

Annual Report 2022

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





Introduction

We began this year in September 2022 with fewer restrictions related to COVID-19 and many more opportunities to engage in person together as a Centre. This included the first all-hands “retreat” for the Centre, faculty and stakeholders. I was greatly encouraged during those two days that despite all of the fragmentation of 2020-2022, the spirit and drive of the Centre was alive and flourishing.

At the end of this new year, with our fourth intake, we have nearly 40 Centre members (our PhD Researchers) who are working to ensure that human values, perspectives and needs drive innovation in data and intelligence driven systems. As well as their individual work, we have many conversations, debates, seminars and informal interactions where together we can consider the bigger picture.

In the wider world, be that academia, industry or popular discourse, the notion that AI or Machine Learning is on a trajectory to outpace or outsmart humans is still strong. Here, at the Centre, our focus, though, remains on the most important “technology” of all – the human. This emphasis has been wonderfully nurtured by speakers in our International Seminar Series, including Neha Kumar of Georgia Tech who pointed to the importance of taking account of diverse frontline healthcare workers’ perspectives for AI development and Ben Shneiderman, one of our International Advisory Board Members, who presented his far-reaching framework for human-centred design.

Our International Advisory Board has been helping us to think of emerging themes and trends that the Centre can tackle. One of the most provoking sets of conversations we have had in this regard is the way that Computer Science is perhaps fuelling two exis-

tential threats – the threat of fake news on democracy and the unsustainable use of resources. The challenge to all of us, then, is how to mitigate and reverse these trends through research and innovation.

As you read the rest of this report, I hope you will be inspired to connect with us; to critique us; and, to change the world for the better!

Matt Jones

Director

A handwritten signature in black ink, appearing to read 'Matt Jones', with a stylized flourish at the end.

November 2022

The Centre's Home

The EPIC Centre continues to be housed in the Computational Foundry at Swansea University's Bay Campus, with the Cohorts having unlimited access to 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, training and formal meeting spaces.

The EPIC Centre has a dedicated 271m² of space including collaboration and interaction spaces, as well as an allocated desk and storage space for each member of the Cohort. The EPIC Centre also has its own dedicated social breakout space. Due to the capacity of our dedicated space, we will be able to accommodate Cohorts 1 to 4 from October 2023.

The space has been used continuously throughout the pandemic, although some of our Cohort did choose to work from

home. Since the relaxation of Welsh Government rules, we are in the process of encouraging all Cohorts to return to the Foundry. Understandably, some of our students remain cautious about the return. We are offering empathy, compassion and support to these students and remain hopeful that all will return to Campus on a regular basis in the coming months.



Our Leadership 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.

All Co-Is have dedicated 5% of their time to the EPIC Centre, and have provided their 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 Cohorts; 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



Dr Matt Roach
Strategic Stakeholder Lead



Dr Sherryl Bellfield
Centre Manager



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



Tashi Gyaltzen
Senior Business Engagement Officer

Equality, Diversity and Inclusion



Equality, Diversity and Inclusion (EDI) continues to be a key driver of our activities and ethos of the Centre. Our management and governance structure includes EDI monitoring, reporting and assessment. Through the work of our internal EDI committee we continue to evolve the EDI strategy and policies of our centre. This year the EDI and Responsible Innovation Committee met three times. The committee has 13 members including supervisors, students and external stakeholders. The membership includes two student representatives. The committee regularly reviews the action plan. One of the main focuses this year has been to improve students' engagement in EDI initiatives across the university and understanding of EDI issues. To achieve improved ownership of EDI, it has been decided to have an additional EDI committee meeting led by students.

The Cohort 4 recruitment cycle has been particularly successful having received 131 applications. From a qualitative analysis of the application, the diversity of applicants has improved, including applications from a wide range of disciplines and backgrounds. We believe that this has been achieved through promoting the ethos and 'people first' approach of the centre. We have continued to make improvements to our website and promotion material. We have also further refined our recruitment process; including using our international networks to promote our Centre. Our students act as ambassadors to promote the vision of the

Centre and we believe this has contributed to improve the diversity of applicants.

Diversity of our student Cohort has improved this year. We have continued to keep a thorough recruitment process, including interview panels with 3-4 members and a panel to reduce unconscious bias and establish a fair process. This has resulted in recruiting a Cohort of high calibre and diverse students.

The Centre has made progress in terms of gender balance. As shown in Figure 1 there has been a steady increase in the proportion of female students over the years, with Cohort 4 having a 62:38 ratio female to male. Disability, age and sexual orientation data also show increased diversity in Cohort 4 (Figure 3, Figure 4 and Figure 5).

