DIGIT LAB DECaDE CAMERA Centre for the Analysis of Motion, Entertainment Research and Applications horizon DIGITAL ECONOMY RESEARCH Centre for Digital Citizens Future Places Centre Lancaster University

Symposium Report

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DE Nexus Symposium: Executive Summary

The two-day symposium offered a very well-received opportunity to bring together the collective of currently funded digital economy researchers and a variety of other key stakeholders of relevance to the community. Across two days, a variety of connections were made and collaborative endeavours planned on the basis of the current and emerging landscape of digital economy research presented. The vitality and importance of well-funded inter- and multi-disciplinary research and innovation into digital technologies was made evident. The leading role of the EPSRC in coordinating this conversation on behalf of UKRI was equally evident and the strengths of the research portfolio in this space were well noted. Critically, the importance of combining research into emerging technologies with human insight into the lived experience of technology use and human-centred foresight around its potential applications was thoroughly underlined, and a variety of highly promising research opportunities were detailed through the activity of the symposium.

Summary of research opportunities identified at the symposium

AI, Trust and Transparency

- How can AI systems continually show and hence justify the trust users need to invest in them?
- Is the trust people ordinarily have in each other of the kind they have with AI systems? Or is another notion of trust required? What might that be?
- Can technological 'moderators' act as agents for users in their dealings with AI? If so, can they reduce rather than exacerbate socio-economic inequalities?

Creative and Cultural Economies

- What is the complex nature of 'value' in digital content, and how are these values oriented to by people when using digital technologies, including GenAI?
- Do GenAI tools imply a transformation of business structures in the creative content domain? Will these transformations lead to greater equality or less?

- What is the complex relationship between GenAI and the potential harms and benefits of the technology as regards cultural outputs?
- Will the impact of GenAI diminish the perceived value of the non-digital? Is it creating new cultural cargoes?

Digital Health and Well-being

- User-driven research should be supplemented with community-driven research.
- Can 'slow science' deliver more sustainable longer-term health and well-being?
- What is the mental welfare impact of AI in the workplace?

New Perspectives on Data

- Are the social purposes of data production more important than the techniques used to process that data, whatever it might be? Is AI constrained by these social processes or enabled?
- Given the social processes of data production, what are the grammars of action suitable for the design of computer tools that process data, like machine learning technologies?
- Data enables understanding but limits it too. What are those limits and what price is paid if they are not attended to?

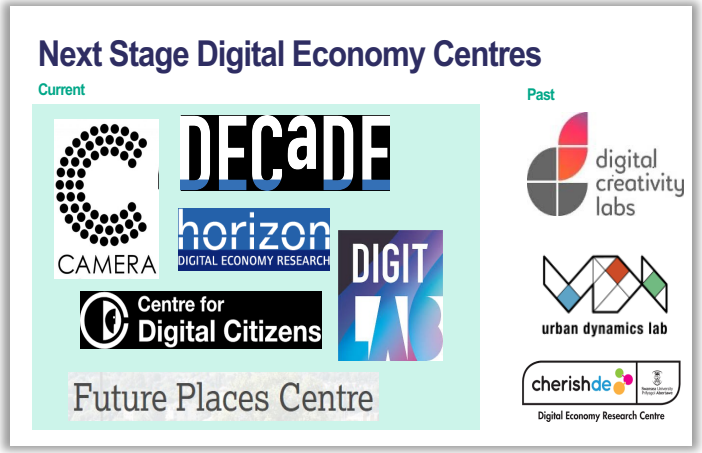
Radical Computing

- What would the technologies of digital rewilding of the internet look like?
- Will new techniques of data access and sharing need devising or will regulatory factors loosen the monopolistic constraints current operating on the internet?
- What is the future of computing when computational speed is not the only criteria used to define efficiency and purpose?

Main Report: The DE-Nexus Symposium

This symposium brought together the six Digital Economy (DE) research centres funded by the EPSRC and cognate agencies, the ARHC and the ESRC. These were commissioned between 2008-2022 and will complete their research in 2025 or soon thereafter. The symposium gave these centres a platform to share their key findings whilst bringing together the principal investigators from other DE projects who could add their own thoughts and research experiences to open up discussion and reflection in the impact of 'DE' research.

