Systems Workshops and Symposia,April 30 – May 06 2022, New Orleans USA.ACM, New York, NY, USA https://doi.org/10.1145/3491101.3503739
Anna Carter	Craig MacDonald, Olivier St-Cyr, Colin. M. Gray, Leigh Ellen Potter, Carine Lallemand, Anna Vasilchenko, Jaisie Sin, Anna. R. L. Carter, Caroline Pitt, Eunice Sari, Deepak Ranjan Padhi, Ajit. G. Pillai. 2022. EduCHI 2022: 4thAnnual Symposium on HCI Education. InCHI '22: ACM CHI Conference on Human Factors in Computing Systems Workshops and Symposia,April 30 – May 06 2022, New Orleans USA.ACM, New York, NY, USA, 5 pag-es.https://doi.org/10.1145/3491101.3503703
Jakub Vincalek	It's the journey not the destination: building genetic algorithms practitioners can trust. In Proceedings of the Genetic and Evolutionary Computation Conference Companion (GECCO '21). Association for Computing Machinery, New York, NY, USA, 231–232.

Example Accepted Publications by Centre PhD Researchers

Making a Difference

We have a growing number of external connections with the Centre, which stems from the inherent credibility of the Centre. It is apparent that people do want to get involved with our Centre. Anne Boden, for example, who is the Founder and CEO of Starling Bank and author of the book 'Banking On It: How I Disrupted an Industry', delivered a presentation as part of our International Seminar Series. Starling Bank has since committed to funding a student at our Centre. Another example is Microsoft Re-search, who approached us to develop an iCase PhD proposal due to the reputation of our Centre, the award for which has subsequently been aligned to our Centre.

A further highlight for the Centre is our Community Accountability in the Research Environment (CARE) Panel. We advertised for people interested in helping to shape the work we are doing. We have succeeded in getting an extremely diverse panel of people who are proving to provide excellent challenge in the work we are undertaking.

We are also proud of the calibre of people who have participated in our International Seminar Series. These people and associated titles of their talks include:

Philippe Palanque - 'Ten Objectives and Ten Rules for Designing Automations in Interaction Techniques, User Interfaces and Interactive System'

Marianna Obrist – 'Multisensory Experiences'

Anne Boden - 'Banking on It: How I Disrupted an Industry'

Scott Jenson – 'Innovative Thinking'

Kristina Höök – 'Soma Design- Intertwining Aesthetics, Ethics and Movement'

Albrecht Schmidt – 'Interactive Human Center AI – A Definition and Research Challenges'

Jessica Cauchard – 'Towards Natural Human-Drone Interaction'.

Making a Difference

Our Cohort 1 Stakeholder Perspectives

Tata Steel

Simon Lewis

Section Manager SIS/TLR, Through Process Quality – Technical

Our project with Connor is at exploratory stage at present but he has been looking at clustering techniques which he will now try out on one of surface inspection defect catalogues. This indicates that the computer vision sees some of our grouped images differently so may help a defect expert to improve classification. We are delighted to sponsor two new PhD projects on the back of this: a follow-up PhD project on cluster analysis and another one which will focus on using Human Computer Interaction approach to train engineers and operators on surface defects.

Facebook

Lella Nouri

Lead Supervisor

Connor's PhD research to date has highlighted the increasing complexities of navigating distinctions between far and extreme right groups online. With a focus on the US alt- right, his research has already shown that the monitoring and tackling of extreme right groups is much harder than groups from other ideologies. The work that Connor will pursue for the empirical part of his thesis will further detail these nuances with the aim of informing both the policy and practice of social media companies.

EMRTS

David Rawlinson

Clinical Informatics & Research Manager -Emergency Medical Retrieval and Transfer Service Cymru (EMRTS Cymru)

PhD Year 1 has been useful to get to know the Foundry and our student and get to grips with some of the research can be used to potentially have an impact on our service delivery as we develop the project over the coming years.

Rivington Hark/Swansea Council

Spencer Winter and Jonathan Hicks

Project Director and Principal Physical Regeneration Manager

The PhD Year 1 process has been the continuation of the journey that began with the creation of the 'Lookout' during Covid.

The 'Lookout' is providing feedback that is now increasing since the return to the city of the public and it is interesting to see how, over time, usage is changing. It is clearly allowing the thought process for the next generation 'Lookout' to be informed from the learnings of this pilot application and we are looking forward to the development of the next piece.

The student is clearly enjoying the interactive process which involves contemporaries from the University and from partner organisations, the teaching staff and the Copr Bay team and has always been prepared and presented the findings and development process as well and is clearly able to articulate the subject matter and take on board input from others.

UKHO

Mark Casey

Head of Research, Design & Innovation, UK Hydrographic Office

We are enjoying the collaborative research projects that allow us to explore bigger questions. As we have just begun the work, there are currently more questions than answers, which in turn reflects the breadth of the work and the potential impact each PhD could have in geospatial machine learning and computer vision techniques.

The partnership with the University has helped expand our network and we have enjoyed meeting and working with the team and students from the University of Swansea.