The number of students from ethnic minorities has slightly decreased in Cohort 4 recruitment as shown in Figure 2. This may be a statistical fluctuation due to the small number of students. However, we will continue to monitor this and explore how we can develop inclusive recruitment material for ethnic minority students in the next Cohort.

CDT Student Gender	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Female	17%	17%	40%	62%
Male	83%	75%	60%	38%
Other	0%	8%	0%	0%

Figure 1 - Gender balance of our CDT students

CDT Student Gender	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Asian	Unknown	8%	10%	15%
Black	Unknown	8%	10%	0%
Chinese	Unknown	0%	10%	0%
Mixed	Unknown	17%	0%	8%
White	Unknown	67%	70%	77%
Prefer not to say	Unknown	0%	0%	0%

Figure 2 - CDT Students' Ethnicity for Cohort 2-4, students' ethnicity data not collected for Cohort 1

Disability	Cohort 1	Cohort 2	Cohort 3	Cohort 3
Known disability (n)	Unknown	25%	10%	23%
No known disability (n)	Unknown	58%	90%	62%
Prefer not to say (n)	Unknown	17%	0%	15%

Figure 3 - Students disability data for Cohort 2-4 - disability data not collected for Cohort 1

Age	Cohort 1	Cohort 2	Cohort 3	Cohort 4
24 or under	Unknown	8%	10%	15%
25-29	Unknown	8%	10%	0%
30-34	Unknown	0%	10%	0%
35-39	Unknown	17%	0%	8%
40-44	Unknown	67%	70%	77%
45-49	Unknown	0%	0%	0%
50-59	Unknown	0%	0%	0%
60 and over	Unknown	0%	0%	0%

Figure 4 - Age distribution for Cohort 2-4 - data was not collected for Cohort 1

Sexual Orientation	Cohort 1	Cohort 2	Cohort 3	Cohort 4
Bisexual (n)	Unknown	25%	0%	15%
Gay man (n)	Unknown	0%	0%	0%
Lesbian (n)	Unknown	9%	10%	8%
Hetrosexual (n)	Unknown	50%	90%	54%
Other (n)	Unknown	8%	0%	0%
Prefer not to say (n)	Unknown	8%	0%	23%

Figure 5 - Sexual orientation for Cohort 2-4 - data was not collected for Cohort 1



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 Department of Computer Science, Founding Director (1983-2000) of the Human-Computer Interaction Laboratory, and a member of the Institute for Advanced Computer Studies at the University of Maryland, College Park. 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.

Stakeholder Strategic Advisory Board

The purpose of our Stakeholder Strategic Advisory Board is to extend the pathways for Cohort engagement during and after completion; and provide horizon scanning input in terms of regional, economic and societal changes and how the Centre might respond to these.

Our members

In 2021/22, the following people were members of our Strategic Stakeholder Advisory Board.



Elin Rhys

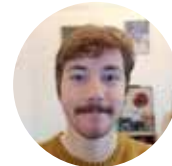
Elin Rhys grew up in Solva, Caernarfon and Llanelli. A graduate in Biochemistry from the then University of Wales Swansea in 1978, she worked as a scientist with the Welsh Water Authority before embarking on a career as a television presenter with HTV and S4C in 1984.

In 1993, she founded her own television company with the aim of popularising science in the media, and to do so mainly through the medium of Welsh. Today, Telegop is a multi-media company and has its headquarters in the city of Swansea.

Telegop productions – whether for television, radio or the Internet, in English and Welsh – are held in high esteem across the world. Fact-based programmes such as the Welsh-language farming and countryside magazine series, Ffermio, regularly attract the highest numbers of S4C's audience. The series Dibendraw, which highlights leading scientists of the past and present has provided a platform for some of Swansea University's science

research stars to communicate their findings to the general public.

Alongside science, Elin Rhys has produced documentaries that explore some of the foremost figures of Wales and the world.



Rory Clark

Rory Clark is a member of Cohort 2 of our Centre. Rory's PhD centres around ethnographic study to ensure that, not only are current radiologists and radiographers comfortable and confident with the Machine Learning tools, but they are able to identify, critique and evaluate potential new machine learning systems that they may wish to implement in the future. Rory's external stakeholder partner is the National Imaging Academy of Wales.



Mark Casey

Mark Casey heads up the UK Hydrographic Office's Research and Innovation function. Mark has 30 years' experience of utilising geospatial data to produce navigation products and services in both the Air and Maritime domains. Initially 22 years spent in the Royal Air Force making aeronautical maps, charts and publications for the RAF and wider joint forces and has spent the last 8 years at the UK Hydrographic Office leading the Research and Innovation team in exploring new technologies and tools to create new marine data and navigation Proof of Concepts for UK Defence and the commercial maritime markets.