Along with sharing and networking, the event provided an opportunity to shape research agendas for 'post-DE' approaches in the future. The DE approach entails treating digital tools and technologies in terms of their social contexts of use and demonstrates how innovation is driven by combinations of the social and the technical. Future UKRI research, largely focused on AI and related technologies, can be seen as driven by technological imaginaries and exclude the social. Factoring the social into these imaginaries and shaping future research agendas accordingly were therefore key topics for the symposium.



The event

The symposium was held at 1, Bird Cage Walk, the Institute of Chartered Engineers, 10-11th June, 2024. Presentations made by PIs of DE projects were complemented by presentations from the EPSRC, the AHRC and by keynotes from academics and parliamentarians. Over 140 individuals registered for the symposium, and a subset were invited to participate in breakout workshops to shape future research topics and questions. Notes and summaries of these were used by Professor Harper and Professor Kirk to prepare this report. The symposium was organised by the centres' managers,

led by Sarah Hall at Surrey University. A video overview of the event was made and can be seen here: https://vimeo.com/982774969/b477e1ff29

The current DE Centre Directors

The Centre management teams

List of presenters and affiliations

Professor Saeema Ahmed-Kristensen, University of Exeter; Professor Neill Campbell, University of Bath; Lorraine Underwood, Lancaster University; Professor John Collomosse, University of Surrey; Professor Charlie Gere, Lancaster University; Professor Richard Harper, Lancaster University; Lord Chris Holmes, House of Lords, Westminster Palace; Professor Dave Kirk, Newcastle University; Professor Boriana Koleva, University of Nottingham; Dr Kathryn Magnay, EPSRC, Swindon; Professor Chris Smith, AHRC/UK-RI, Swindon; Professor Yvonne Rogers, University College London

Panellists

Professor Ben Azvine; Professor Kirsten Cater; Professor Lynne Coventry; Professor Daren Cosker; Dr Clara Crivellaro; Professor Mark Elliot; Dr Mike Evans; Professor Mike Frazer; Dr Rhia Jones; Dr Cathy Kerfoot; Professor Roger Maull; Rashik Parmar; Professor Gerard Parr MBE; Dr Bruna Petreca; Dr Neelima Sailaja; Dr Helen Thornham.

Report on the Event

The event was introduced by Professor Harper (Lancaster University). He explained how the 'Digital Economy' (DE) theme has been a cross-council programme (EPSRC/AHRC/ESRC) that has funded £254 million of activities, in fellowships, networks, research centres and PhD training centres. Its themes have been on content and content creation, on trust and identity, on a data and post data driven economy, and on equitable and sustainable societies. The centres reporting at the symposium have received £40.5 million of this total.

Opening keynote

The intellectual work of the event began with a keynote from Professor Yvonne Rogers (UCL). She explored how the big challenges facing society such as climate change, health and well-being, could be addressed by technology and science research. Those undertaking this research will need to extend and deepen their collaboration with society, with government, business and the community. They will also need to be 'mission driven' and people-led. Rogers explained that these goals are not easy to attain. Taking examples from projects in London and Bristol, she showed that technology and science-led research needs to adjust itself to deal with the multiple perspectives of the real world, and with the complex task of using measures that judge real world impact. Traditional 'HCI' methods, for example those used to understand and design interaction with computers, need to scale up for these challenges, as well as be redesigned to enable large scale, community wide collaborations

The DE Centres

The Future Places Centre, Lancaster University

This centre is based at the University of Lancaster. Its Principal Investigator (PI), Professor Richard Harper was joined by Co-I Professor Charlie Gere and research associate, Lorraine Underwood, to report on how the centre focuses its research on its local area – the coastal towns around Morecambe Bay, including Lancaster itself, and does so in a multidisciplinary way, combining computer science with the arts and humanities. The centre seeks to shape how 'places' can be more equitable and sustainable – with the case study being the Bay area. Data is obviously presumed to be essential for this but the FPC examines what type of data and depending on that, what are the end results of data driven perspectives and policie?. PI Harper explained that 'data' does not provide a panacea for shaping the custodianship of landscapes; data is a tool used in social practices and hence understanding the nature of those social practices and the role data has in them is also important. Once mapped, the role and the types of data suitable for better custodianship of the environment can be determined. Similarly, the role of data processing techniques such as offered by AI are all dependent not only on the quality or sophistication of the data processing but on the social context in which that processing finds its place and which interprets the output of that processing in particular ways. In light of this, the FPC has been making investigations into the nature of data and its social contexts of use crucial to its enquiries. So, for example, the centre has been helping local communities use socio-demographic data to identify opportunities for social value change. In the process the centre has been broadening what counts as data and who uses data.