It has challenged those outside of the data science team to learn computer vision and machine learning concepts which has been valuable. In terms of the two Computer Vision navigation or vessel positioning projects, once they move away from theoretical simulation to real data used on board a vessel, we may see some real significant impacts. Lastly, presenting the work we are doing with the university regarding the computer vision projects at various autonomous vessel or navigation forums has demonstrated that the UKHO is a thought leader in this space and certainly captures people's attention and imagination, so if I could point out anything in terms of impact, then that would be it.

Equality, Diversity and Inclusion

Equality Diversity and Inclusion is at the heart of what our Centre does and aspires to be and we are committed to supporting, developing and promoting equality and diversity in all our practices and procedures. Our aim is to establish an inclusive, supportive and positive culture free from discrimination and based upon the values of dignity, courtesy and respect. We are committed to advancing equality on the grounds of age, disability, sex, sexual orientation, gender reassignment, race, religion or belief, marital status, pregnancy and maternity.

We believe that Equality Diversity and Inclusion needs to be encoded into our future big data and intelligence based systems: the data structures, training algorithms, visualisations and inter-action styles all need to reflect the breadth of perspective and talent in the population and society's aspiration to extend this. Without this, there are likely to be further serious negative consequences with segments of society discriminated against or excluded from active participation by systems.

Our management and governance structure include Equality Diversity and Inclusion monitoring, reporting and assessment. Through the work of our internal Equality Diversity and Inclusion committee we are deploying approaches to:

- Achieve, promote and embed inclusive and diverse participation in all the centre's activities
- Ensure that the students and staff recruited and retained to the Centre are drawn from broad backgrounds and perspectives so that the future UK research and innovation leader talent pool is strengthened
- Increase diversity in Stakeholder engagement
- Develop and grow a sustained programme for wider community engagement

We work with Swansea University and our internal and external stakeholders with the aim to become an exemplar of Equality Diversity and Inclusion best practice.

We are pleased that the diversity of our Centre has increased year on year. This is shown in the tables that follow.

CDT Student Gender	Cohort 1%	Cohort 2%	Cohort 3%
Male	82%	75%	60%
Female	18%	17%	40%
Other	0%	8%	0%

CDT Student Gender	Cohort 2%	Cohort 3%
Asian	8%	10%
Black	8%	10%
Chinese	0%	10%
Mixed	17%	0%
White	67%	70%

**Cohort 1 BAME information not collected

International Advisory Board
Our members

To ensure our Centre is inspiring, successful, challenged and of international relevance, we have set up an Advisory Board with academic members who are experienced in innovative training and who are setting the global computational science agendas.

Ben Shneiderman

Ben Shneiderman is an American computer scientist, a Distinguished University Professor in the University of Maryland Department of Computer Science, which is part of the University of Maryland College of Computer, Mathematical, and Natural Sciences at the University of Maryland, College Park, and the founding director (1983-2000) of the University of Maryland Human-Computer Interaction Lab. He conducted fundamental research in the field of human–computer interaction, developing new ideas, methods, and tools such as the direct manipulation interface, and his eight rules of design. He has received six honorary doctorates, including from Swansea University.

Vint Cerf

At Google, Vint Cerf contributes to global policy development and continued spread of the Internet. Widely known as one of the "Fathers of the Internet," Cerf is the co-designer of the TCP/IP protocols and the architecture of the Internet. He has served in executive positions at the Internet Society, the Internet Corporation for Assigned Names and Numbers, the American Registry for Internet Numbers, MCI, the Corporation for National Research Initiatives and the Defence Advanced Research Projects Agency and on the faculty of Stanford University. Vint Cerf sits on US National Science Board and is a Visiting Scientist at the Jet Propulsion Laboratory.

Vicki Hanson

Vicki Hanson FACM FRSE FBCS, is an American computer scientist noted for her research on human-computer interaction and accessibility and for her leadership in broadening participation in computing. She was named the Chief Executive Officer of the Association for Computing Machinery (ACM) in 2018 having served as its President from 2016 to 2018. Dr Hanson was a Distinguished Professor at the Rochester Institute of Technology within the HCI and Accessibility research groups. She was also Professor and Chair of Inclusive Technologies at the University of Dundee where she led multiple efforts related to inclusion of older adults and individuals with disabilities.

Moshe Vardi

Moshe Vardi is an Israeli mathematician and computer scientist. He is a Professor of Computer Science at Rice University, United States. He is an expert in model checking, constraint satisfaction and database theory, common knowledge (logic), and theoretical computer science. He is the author of over 600 technical papers as well as the editor of several collections.

Elisabeth André

Elisabeth André is a full professor of Computer Science and Founding Chair of Human-Centered Multimedia at Augsburg University in Germany. She has a long track record in multimodal human-machine interaction, embodied conversational agents, social robotics, affective computing, and social signal processing. Drawing on the concept of computer-based role play with virtual characters, she has promoted a novel form of experience-based learning, for example, to help children and young people cope with bullying at school, develop intercultural sensitivity or master socially challenging situations, such as job interviews.