Helen Griffiths

Professor Helen Griffiths was appointed Pro-Vice-Chancellor with responsibility for Research & Innovation at Swansea University in August 2020. She is responsible for leading the development, implementation and continuous improvement of Swansea University's Research & Innovation Strategy. She is a Fellow of the Royal Society of Biology and a member of the Editorial Board for Redox Biology. She has previously served on the Boards of Surrey Sports Park and of Surrey County Council Health and Wellbeing Board. She has been a member of the Council of Governors for two major Health Trusts in Birmingham and Guildford.



Jonathan Burnes

Joining from Swansea University, Dr Jonathan Burnes is tasked with overseeing delivery of the £1.3 billion investment portfolio throughout South West Wales. Dr Burnes has held a number of senior positions at the university in the last 12 years. These include Director of Information, Services and Systems; Digital Strategy Development Manager; and Associate Director of Planning and Strategic Projects. As the City Deal's Programme Director, Dr Burnes will establish and lead a new City Deal Programme Management Office that will co-ordinate a portfolio of major projects across the Swansea Bay City Region, which is made up of Carmarthenshire, Neath Port Talbot, Pembrokeshire and Swansea. The City Deal programme is aimed at creating conditions that attract business and simulate economic growth for the City Region.



Laura Clark

Laura Clark is the UKI NHS Value & Partnership Manager at Amicus therapeutics. As NHS Value & Partnership Manager Laura is responsible for leading strategic collaborations across the NHS, life science industry and academia. Laura began her career at Pfizer Pharmaceuticals and has over 15 years' experience of working within the pharmaceutical industry in a number of senior commercial and operational roles, developing and delivering strategic programs across the UK to support life science collaborations with health systems to improve health and wellbeing. Laura is currently leading the Amicus collaboration with Swansea University, focusing on improving patient outcomes in the area of rare disease.



Peter Waggett

Peter Waggett started work as a Senior Research Scientist at the Marconi Research Centre and is now IBM's Director of Emerging Technology. He has advised a number of public and private sector clients on how to harness innovative and disruptive technologies and acted as a subject matter expert on a number of major projects. He leads teams of specialists who are charged with developing first of a kind and prototype systems using research and development assets for IBM's clients and partners. The teams include developers of IBM's Watson cognitive computing offerings and 'big data' analytic solutions.

Publications

The EPIC CDT provides a four year programme, consisting of one year MSc studies and three years of PhD research. At the time of writing the report, only Cohorts 1 and 2 had already progressed into the the PhD phase - Cohort 3 have just finished their MSc, and Cohort 4 is taking up their studies. Publications by PhD researchers are listed below, with the researchers' names in bold.



Emily Nielsen: Think Zebra; Three Minute Talk Finalist June 2022

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.

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. July 10-14, 2021

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

Stuart Macdonald, **Connor Rees**, & Joost S. Remove, Impede, Disrupt, Redirect: Understanding & Combating Pro-Islamic State Use of File-Sharing Platforms. April 2022

Pranjal Jain, Alex Jordan Blandin, Jacki O'Neill, Mark Perry, Samia Ibtasam, Paul G. Allen, Suleman Shahid, Beni Chugh, David Sullivan, Heloisa Candello, James Pomeroy, Rajat Jain, Robert Dowd, Matt Roach, Matt Jones. Platformisation of Digital Financial Services (DFS): The Journey of DFS in the Global North and Global South. CHI '22 Extended Abstracts: CHI Conference on Human Factors in Computing Systems Extended Abstracts, New Orleans, LA, USA, April 2022

Yashi Jain, **Pranjal Jain**. Donut Plugin: A Circular Design Tool to Implement Circular Economy. CHI '22: ACM CHI Conference on Human Factors in Computing Systems, April 30 – May 06 2022, New Orleans USA.ACM, New York, NY, USA.

Pranjal Jain, Anirudh Nagraj, Kartik Joshi, Taru Jain, Dilrukshi Gamage, Sayan Sarcar, Nova Ahmed. HCI Knowledge Dissemination in South Asia through both Coursework and Community Engagement. EduCHI'22, April 30-May 1 2022, LA, USA

Anna R. L. Carter, Miriam Sturdee, Alan Dix Prototyping InContext: Exploring New Paradigms in User Experience tools. AVI 2022: Proceedings of the 2022 International Conference on Advanced Visual Interfaces June 2022

Jennifer Pearson, Gavin Bailey, Simon Robinson, Matt Jones, Tom Owen, Chi Zhang, Thomas Reitmaier, Cameron Steer, **Anna. R. L. Carter**, Deepak Ranjan Sahoo, and Dani Kalarikalayil Raju. 2022. Can't Touch This: Rethinking Public Technology in a COVID-19 Era. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems. Association for Computing Machinery, New York, NY, USA, Article 401, 1-14.