A further concern for the centre has been exploring the arts as a form of data – or at least to examine what might ensue when arts are treated as such. Cultural practices including pictorial art, fiction and poetry can all document and describe landscapes and the relations between society and nature and so can mould understanding of that nexus. Paintings, poems and stories can and do shape relations to place. To investigate this the centre has funded environmental painting, poetry and literary activities, working with local communities and festivals. Topics for the research centre also include examining how individuals come to learn about and start to use data-driven perspectives from an early age. With this in mind, the centre is examining how school children can be taught to use lightweight computer platforms to gather and explore data

about their local environment. The devising of lightweight, easy to assemble tools and technologies such as with Micro:bits, has been key to these studies.

The DigitLab, Exeter University

This centre is based at the University of Exeter and its partners include Oxford Brookes, UEA, Royal Holloway and multiple external partners, including government (DSTL), health organisations and service providers and manufacturers. Its PI is Professor Saeema Ahmed-Kristensen. She explained that the centre's goal is to explore how the digital can drive (clean) growth, innovation and transformation in large, already existing organisations.

These transformations and growth mechanisms take many forms. The centre is looking at how organisations can better manage and facilitate the path between digital demonstrators and large-scale implementation of those potential digital enhancements. This includes building secure, trustworthy testbeds to develop and evaluate digital technology and ideas (construction and agritech), to developing the appropriate business models and organisation structures to support digital transformation, as well as developing digital technology to support individuals. Digital innovation is a key theme, with examples including an opensource app and also understanding how best to implement digital services. These can monitor individual health and can enable new diagnosis opportunities and service provision but doing so implies altering the organisations supporting the medical services in question. In the setting of the NHS, the use of mobile data is not only leading to better service design but is also leading to the better design of the working practices of the individuals providing those services. Better health is delivered to the end user and to the worker providing the medical support. Responsible innovation runs through throughout the centre, including recent case studies in agriculture.

Within, Digital innovation, Digit Lab is examining the role AI tools and technologies (e.g. LLMs) might help in product ideation and innovation processes. Here generative AI tools can produce concepts at scale, with human experts and users currently those evaluating these, and have collected a large dataset of both human and AI generated ideas. The research enables an understanding of where effort of LLM are best placed alongside human capabilities to facilitate their adoption, and in particular in sectors such a manufacturing where the use of available LLM are not easily adoptable due to security and privacy.

DECaDE, Surrey University

This centre is based at Surrey University and is a collaboration with Edinburgh University. Its PI, Professor John Collomosse of Surrey, explained that its concerns are the infrastructures of digital content production and distribution. If, at the current time, the digital economy allows multiple parties to engage in economic and cultural activities, the infrastructure for those activities tends to be centralised, Collomosse explained; 'platform' companies (such as Apple, Alphabet and Microsoft but many others too) provide the majority of these centralised systems and, in the process, constrain to their own advantage the digitally mediated activities in question. DECaDE asks what would be possible if the infrastructure were itself decentralised? Could this transform the digital economy?

Like all the DE centres, DECaDE is multidisciplinary, with contributors from computer science, management science, design and law, amongst others. Professor Collomosse illustrated its research with the case of digital rights, or more particularly with the notion of provenance in the digital world. He asked whether manipulated images were misinforming or were they misattributed? He asserted that most were the latter, and if misattribution were seen then many of the problems of misinforming would abate. If content – whatever it might be, an image, some text, an output of some computer activity - has metadata that describes its provenance, then that metadata can ensure that when the content it used, its history, and such things as ownership, purpose and value would be made visible. Metadata is one technique, fingerprinting another, watermarking a third. The consequences of these properties - and even the willingness of parties to endow them on digital media - is not simply a computer science problem, but has implications for organisational and individual actions, for legal notions to do with digital artifacts, and for post hoc matters of accountability and hence the law and finance.