Charles (Chuck) Hansen

Charles (Chuck) Hansen is an IEEE Fellow and a Distinguished Professor of Computing in the School of Computing and a founding member of the Scientific Computing and Imaging Institute at the University of Utah. Chuck Hansen has published over 170 peer reviewed journal and conference papers and has been a co-author on three papers recognized with "Best Paper Awards" at the IEEE Visualization Conference (1998, 2001, 2002). He was twice an Associate Editor in Chief (AEIC) of IEEE Transactions on Visualization and Computer Graphics. His research has made contributions to the fields of scientific visualization, computer graphics, parallel computation and computer vision.

Anirudha Joshi

Anirudha Joshi is professor in the interaction design stream in the IDC School of Design, IIT Bombay, India. Anirudha is involved in designing interactive products for emergent users in developing economies. He has worked in diverse domains including healthcare, literacy, Indian language text input, banking, education, and industrial equipment. He got the IFIP Outstanding Service award in 2015 and the IFIP TC13 Pioneer Award in 2019. He is currently the VP Finance on the ACM SIGCHI Executive Committee, a member of the India HCI Steering Committee, and the chair of the INTERACT Steering Committee.

Jinwoo Kim

Jinwoo Kim received his BS degree in computer science and statistics from Seoul National University in Seoul, South Korea. After receiving his master's degree from Courant Institute of Mathematical Sciences (New York University), he continued his study in the PhD program at the Real Time Compilation and Instruction Level Parallel Processing Lab of NYU as a research scientist. He subsequently became involved with the Center for Research in Embedded Systems and Technology (CREST) at the Georgia Institute of Technology in Atlanta, Georgia where he spent another two and half years conducting research funded by the Department of Defense, Hewlett-Packard and the State of Georgia.

Building up the Community

We have organised cohort training, development and networking activities to build up our community as described in the table that follows, capturing activities from Year 1 and Year 2:

Target/Plans	Progress to Date
Training the Trainers: Forming Event	A day-long forming event was held on the 19th July 2019 to review the aims and approaches of the Centre, provide opportunities for colleagues to gain further insights on the diversity and richness of views on the research challenges and to share supervisory approaches.
Training the Trainers: Master Classes	In February 2020, Alan Dix delivered a two-day statistics masterclass. In November 2020, Scott Jenson from Google delivered a masterclass on Innovative Thinking. Our International Calibration Committee held a masterclass with Cohort 1 and Cohort 2 in February 2021. We are in the process of planning the first of our annual retreats for the Centre (delayed due to the pandemic), where several masterclasses will be given.
Training the Trainers: Early Career Supervisor Training	We have paired experienced supervisors with talented colleagues who have not yet led a PhD student to completion for a number of our Cohort 1 and Cohort 2 PhD projects.
	The initial launch of the Centre was held on 16th September 2019. We updated all academic staff and researchers in the Computational Foundry plus other select invitees from across the University, on the progress we have made to date with the Centre. The Director also explained how those present can contribute and engage with the Centre and its cohort of students, partners and projects.
Building a Movement: Launch of the Centre	On the 21st and 22nd September 2019, we held our first induction weekend, an opportunity for everyone to meet and get to know one another but also learn about the ethos of the Centre and how we plan to build and grow as a Cohort.
Building a Movement: Induction Weekend	Although the content was similar, the delivery of our induction event differed for Cohort 2, due to the pandemic. We thought hard about the purpose of the induction session and decided to deliver this as a hybrid option i.e. a combination of online and in person delivery. The induction for the third Cohort included an overnight stay, with members from both Cohort 1 and Cohort 2 and the core EPIC team present.
Project Co-Creation: Sandpits	We achieved the target of holding three sandpits during our first and second year of operation. These sandpits were held on the 30th October 2019, the 11th December 2019, and the 5th February 2020 for Cohort 1 and the 28th January 2021, the 18th February 2021 and the 11th March 2021 for Cohort 2.
Project Co-Creation: Project Shaping Surgeries	These surgeries have been held monthly during the second semester of Year 1

Building up the Community

Target/Plans	Progress to Date
Recruiting the Cohort: Recruitment Roadshows	As part of the recruitment plan for Cohort 2, we held a recruitment roadshow at St Andrew's University and Edinburgh University, attended by one of our CoIs, Alan Dix, and one of our students from Cohort 1 (Anna Carter). Presentations about the Centre were also delivered by some of our Co-Is to academics and students from other institutions including Lancaster University, York University, Glasgow University and Newcastle University.