Alex Blandin, Matt J Roach, Matt Jones, Jen Pearson, Daniele Doneddu, David Sullivant. Co-Designing Explainable AI for a Mobile Banking App. CHI '22: ACM CHI Conference on Human Factors in Computing Systems, April 30 – May 06 2022, New Orleans USA.ACM, New York, NY, USA.

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: 4th Annual 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.

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. In Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems (CHI EA '22). Association for Computing Machinery, New York, NY, USA, Article 26, 1-7.

Anna. R. L. Carter, Miriam Sturdee, Alan Dix, Dani Kalarikalayil Raju, Martha Aldridge, Eunice Sari, Wendy Mackay, and Elizabeth Churchill. 2022. InContext: Futureing User-Experience Design Tools. In Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems (CHI EA '22). Association for Computing Machinery, New York, NY, USA, Article 95, 1-6.

Emily Nielsen, Think Zebra: 3 Minute Talk Finalist, June 2022

Andy Gray, Alma A. A. Rahat, Tom Crick, Stephen Lindsay, Darren Wallace. Using Elo Rating as a Metric for Comparative Judgement in Educational Assessment. 2022 6th International Conference on Education and Multimedia Technology. July 13-15 2022. Guangzhou, China

Luke Thomas, Michael Edwards, Austin Capsey, Alma Rahat, Matt Roach. Deep Visual Place Recognition for Waterborne Domains. The 29th IEEE International Conference on Image Processing (IEEE ICIP), Bordeaux, France, October 16-19, 2022

Matt Hall. Exploring Clinicians' Use and Perceptions of Patient-Reported Outcome Measures at a Tertiary Cancer Centre in Wales. ISOQOL 29th Annual Conference. 19-22 October 2022. Prague, Czech Republic

Changing Our Approaches

We involve our PhD researchers in the co-creation and shaping of our activities. The ways we have adapted this year are detailed, below.

What our Centre Members said

Communication between the Centre and Cohort members can be improved.

The Social Action Projects need further engagement and “buy-in” from members.

Accessibility issues for disabled users within the Foundry need to be addressed

What we did

The Centre Manager is responsible for determining the problem with communication. The Centre Manager has contacted each member of the Cohort for feedback about communications, including specific examples of good and poor communication. This feedback can be given anonymously and both individually or collectively. Once the feedback has been gained and analysed, an action plan will be developed and implemented. The results will be presented at our next Leadership Team Meeting.

The Social Action Projects are part of the wider PhD programme where we provide no-cost projects to local charities. This year we developed a mixture of new projects brought in by the Centre and projects proposed by the Cohort themselves, which has worked well. We are currently working with Cohort representatives to further improve the programme. Social projects remain a key part of learning at the Centre that make a difference to charities trying to address pressing societal issues. The Centre management will increase the communication of the importance of these events to supervisors. Students already have regular (up to weekly for some periods) communication with the Centre Director on the Social Action Projects.

Frequently used fire doors automatically held open. Salto locks re-positioned and re-programmed. Automatic doors to be investigated depending on the outcome of the actions implemented to date

The PhD projects on offer could be more varied

We would like a timeline of Centre activities to improve communications and aid in planning

Some stakeholders have concerns that the Social Action Projects are detracting Cohort members from their PhD

Ensure that all stakeholders are aligned to the Centre’s vision

The PhD projects and research areas are led by the three contexts of the Centre: health and wellbeing; smart manufacturing and cross-cutting digital economy services. It is also dependent on the nature of challenges and the industry the stakeholders represent. Last year, four PhD projects were withdrawn due to stakeholders pulling out at late stages in the development, that is out of our control. We will continue to bring a range of diverse and challenging projects as possible. This year we have new potential stakeholders from HSBC, Pearson, Hywel Dda University Health Board, GSK, TWI Consulting, Lusas Engineering, Altair and Natural Resources Wales.

A ‘live’ timeline of Centre activities has been created and shared with members of the Cohorts.

These concerns mainly derived from the early Cohorts during which the Centre hadn’t fully communicated the programme on the side projects. They have since been informed. Also, new stakeholders are briefed on this being as part of our wider PhD programme during the initial conversation and reiterated throughout the project development stages.

During the early engagement period, all potential stakeholders are given the overview of our human-centred philosophy in creating new forms of AI technology. We progress the engagements to project scoping only with the stakeholders who are aligned to this vision. All Centre projects will have academics and researchers from the human computer interaction field regardless of the nature of the stakeholder challenge. Lastly, the Centre management board reviews the stakeholder projects to ensure they are human-centred.