CAMERA, Bath University

The Centre for the Analysis of Motion, Entertainment Research and Applications is based at The University of Bath with an extensive network of partners in industry and academia. PI Professor Neill Campbell explained how the centre was initiated to take cutting-edge technologies from the entertainment sector, perform novel research and create technologies and tools for the capture and analysis of motion. Refracting this technology and know-how through the lens of world-leading fundamental research in Computer Vision, Graphics, HCI and AI disciplines has enabled the centre to craft solutions in areas as diverse as sport, health and rehabilitation, psychology and entertainment with real-world impact. Campbell illustrated how CAMERA work at the intersection between research and industry across three core areas - Creative Science and Technology, Human Performance Enhancement, and Digital Health and Assistive Technology.

From applying machine learning (ML) for faster image capture and transfer in film sequencing to underpinning the visuals using motion capture for a reimagined Puccini's Madame Butterfly experienced and toured in Virtual Reality (VR) CAMERA has supported the development of award-winning art and artists since its inception and become a leader in the UK for research and training in the innovative creative industry sector. Spanning physical, sporting, and performance enhancement, CAMERA is creating new ways of capturing data 'in the wild'. Environmentally robust and unobtrusive methods deliver meaningful end-user feedback to support athletes, such as Team GBs skeleton bobsleigh team, in achieving next-level potential. Whilst elite sporting performance fuels research at one level, accessibility remains the heart of CAMERA's mission. CAMERA is working with collaborators from the NHS to the MOD to better record, understand and combat physical limitations through illness and injury. One example includes transforming healthcare solutions by developing new interventions including gait retraining using motion capture to relieve osteoarthritic pain and inflammation and the development of motivation and guidance apps such as iKoala, helping reduce knee pain by 50%. CAMERA has now been incorporated as a Core Research Facility, becoming a permanent part of the University of Bath. As gateway to the university, CAMERA is a vital connector between emerging technologies and their application in research or commercial projects. Its unique infrastructure—featuring four integrated systems (volumetric capture,

photogrammetry, motion capture, and virtual production stage)—and exceptional research capabilities continue to set it apart from comparable centres across Europe.

HORIZON, Nottingham University

This centre is based at Nottingham University. It is led by Professor Boriana Koleva and Professor Derek MacAuley. Professor Koleva presented an overview of the Centre. She explained that the centre's concern is with data, or rather that it was when it commenced some fifteen or so years ago but is now concerned with how data comes to be trusted through the blending of data with real artifacts and processes in ways that shifts social processes as well as technical ones. Its research consists of studies into these, into experiential products and into digitally augmented tangible goods. These research topics spill out into questions about how products can be operated within complex social settings, how they need to be trusted and how the physical and the digital can be integrated effectively.

All these themes require cross disciplinary research, Professor Koleva explained, with co-production and user-centric approaches being central. Examples of research included a digitally enabled story-telling application for professionals and children; the cultural framing of adaptive movies - where the narrative reacts to audience preferences; and the personalising of consumer products developed through interaction with generative AI. In the latter case, the source of the data is the user themselves, and thus requires that user to understand how that data is produced, how it is processed by the generative AI tool, and how this in turn might lead them alter their actions to lead to generative outputs that are more appealing. All of this research needs a combination of computer science engineering and user research, and hence cross-cutting disciplinary thinking. This thinking also produces cross-cutting themes such as those to do with mental welfare, as regards responsibility and ethics, and for sustainable living.

Professor Koleva ended her presentation by remarking on how HORIZON invests in new structures and career paths for its staff, with 'transitional assistant professor' roles enabling moves across and between business and academe.

Centre for Digital Citizens, Newcastle University

This centre is led from Newcastle University by Professor Dave Kirk, Professor Abi Durrant and Professor Pam Briggs (Northumbria University). The CDC is concerned with how digital tools and technologies can enable smart, data rich living in urban, rural and coastal areas, with the digital needing to be part of long-lasting social changes.