Due to the pandemic, we were unable to undertake any recruitment roadshows for Cohort 3. We thought hard about our recruitment campaign for Cohort 3, to minimise any impact this might have. |
Researcher Development: ORBIT Training	On the 17th December 2019, Cohort 1 participated in the ORBIT Foundation's training. On the 7th and 8th July 2021, ORBIT training was delivered to all students in Cohort 2 and offered to all Cohort 1 and Cohort 2 supervisors.
Researcher Development: Yearly Personal Development Review	For the yearly personal development review, we have a structured reporting system where students and supervisors set SMART targets. The Centre has oversight of these records.
Researcher Development: Student Run Monthly Centre Seminar Series	Due to logistical issues, the student run monthly Centre seminar series did not materialise in the way we expected. We plan to review this going forward.
Governance, Management and Operations: Centre Leadership Board	The Centre Leadership Board has met monthly as planned.
Governance, Management and Operations: Stakeholder Strategic Advisory Board	To date, we have held two Stakeholder Strategic Advisory Board meetings. Our third meeting is scheduled for November 2021
Governance, Management and Operations: International Advisory Board	We held our first International Advisory Board meeting in October 2020. Our second board meeting was planned for July 2020, however, it proved impossible to schedule due to the different time zones of our Board members. We have since consulted with Jin Woo, who is based in Japan, and it has been agreed that his physical presence in our meetings is not required. Our next meeting scheduled for November 2021.
Governance, Management and Operations: Responsible Innovation Committee	The Equality, Diversity & Inclusion and Responsible Innovation Committee (EDI&RI), which was established in 2019, has continued to meet regularly, providing on-going guidance and oversight of the Centre. The committee membership was refreshed to consider changing circumstances of its members as well as providing new and diverse perspectives. In the last academic year, the Committee met three times (December 2020, March 2021 and July 2021).

Refining our Approaches

Side projects (20% projects)

We launched side projects with Cohort 1 in October 2020 alongside their main PhD research. Side projects take inspiration from Google where staff were allowed to use 20 percent of their time on other innovative projects that enable personal development and bring new concepts to the company. The Centre asked the cohort to get into groups and think of innovative side projects that have societal impact and where they will learn new techniques to strengthen their PhD thesis. We then provided a few relevant industry superviosr options for their project proposals and organised scoping meetings. The industry supervisor would provide their free time, once every fortnight to guide the project, and the students would spend one day a week on the side projects.

After successfully pairing the project teams with relevant industry experts, the projects were pitched to the CARE panel for feedback in February. All teams were successful in their presentations and were awarded a small budget of up to £2,000 in January 2021. The projects ranged from undertaking a feasibility study with charities on digital payment for Barclays, looking at how smart speakers may have bias towards female voice with the BBC, to outreach activities for school children to get learn about celestial and aero dynamics with the European Space Agency and Technocamps, and developing new machine learning techniques to measure the presence of humpback whales in the ocean with IBM's Mayflower project. The project teams presented their findings to the CARE panel and stakeholders on 22nd September 2021.

CDT Cohort 2 Year 1: Reflections from the Directors

In the second year of the CDT we built upon the successful elements and lessons learned from the first iteration of the MSc programme. For the 2020 intake we made several improvements to the structure and operation of the year (as outlined below) based on student feedback and our own evaluation; and, adjusted events and activities to adapt to the restrictions and impacts around COVID-19.

Starting in 2020 we made the CDT MSc available more widely, recruiting additional students (up to a maximum of the same number enrolled in the CDT cohort) for a one -year version of the programme. This year, five students were accepted. While not formally part of the CDT scheme, these students brought a range of new perspectives (none of the five have Computer Science backgrounds; the majority were international), complementing the skills, experience and interests of the core CDT Cohort of 12. Feedback about this experience has been very positive. We also made progress in diversity: Cohort 2 and the five one-year MSc students are from a mix of genders, ages and backgrounds. Six of the 17-strong group have previously studied Computer Science, but beyond this there are medical backgrounds, engineering, law and industry experience.

While we were not able to run in-person versions of many of the activities originally planned as part of the MSc programme due the restrictions around the pandemic, those that were not able to be replaced with equivalent online versions have been rescheduled now that in-person activities are again possible. For example, in December 2021 we will hold a MSc celebration and PhD planning retreat for Cohort 2 in lieu of their residential induction event that could not go ahead.

We tried hard to support students in setting up contact groups and other ways of bonding as a team, but the experience was clearly affected by the restrictions we were forced to put in place. However, we allowed students to return to campus in person as soon as this was permitted, which has helped them feel more connected both to their own Cohort and to the wider CDT family. We have continued to invite all cohorts to the activities of the others for example, Cohort 1's 20% pitch day in September 2021 and Cohort 2's MSc project presentation day in October 2021). In addition, we are working hard to ensure the physical CDT space is an enjoyable collaborative working environment within the Computational Foundry. As part of this we have recently set up a more informal space for all cohorts to share. This room, which is adjacent to the main desk area, has been equipped with sofas and an air hockey table, and we are currently liaising with the cohorts as to how we can best further adapt the space to suit their needs.

While the majority of Cohort 2's experience has been via Zoom, we are now seeing more in-person activities take place and more students making use of their dedicated spaces and social areas around the building.

Following student feedback and enquiries from potential applicants, we submitted a formal pro- posal at the University level requesting approval to run a part-time version of the programme. In consultation with representatives from the existing cohorts, we have designed this variant in a way that ensures students will feel part of the community even if they are studying part-time (for example, by starting their project earlier than would traditionally be done in a part- time programme). A decision about this new offering will be made by the University in November 2021 after a formal review.