All meetings should include a hybrid option

We want more integration with students undertaking standalone PhDs

We should not be expected to select a minimum of 3 PhD projects during the project selection process

As a Centre, we need more knowledge sharing

We would like more social events

We are prioritising in person meetings to help remedy disconnections over the Covid period.

All standalone PhD students in the Computational Foundry have been given access to the EPIC centre. All standalone PhD students in the Computational Foundry are invited to attend the Centre's Festival of Ideas

The approach behind the requirement is that the Centre can allocate projects that are as close to the student's research interests as possible. The students are regularly advised and encouraged to be open-minded about projects and keep their options open during sandpit events. We recognise that this is a stressful time for the students and have significantly increased the communication around this process with them in recent years, and that the selection and allocation criteria is clear, transparent and communicated to students ahead of selection. The expectation to select a number of projects will remain, with an open policy of discussion with individuals on a one-to-one basis should they find themselves struggling with the choices available.

Including poster presentations and 'Why It Matters' sessions within the Festival of Ideas. Encouraging all Cohort members to undertake a weekly 'Why It Matters' talk

An evening social event has been scheduled into the Festival of Ideas programme. Student representative has been asked to investigate the appetite for having a Social Events Coordinator within the Centre. Monthly "Connect" lunches are planned.

The MSc year

All Centre members begin their EPIC journey with a MSc year, which aims to ensure that everyone has the foundations for effective PhD research in the second and subsequent years. This year, it was nice to be able to go back to fully in-person activities for the third Masters year of the Centre. The challenge of maintaining a sense of togetherness and Cohort feeling outlined in the previous Annual Report was lessened by this return to the Computational Foundry and the wider Campus. We have also worked to make the physical CDT space a welcoming and enjoyable environment, with Cohort members rearranging the space, adding plants and decorations and generally making it their own.

Following last year's intent to offer a part-time version of the programme, we made this available for the Cohort 4 intake. There were no applicants to this variant for a 2022 intake, but we will continue to offer part-time study as an option.

In last year's report we noted that two students had decided to suspend and defer the Masters year. These individuals have subsequently decided that they are not able to return to the Centre due to personal circumstances.

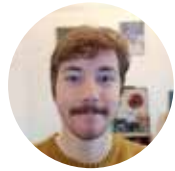
Timetabling of modules remains complex, but here the COVID-19 pandemic did spur positive change. Recording of all lectures by default and broader access to online resources means that while in-person sessions are still missed due to clashes, material is available to catch up on. This aspect is another area where the strong Cohort-based structure of the programme is a benefit, with students able to provide support to others who miss activities, and compensated by reciprocal support when they miss activities themselves.

We ran a reflection session at the 2022 Annual Retreat, and the feedback and action points are detailed earlier in this report. The key issue raised across Cohorts was that of communication: we need to do more as a Centre to communicate clearly, compassionately and in a timely manner. The Centre Manager has been tasked to develop a communication strategy and also provide and attend training to help all members of the team communicate coherently and centrally to avoid confusion.

Aside from issues of communication, and Social Action Project challenges discussed above, feedback from Cohort members was broadly very positive. Cohorts appreciate the dedication and support available, and are very much enjoying their experience at the Centre.



Cohort Perspectives



Rory Clark (Cohort 2) - Student Representative on the Strategic Stakeholder Advisory Board

It's always difficult to summarise an entire year in a few paragraphs, but I think it's important to convey that this year was one of reconstruction. At current it is almost impossible to write about anything in either the professional or personal sphere without mentioning the large viral elephant in the room, but it has undoubtedly been one of the strongest years for the CDT as a whole. Retreats to the Vale Resort, numerous publications and presentations all across the world from Vienna to New Orleans, and the induction of a new all-in-person Cohort has meant that the Computational Foundry has not seen many idle moments.

Granted, this year has not been entirely smooth sailing. Building a Centre is an iterative process that cannot avoid teething problems, and there have been points of disappointment and frustration for students and staff alike - returning to an office culture is something everyone sees in a different light, and ensuring that the needs of the Centre align with the needs of the student is something that takes a great deal of patience, communication and (of course) trial and error. However, I genuinely believe we've made some great strides and are constantly improving.

That brings me back to my earlier word "reconstruction". If you were to visit Room 328 a year ago you would have been a rather empty, quiet office that likely wouldn't have given instant inspiration. Today, that office is abuzz with students from all three Cohorts and more, discuss-

ing their workshops, new builds, meetings with important members of society, but also their weekend plans and what they saw on TV last night. There is constant collaboration, sympathetic conversation, and yes, lots of coffee. The key aspect of this year is that, even when there are moments of friction, there is the ability to communicate with the person next to you, or in the office below you, or with a member of management; all of whom are willing and able to help. That has been the experience of being a CDT member in 2021/22, and with any luck it'll be the experience next year, too.