The addition of the part-time option will be an additional sup-port, allowing students to participate on a more flexible basis if their circumstances change.

Following the mixed success of the pre-semester training for cohort 1 students with non-Computer Science backgrounds, for cohort 2 we pointed more directly to programming resources and training, recommending that these students took advantage of introductory programming courses and also complementary training run by the Swansea Academy of Advanced Computing.

Refining our Approaches

Timetabling of taught modules remains complex due to the multidisciplinarity and optionality of the MSc programme. Clashes between modules that are taught in different formats are inevitable. Here, the changes spurred by COVID-19 restrictions had some beneficial effects (e.g., all lectures are recorded and available online; virtual events sometimes meant more attendees could commit). We have also maintained our flexible approach to scheduling, for example by rescheduling activities and core module lectures where needed to avoid clashes.

Cohort 2 raised concerns about the compulsory module "Designing in Trust, Understanding and Negotiation", and exam performance was lower than average. The External Examiner also highlighted this module in their report, which is a concern. We have asked the module coordinator to investigate whether switching to a 100% coursework format would be possible and will review this module regularly in consultation with the newly-started cohort 3.

Following the experience in the first year of the Centre (see year 1 report), the project sandpit events were redesigned and moved to the second semester of the MSc year. This change, coupled with a switch to online-only events due to COVID-19, meant that the sandpits were in our view more successful.

While the videoconferencing format meant that serendipitous meetings with other attendees were less likely, this was more than offset by the increased ability and willingness of stakeholders to attend the event, and the ability of students to systematically visit and discuss project topics with every industry stakeholder during the breakout room portion of the event.

The post-sandpit MSc+PhD project selection process was more successful than in the first year of the Centre, and all students were able to be matched with one of their top choices.

However, with 18 committed stakeholder projects and only ten students, it was inevitable that many stakeholders were unable to be matched, although they were aware of the competitive nature of the process. There is a balance needed between not recruiting too many stakeholders and also allowing plenty of choices and a diverse range of projects to the cohort. The advantage of having surplus stakeholders this year was that we were able to provide one-year MSc student projects to three stakeholders: three of the five students on this scheme were keen to work on projects initiated through CDT stakeholder connections.

In October 2021 we held a project presentation showcase day where each student gave a talk about their work. The standard of these presentations and MSc dissertations was particularly high (the average dissertation mark was 74%). Reviewing these projects and the course as a whole, the external ex-aminer again commended the operation and management of the programme, and the high standard of the work produced.

Stakeholder Engagement Sandpits

Recommendations:

Hold (3) sandpits later in academic year after briefs have matured

- Week one in Feb, Week four in Feb, Week three in March
- Each sandpit contains the different companies I.e.companies need only attend one sand pit but are welcome to come to more if it is helpful.

Sandpits will take place in the morning follow agenda to that of sand pit three last year.

Remove themes and have open topics for sandpits

Remove the knowledge exchange element - make them explicitly about CDT engagement

- More useful for students
- More useful for companies that are serious about sponsorship
- Less useful for warming up companies to the CDT

Project Development

Recommendations:

- Business Engagement Officer (BEO) will give brief updates in Simon's lectures to students (once per month) on business and project ideas emerging. (Note: this will need to be general enough to apply to both CDT PhD and stan dalone MSc students). This session will also allow BEO to listen to students' interest in other stake holders.

- BEO will still bring in stakeholders to have a general chat to the cohort on an ad hoc basis.
- BEO will send open invite emails to Computational Foundry and wider academics when discussions with new partner start so people can volunteer to engage them selves.

  Students only start to co-shape the
- projects at the sandpit when briefs are more matured.

  All stakeholders strongly encour-
- aged to have direct relationship building with BEO

Project Allocation

Recommendations

- Pre-allocation (project created by students – must include identification and securing – with centre's support of sponsorship?)
- No co-development for individu- al students, where academics and stakeholder were the drivers, co-development in sandpit form for all.
- Expectation management - students must understand to keep their options open in terms of topics, supervisors and sponsors as much as possible.

Refining our Approaches

Recruitment

Although it is likely the Covid pandemic had impacted on the number of applicants we re- ceived for Cohort 2, we realised that a more targeted recruitment campaign was needed. Our targeted recruitment campaign included several key actions such as:

- Placing a prominent advertisement in the NewScientist magazine.
- Using Google Ads, the online advertising platform developed by Google.
- Advertising the opportunity in FindAPhD.
- Keeping the Centre's website looking fresh and updated.
- Using the Computational Foundry's Twitter feed to promote the Centre and encouraging our followers to Retweet.
- Promoting the Centre through societies (e.g. Code First Girls) and professional networks (e.g. the Digital Economy Centres).
- Creating discipline tailored adverts for the Centre.
- Promoting our good news stories via our website, social media, Co-Is and Friends of the Foundry.

Recruitment for our third Cohort began in De- cember 2020, with a two-day information and selection event scheduled for April 2021. This year, international students were eligible to join our Centre, albeit with a 30% cap. The changes in eligibility with international students, along with the targeted recruitment campaign, vastly increased the number of applicants we received to join us (89 applications in total).