Pranjal Jain (Cohort 3) - Student Representative on the Centre's Leadership Team

The Centre is a melting pot where constant conversations and debates about how machine learning-driven systems impact various aspects of our daily life. The Centre enables us to engage with faculty members and stakeholders outside the Computational Foundry. Every researcher at the Centre is passionate about these conversations, and we raise questions that shape, reshape, and improve data-driven products and services. Our collective efforts answer what impact today's research will have on future intelligence-powered products and services.

We at the Centre not only create data-driven systems but also understand the social context in which these systems would be deployed and later used. That grounding of the socio-technical systems is the key that makes our efforts meaningful.

Various activities in the Centre enable us to develop the skill sets needed to continue walking on the journey that we have embarked on. Interacting with other researchers and practitioners around the world or presenting our research on a weekly basis helps us to reflect and navigate the journey. We also get together and meet through retreats where not only faculty members come, but stakeholders do join us in those retreats.

We are proud to be part of the Centre as it means to be part of high-impact science that collaborates with industry, helps us do multi-disciplinary research, provides a support network, and gives tools to

achieve our goals. Lastly, the Centre feels like another home as it fosters family values.



New Stakeholders & Projects

Project allocation for Cohort 3 is as follows:

Stakeholder	Project Title & PhD Student
British Telecom	Immersive Data Capture and Presentation for Industrial Decision-Making and Knowledge-Sharing – Pranjal Jain
CENTURY	A Human-Centred Approach to Investigate Learners' Motivation and the Impact of e-Learning - Laura Smith
Morrison Hospital	Early Pancreatic Cancer Detection using Medical Imaging and Spectroscopy – Zheng Tang
Rescape Innovation	Exploring the role of Virtual Reality and Artificial Intelligence in reducing loneliness within individuals – Saskia Davies
Swansea Bay University Health Board	A Human-centred Machine Learning system to Analyse and Predict Patient Flow through Hospitals – Suzannah Downie
Tata Steel	A People-First Bayesian Approach for Decision Making in Quality Control – Aaron Rees
Vaarst	Leveraging machine and human intelligence for efficient labelling of challenging data – Jason Summers
Vaarst	Novel human-in-the-loop 3D point cloud completion for subsea surveying – Keneni Tesema
Betsi Cadwaladr University Health Board	AI-enabled Histopathology Image Processing Within The Colorectal Cancer Diagnosis Pathway – Connor Atkins

Stakeholders & Projects

Stakeholders' Perspectives for Cohort 4

The stakeholder landscape for Cohort 4 will be dynamic and build on our existing work. It is expected that there will be some follow-up or complementary projects from the existing portfolio of projects. We are also actively pursuing project discussions on tackling climate change with stakeholders such as National Resources Wales, Welsh Water, Swansea Council, Protium and Shell UK. The Centre will also continue to welcome new stakeholders who bring energy and new sets of challenges. We are currently in early discussions with HSBC, TWI Engineering, GSK, Pearson, TEC Cymru, AppsBroker, Marine AI, Digital Cabinet Office, Lusas Engineering, National Trust, Hywel Dda University Health Board, and G Research.

RivingtonHark/Swansea Council
Spencer Winter and Jonathan Hicks
Project Director and Principal Physical Regeneration Manager

The first year MSc project produced a real and tangible output in the form of two "Telescopes" which allowed members of the public to view a digital creation of the new arena, achieving some 10,000 uses from the public. A second generation of these is about to be commissioned which, located within the new development, will allow the public to pan around and view the history of the area in a geospatially correct digital recreation through available images and archives. Currently, we are coordinating to facilitate the development of a digital sensory experience, this is being trialled during public events with surveys undertaken by Anna and her colleagues to measure and record the public's reactions. It is hoped that this can

be developed to produce both commercial & educational outputs, particularly for people who may lack senses such as sight or hearing where a greater knowledge and experience can be imparted in a targeted and controlled way via other sensory inputs, also for those with learning difficulties or associative / human interaction issues. The fact that so much has been achieved through the restrictions of the COVID pandemic, and all the measures put in place to control the spread of the virus, has been a testament to the cooperation between all parties involved in this project to date; and we look forward to its further development.