As part of the recruitment plan for Cohort 2, we held a recruitment roadshow at St Andrew's University and Edinburgh University, attended by one of our CoIs, Alan Dix, and one of our students from Cohort 1 (Anna Carter). Presentations about the Centre were also delivered by some of our Co-Is to academics and students from other institutions including Lancaster University, York University, Glasgow University and Newcastle University.

Due to the pandemic, we were unable to undertake any recruitment roadshows for Cohort 3. We thought hard about our recruitment campaign for Cohort 3, to minimise any impact this might have.

On the 17th December 2019, Cohort 1 participated in the ORBIT Foundations training. On the 7th and 8th July 2021, ORBIT training was delivered to all students in Cohort 2 and offered to all Cohort 1 and Cohort 2 supervisors.

For the yearly personal development review, we have a structured reporting system where students and supervisors set SMART targets. The Centre has oversight of these records.

Due to logistical issues, the student run monthly Centre seminar series did not materialise in the way we expected. We plan to review this going forward.

The Centre Leadership Board has met monthly as planned.

To date, we have held two Stakeholder Strategic Advisory Board meetings. Our third meeting is scheduled for November 2021

It allowed us to attract students from all over the world and bring together individuals from different cultures and backgrounds. Offering positions to international students has also allowed us to increase the diversity in applications, attracting applicants we previously could not offer places to and also allowing us the chance to further grow our multi-disciplined approach within the Centre.

Unlike Cohort 2, the information and selection event for Cohort 3 was a two-day online process. The first day included similar activities to those described above for Cohort 2, as well as a number of group activities. In the evening, all candidates were then invited to an informal chat and quiz. The 30-minute panel interviews, using the same process described above for Cohort 2, then took place on day two of the information and selection event.

As we understood there was a 30% cap administered on international students, during our shortlisting process, we separated the applications into home students and international students to ensure the proportion of candidates interviewed reflected the 70%:30% split.

To ensure parity, the interviews were also separated into home students and international students. All students were, however, asked the same questions and scored in the same way. During the offer phase, we maintained the 70%:30% split.

Following the information and selection days for Cohort 3, 11 offers were made (55% Female, 45% Male). Of these offers, eight were home students and three were international students. Of these offers, 2 were declined so their places were offered to 2 of the reserve candidates, leading to an intake of 10 students in September 2021 (40% Female, 60% Male).

Gender Data	Applications	Shortlisted	Offered	Accepted
Male	64%	52%	45%	60%
Female	35%	45%	55%	40%
Other	1%	3%	0%	0%

Cohort Perspectives

Cohort 2 Student Perspective

Our journey as Cohort 2, started off with at the group interview stage which included presenting academic posters on an area of interest that we had individually worked on previously. Unfortunately, this was via Zoom due to the pandemic. However, it was extremely well organised and ran smoothly, we were all made to feel welcome and got to know each other as best we could. Thankfully, at enrolment, we all got the chance to meet each other face to face, well sort of, socially distanced and masked, but at least it was in person. Regrettably, this was not to last as the country swiftly went back into lockdown and we resorted back to online methods. Nonetheless, we made the best of this situation and soon got to know each other through, WhatsApp, Zoom sessions and other safe methods. We quickly realised that we were an eclectic group with many interests and diverse backgrounds. Many if not all of us became grateful for this. On a personal level, I was certainly grateful for the assistance with learning to code, coming from a Law background. Hitting the ground running while learning a new subject matter personally felt ambitious and at times overwhelming.

But the support from the Centre and fellow colleagues was amazing. There is always someone to chat with and air any grievances or problems and the team's guidance meant no one fell behind. There is also flexibility with module selection too which is excellent. The assortment of modules is widely varied too covering many areas outside of Computer Science, encouraging discoveries and collaborations.

Semester two, introduced us to the time of project selection via sandpit sessions. This gave all of us the opportunity to chat with stakeholders and potential supervisors about our long term goals and ideas moving forward. The selection of projects available were extremely diverse and all of us managed to select projects of interest.

After the PhD project selection process, we ventured into completion of our first After the PhD project selection process, we ventured into completion of our first year with the undertaking of our Master's project. Unfortunately, for some, including myself, this felt a little pressured due to time constraints and in part inconsequential, this could be perhaps down to the way the year had to be structured due to COVID-19, but many of us had previously completed a Master's and had expected to start much earlier in the year to complete, ethics approval and literature reviews. Despite this, though the year has been an incredible adventure.

Lydia Channon

Cohort 1 Student Perspective

Over the past year, members of the first cohort completed their master's theses and began their PhD dissertations. Each member of the cohort is tackling a unique challenge currently being faced in their sponsor's industries. Due to travel restrictions, many of the common activities associated with research have had to be postponed or have had alternatives implemented. This includes conferences, research trips, and visits to stakeholders. Despite this, three members of the cohort managed to visit their stakeholder and present their work in Devon. This allowed them to engage with other employees at their sponsor company while gaining a better understanding of how their work impacts their stakeholder. As for conferences, members of the cohort attended virtual conferences related to their research. I had the privilege of attending and presenting at two conferences, including the conference in evolutionary computing.

Most members in the cohort have started working on or completed work on a publishable piece of work. Most impressively, one of our members has submitted work to three separate tracks at the leading conference in human-computer interaction.

Some, including myself, have started working on multiple research pieces often working alongside students and staff outside of the CDT bubble. I have been fortunate enough to have an article accepted earlier this year and set to be published by the end of the year.

One of the challenges faced by the cohort this year has been the side projects. Many have found the projects to be an extra burden on their workloads. As a result, some students have abandoned their side projects. We welcome the proposed changes to make these side projects more accessible and more in line with our current research. Personally, I have enjoyed doing a side project as it has allowed me to work with other members of staff in the Computational Foundry and another PhD student outside of the CDT.

With the start of each new academic year, a fresh intake of new students comes into the office. While not all students have come in yet, it is refreshing to see new members of our community use the research space provided. We look forward to welcoming all students once they feel comfortable coming in and to see students who will be joining us in Cohorts 4 and 5.

Jakub Vincalek

New Stakeholders & Projects

Cohort 2

This year we had 19 committed PhD projects available: seven projects in health and wellbeing, two in smart manufacturing and ten in the cross-cutting digital economy context. All project briefs had been co-created with the stakeholders and relevant academics with feedback from the PhD students at sandpits. The projects were presented in a project brochure and circulated to the students to review for two weeks. In the end, all ten students were allocated projects taking into consideration three key factors: student project preference, student performance/panel ranking in the interview and Centre optimisation.

Project allocation for cohort 2 is as follows:

Stakeholder	Project Title & PhD Student
Aneurin Bevan University Health Board	Advanced Machine Learning to Improve Patient Care and Outcome using Real-time Hospitalisation Data - **Fergus Pick**
CDSM Interactive Solutions	Developing Novel Machine Learning Techniques to Improve Comparative Judgements for E-learning and E-assessment - **Andy Gray**
ITSUS Consulting	Human-in-the-loop Approach in Lawful Interception **Lydia Channon**
National Imaging Academy Wales	A Framework for Evaluating Diagnostic Imaging Artificial Intelligence Medical Tools - **Rory Clark**
Ordnance Survey	Incisive Tagging: Humans-in-the-loop in Selection and Labelling of Remote Sensing Datasets **Michael Johns**
Starling Bank	Developing Trust in Algorithmically driven Services by Enhancing Explainable and Fair Machine Learning - **Alex Blandin**
The City and County of Swansea Council	Human-centred AI systems to Inspire Swansea City Residents to Engage in Creative Placemaking **Tunde Olatunji**
Tech Against Terrorism	Expanding and Assembling Approaches to Improve Decisions on Identification and Classification of Online Terrorist Content - **Adam Cooke**
Tata Steel	Developing Novel Machine Learning Techniques to Enable Better Decision Making on Operations Maintenance. - **Beth Delahaye**
Velindre Cancer Centre	Developing Data-driven PROMs and Evaluations of Inclusive Digital Interventions to Support Patient Lead Cancer Care Pathway - **Matt Hall**

New Stakeholders & Projects

Stakeholder's Perspectives for Cohort 2

Phillip Wardle and Victoria Whitchurch

Director and Programme Manager,
National Imaging Academy Wales

We were fortunate enough to be introduced to the Centre by our NHS Colleagues at the National Data Resource. They introduced us to the exciting opportunity that the Centre and its PhD Students offered. We were not disappointed.

The experience has been a very positive one. We have found the Centre and its team to be very supportive, guiding us novices through, what we thought would be, a difficult process with ease. The team have aided us in the refinement of our project proposal and in the identification of a student that we are excited to work alongside.

We wish to gather enough knowledge & data to develop a framework that will support NHS Wales to evaluate AI devices in diagnostic imaging

This will empower clinicians and other AI users in the NHS to make informed choices about the AI devices procured and will support and encourage our colleagues to get involved in the design, manufacture and deployment of AI devices in their area of work.

Darren Wallace

Chief Technology Officer,
CDSM Interactive Solutions

The collaboration has allowed our development team to think through the challenges we face in broader terms than usually allowed by immediate commer-cial pressures. It has also enabled haring ideas with talented individuals who are addressing the same technical challenges we face, but from an entirely different perspective. We are excited by the wealth of talent coming through the centre and hopefully establishing a valuable working relationship that will benefit us for years to come.

Paul S Davies and Richard Whitelock

Principal Engineer Automation Systems and Improvement Manager – Engineering CoE,
Tata Steel

We collect a lot of machine data in Tata Steel that is un-utilised. The AMDC project was set up to make the best use of this data through combining disparate data sources and applying advanced analytics and statistics to reduce unplanned losses. We have the ability to collect the data sets and display the data through our software developers but were lacking the skillset from a data science perspective to properly analyse the data to enable predictions and convey that information effectively to the right people. The experience has been quite positive so far with the selection of an enthusiastic candidate to take the project forward. To develop advanced analytical techniques that can be applied to our various data sets to give predictions on Asset Health that the end user can engage with to take the necessary action to prevent unplanned losses of our equipment.