Amicus Therapeutics Ltd
Gerard McCaughey and Solomon Kamal-Uddin
Cluster Medical Director and Medical Advisor, UKI

It has been a pleasure for Amicus Therapeutics to continue supporting the Swansea PhD students this year. During our regular updates our team has gained insights into how AI tools can find a place in the Rare Disease Industry and ultimately benefit patients. Descriptions of the challenges encountered have been just as beneficial as the progress of the projects. Both Suraj and Emily will be travelling to the Amicus offices later in the year to present to our International Divisions, to highlight our partnership with UK academia, see how the novel tools are bringing benefit to the industry and hopefully generate conversations for further opportunities.

Facebook

Lella Nouri
Lead Supervisor

This year Connor Rees has been progressing very well with his PhD research working alongside two partner organisations – Facebook and Tech Against Terrorism. His research is showing signs of clear cross-discipline innovation which will make for very impactful findings within his field. His collaborative research highlights the strengths of the CDT in its ability to embrace Social Science researchers alongside those with a background in Computer Science.

Tata Steel

Simon Lewis
Section Manager SIS/TLR, Through Process Quality – Technical

Connor Clarkson is working on some novel techniques to understand object detection and to compare human and computer answers. He is experimenting with active learning techniques to involve the operators and to give feedback by developing an interactive tool for use. The next stage proposed will involve testing the tool with surface experts in the works. The benefits are to help quality experts understand the inspection system principles better and train them more effectively. This improves accuracy and reduces the chance of mis-training with reducing accuracy.

Tata Steel

Paul S Davies
Principal Engineer Automation Systems

Having had meetings with Beth and the academic team over the last couple of

weeks, progress is on par where it should be. We will be increasing our sensor estate in the next few weeks and that will get us the data to progress to the next level. We are also engaging with the wider Engineering teams at Tata to see how they feel about AI/ML and what would they want to do to adopt it in normal working. Beth is getting to grips with MCSA and what approach to take to introduce an AI/ML solution to the engineering teams. Through statistical analysis we can tell the Motor A is worse than Motor B, the challenge for next year (or two) is to say Motor B is bad because of X and you have Y weeks/months before it fails. Getting the hardware on site and installed to support the data from the asset has been a challenge this year. If we can get to a position whereby we understand the failure frequencies of the MCSA spectrum and convey that information to the engineers in a user friendly way.

Rescape Innovation

Kev Moss
Director of Product Development

We were excited by the team's explanation of the Centre and how a collaboration could be beneficial. Throughout the process the team has been inspirational and professional putting in context our needs, the Centre's needs, and the students. We loved the shared passion for user-centric design and using tech for good. We decided that the PhD project would give us a different insight by using external thinking and knowledge. We are pragmatic technologists and hope this project will highlight real-world opportunities. We know machine learning will have an impact on our immersive products and we hope this project will inform

and start discussion on how it can develop into future and present immersive products.

ITSUS Consulting

Jon Jones
Senior Research Technologist

The experience this year has been overall positive. It has been great to interact with the CDT and the students and we hope to attend more events there in the future. Our PhD project with the Centre is going well and has shifted from the initial brief to a topic that the student is happier with and that still provides actionable insights to our business needs. We would love more opportunities for the industrial partners to explore the research being carried out. The student is engaging well with us, and taking part in company events, when possible, which is positive and something we look for in our supported researchers. We believe the CDT provides an invaluable resource to allow us to expand our research capabilities and provides access to new and energetic ideas which we can apply in our sector.

EMRTS

David Rawlinson
Clinical Informatics & Research (Manager)

Our project is now in full swing, and we are already gaining insights into how AI may or may not assist with our challenges. The exploratory work has also been useful to reflect in depth on how current process work. The main challenge we have had is with the NHS research governance, and so as a point of learning we would look to start the IRAS process much earlier, although it is hard to properly identify the requirements until some exploratory work is complete.

Vaarst

Dr Lyndon Hill
Head of Research

We had prior contact with the Centre via our CTO who had been involved with sponsored projects in their previous role; however, we would have looked to collaborate anyway due to the Centre's focus on relevant areas and proximity. It's early in the projects we are sponsoring but we feel informed and confident that we are in good hands. There are multiple objectives within the two projects we are collaborating on but we expect that we will cover some long term areas of research that will hopefully be in a position to direct future product research and development at the end of the programme

CENTURY

Paramdeep Khangura and Courtney Laing
Data Science Team Lead and Head of Strategic Projects

The Centre's focus on novel projects that keep human interaction and impact in technology was something quite unique and very appealing for us as a company. We feel that this research project will help us better understand the relationship students and teachers have with an intelligence based ed tech platform. The research findings will help us to continue providing a platform that focuses on giving everyone the best possible opportunity to fulfil their potential.