Mike Ogonovsky

Chief Digital Officer, and John Frankish Head of Digital Transformation & Business Change,
Aneurin Bevan University Health Board

Machine learning & artificial intelligence are likely to play a significant role in clinical decision support in coming years. Working in partnership with the Computational Foundry using a PhD vehicle is a highly cost-effective opportunity for a clinical operational organisation to start to learn about ML & AI and its applications in health care.

The working experience with the computational Foundry has been excellent. The CF team communi-cate regularly and clearly and are responsive to our questions and requirements ensuring that we could bring our clinicians into conversation with students and academic staff to get jointly owned vision of the research topic.

To develop a clear understanding of the organisational structures, processes and resources involved in developing ML & AI solutions from clinical and technical perspective including risks and issues that can arise and how we need to manage them.

Tracey McNulty

Head of Cultural Services,
Swansea Council

We have worked with Swansea University on several initiatives over the years, but our service engaged with this Centre due to its ability to help us understand and address some of the difficult questions and answers we were seeking about the city, cultural exchange and place making, post Pandemic. The experience has been supportive, exploratory, inclusive and encouraging in helping us understand what we are trying to achieve longer term. By the completion of the PhD we hope to have truly people centric policies for cultural participation, development and provision in our city, with legible human scale public assets that are accessible to all, shaped by needs and use and which create a distinct identity for Swansea.

This will inform ourdecision making and application of resources alongside future collaboration and partnerships for cultural development city wide, ina sustainable way.

Early successes have included workshops with team members to understand how applied arts and digital assets shape our thinking and actions which has helped us develop a new 'Experience Centre' in the city centre; achieving funding from Creative Wales for it to be designated a South West Wales Creative Hub.

Harriet Rees and David Sullivan

Head of Data Science and Lead Data Scientist,
Starling Bank

We recognise that explainability and the development of trust / fairness in AI systems is a new and rapidly evolving field of active research. Given the centres focus on human interaction in such systems and Starlings position in the digi-

New Stakeholders & Projects

Stakeholder's Perspectives for Cohort 2

tal banking sector, we felt there was a strong opportunity for collaboration.

Our collaboration experience with the Centre has been very positive - members of faculty have been very engaging in our research topic and provided valuable insights and ideas in how to approach the problem from both an academic and industryperspective. We hope to develop a framework / method for practicing explainable and fair AI in the banking sector which put our customers in complete control of/ enable them to better understand financial decisions taken using their personal data.

Stuart Morris

Chief Digital Officer,
Velindre University NHS Trust

As part of a drive to build academic partnership across Wales to support the development of our services for Blood and Cancer. Working in partnership – we will redesign services based on academic research and evaluation. Thoroughly engaging, it has been a fantastic learning experience for many across the organisation. Our PhD will focus on Patient Related Outcome Measures. These PROMS will help us to refine and design improved patient experiences and outcomes in the future.

Adam Hadley

Executive Director,
Tech Against Terrorism

We engaged with the Centre because of its demonstrable expertise with regards to online regulation and violent extremist content and its affiliation with leading conferences and research organisations in this area. We have very much appreciated the opportunity to engage with leading experts in the field at the Centre and much of this has been incorporated into the work carried out by Tech Against Terrorism. In engaging with the PhD projects at the Centre we aim to incorporate the very best analytical techniques from data science and computational science for the benefit of terrorist content analytics in particular we are looking forward to benefiting from expertise with regards to analysing terrorist content as it is disseminated across the internet.

Into Year Three

By listening to our steering committees, stakeholders, cohort members and faculty members, we've improved the ways we co-create PhD project proposals; refined the focus of our "20% projects" to facilitate and nurture social activism in our cohort members; extended our weekly cross-cohort training activities; and, adapted some elements of the taught aspects of the programme. We are grateful for all the engagement we have had across our community.

As we begin this third year as a Centre, there is a great deal to look forward to. Firstly, we have been joined by a high potential new intake. We were delighted to offer places to both UK and International colleagues, meeting the goal of 50:50 Female: Male offers we set ourselves at the start of Centre's life. Then there is excitement in seeing our PhD researchers begin to impact on the wider research and innovation community through conference and journal submissions and importantly through plans to travel and network globally. One of our Centre's aims is to foster a deeper engagement with the people-first perspective. This coming year will see us convene a number of events - including a Festival of Ideas to be curated by our PhD researchers; and an all-hands residential retreat - to elaborate and communicate the concepts and practice. And, so the "strange year" just past, gives way to one where together we focus on nurturing, equipping and encouraging our members who in turn commit to making better futures through ambitious and adventurous discovery and innovation.

If you are reading this as prospective cohort member or a stakeholder who wants to join our invigorating and purposeful mission, please do get in touch. We are keen to engage with anyone, anywhere who has a desire to build a digital future that celebrates, includes and is driven by as rich and as wide a set of perspectives, centred on that most important of "technologies": people.

Matt Jones
Director, EPIC
November 2021