Social Impact Projects



Rich Heritage Group

Wales Heritage Walk; mapping sites and providing key information
Group members: Connor Rees and Floyd Hepburn-Dickins

The project aims to increase awareness and accessibility for local walking routes and heritage sites in the south Wales area, initially focused on Port Talbot. It carried out activities such as route mapping, collating information on adjacent heritage sites where information/details on sites are insufficient. We will attain it ourselves via engaging with local residents, packaging all of this together for the Rich Heritage group. In terms of achieving impact, it will galvanise interest in the local routes and sites in the area, engaging the local community with respect to the historical sites. Our experience so far has been good particularly our conversations and engagement with the Rich Heritage Group



Down to Earth

Biodiversity Monitoring System
Investigating a new way to evidence the biodiversity improvement in their sites
Group members: Emily Nielsen, Anna Carter, Matt Hall, Fergus Pick and Rory Clark

It is the project's aim to design a low fidelity prototype which supports biodiversity monitoring, by conducting observational study and interviews and creating a prototype. This will have impacts, including encouraging non-expert individuals to identify and record local wildlife, provid-

ing better app usage, and communicating a clear and appropriate design specification for the app to the Down to Earth team. The team is gaining skills working with people in different specialist areas, learning more about biodiversity monitoring and the different types of wildlife and also further enhancing our HCI research skills



The Troedrhiwfwuch Group

Troedrhiwfwuch Digital Preservation - 3D mapping of churches in the area which will be lost due to environmental hazard.
Group members: Tulsi Patel, Luke Thomas and Ben Wilson

The project aims to create an interactive AR application to help preserve historical artefacts and everyday struggles and triumphs of people from Troedrhiwfwuch, a once-thriving but now abandoned village in the Rhymney Valley. To fulfil this, we are 3D scanning artefacts from a now razed church. The team uses the scans to create an augmented reality application that will model the church interior and contents. In conjunction the application will create an interactive experience around the memorial gardens to commemorate the soldiers of WW1 and WW2. We hope to assist the surviving online community to keep the memory and discourse around the village alive and spread awareness. The team has gathered experience in modelling and traversing 3D spaces for phone applications. In addition, the various challenges in 3D scanning objects of different textures and sizes.



Computing at School

Teaching machine learning to school kids via an interactive web app
Group members: Andy Gray, Suraj Ramchand and Michael Johns

The project aims to work with Computing at School, a charity focusing on supporting computer science teachers in schools (Primary, Secondary, and College), to create a teaching and learning tool that will help educators teach the concepts of machine learning and AI. The project's main outputs are to create lesson PowerPoints, lesson plans and a web application for students and teachers to use within classes. Therefore, aiming to reduce the need for the teachers to have a deep understanding of the topic but still allow the students to learn about key technologies that impact their everyday lives. The impact would be significant in that it supports teachers in delivering new and upcoming technology in a way that will engage students. At the same time, it allows them not to worry about their knowledge of the subject not being at an in-depth level.



Welsh Refugee Council

Developing a computer skills curriculum for refugees
Group members: Adam Cook, Tunde Olatunji, Lydia Channon, Conner Clarkson, Ben Lloyd-Roberts

The goal of the project is to give refugees a range of tools, appropriate to their needs, to help them live and work. By the

end of this project, the Welsh Refugee Council will have 1 or 2 courses that they can use to help them inform and educate their refugee clients on digital literacy skills. Success will mean it is easier for the Welsh Refugee Council to deliver technical guidance to refugees, and that the refugees are getting a tangible benefit in their computer literacy skills. To deliver the project, the main skills we will use are research, data presentation, HCI, and storytelling. Whilst the project is not a highly technical one, it does require a high degree of consideration in the Human-Centred Design. The project challenges assumptions on how to design tools in a way that enables people from a diverse range of technical backgrounds and experiences to engage with them. The project also gives us a deeper sense of empathy and understanding of the challenges some of us face in our daily lives.

Into Year Four of the Centre

As we enter the fourth year, although the pandemic for many has receded, other concerns begin to loom. From a UK perspective there are worries around the cost-of-living; the adequacy of health and well-being services; geo-political threats; and an energy crisis! While it is easy to despair at this scale of these issues, at the Centre we will continue to work in ways that provide hope and light. We will do this by tackling real problems that if solved will help to make people and society more resilient; and, by nurturing and training our members to approach their work with the lenses of responsible innovation and values that emphasise equitable, inclusive and diverse design.

With three full years of operation, we believe we have well matured and refined procedures and practices. We will though continue to respond to our stakeholder, faculty and PhD researcher steers to further improve how we operate.

At the end of this fourth year, our founding Cohort will begin to submit their PhD theses and leave us for new careers and roles. We are confident – and commit to ensuring – that they will do so in good heart and with great potential.