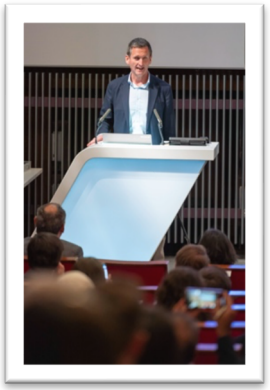
This general theme unpacks into various specific topics that include such things as ageless learning, where the digital can enable continual engagement with learning whatever the point in a person's life cycle. Crucial here is to link the digital to relevant social processes which vary and evolve dependent on this life cycle and the community at hand. Another topic is looking at how individuals can be connected to each other in their communities and to the political and government structures for those communities – both local and central. Here the term 'digitally enabled citizens' labels more than a set of web enabled tools for citizen-government connection, as processes for eliciting and understanding modes of engagement. The digital can enable engagement as well as foster separation, depending on how effectively the systems in question are designed and how well integrated they are to the social practices of which the citizen-government nexus is a part. In addition to allowing for diversity in engagement, solutions also need to be safe, as well as equitable in their consequences. They need to ensure that individuals remain healthy even as digital tools can foreground matters of, for example, their mental health and what that implies in terms of government assistance. Having care assistance at home provided by the local government can highlight questions of status, and in some circumstances can lead to stigma. Needing health assistance is not just a medical matter; it is a social one too.

Within the CDC, all attempts to explore notions of the 'well citizen', the 'connected citizen', the 'safe' and the 'ageless citizen', are examined through co-design, with participatory platforms and data-driven technologies providing an infrastructure, but not a constraint, on what are offered as designed solutions. Providing these solutions and testing them in real world conditions inevitably entails multidisciplinary approaches.

Afternoon Keynotes and Panels

Keynote on Regulation and the Digital

The DE centre presentations were followed by a keynote by Lord Holmes on the subject of legal governance and the digital economy. His Lordship spoke on the nature of legal frameworks for the digital and, in particular, to do with personal data and its management and the use of the same by corporations. He remarked on how many of the frameworks of governance for corporations and business were devised long before the full implications of a data rich society were imagined or thought through. Indeed, many of the legal frameworks applied to questions about data need independent state level management; that is to say legislation, but the nature of the legislative process can make law 'untimely'. Lord Holmes recounted some of the practical problems of getting legislation into law.



Panels on Digital Economy (DE) Themes

The afternoon sessions were given over to panels where representatives from other DE funded projects and experts on the topic at hand were able to share their thoughts and insights about research that has been and needs to be done.

The first was in an **Equitable and Sustainable Digital Society**, and here Chairperson Dr Rhia Jones asked Dr Helen Thornham, Dr Clara Crivellaro and Dr Bruna Petreca to remark on the various dimensions of these problems. One concern was on ensuring that economics did not continue to determine access to the digital; that notions of what citizenship entails should be supported and expressed in digital tools, and how consumer awareness of matters of sustainability through recycling should be delivered through digital tools.

Professor Damian Murphy chaired the panel on **Content Creation and Consumption**, where Dr Mike Evans, Professor Darren Cosker, Professor Kirsten Cater and Dr Cathy Kerfoot remark. Here, discussion focused on the widening of participants and businesses in the content production context, and the implications this has. These were not just related to 'long tail' arguments (where a single person may consume some content) but as regards regulation and business structure. The role of government intervention was raised and the case of the BBC where content production was not simply measured by marketplace indices in terms of monetary value as through cultural value too.

The third panel was on **Beyond the Data-driven Economy**. Here Professor Roger Maull chaired discussions with contributions from Professor Mike Frazer, Rashik Parmar, and Dr Neelima Sailaja. A number of concerns were raised here, initially to do with what might come to be 'data-rised' (everything!) through the difference between having data driven outputs as against data driven outcomes. Outputs are merely the aggregates that derive from data analysis; outcomes are the policies and interventions that can build on these outputs. Too often data-driven processes produce outputs but no outcomes.

The panel on **Trust, Identity, Privacy and Security** (TIPS) was chaired by Professor Gerard Parr. The panel included Professor Lynne Coventry, Professor Mark Evans and Professor Ben Azvine. Here discussions focused on the persistent problems of privacy and trust, bound up with the continually changing technological landscape and with 'users' of the same often being unaware of the potential threats that invasion of privacy and security entail. Current examples from the NHS were naturally central to the discussion.

The Digital Future: the view from the UKRI

The symposium next learnt about the perspective of the ARHC on the digital future, or rather how the arts and humanities are factored into the UKRI's research funding plans. Professor Chris Smith, executive chair of the AHRC, set out the context of the UK research councils, and how they aspire to enable the UK research community to thrive whilst being fully inclusive and engaged with communities and business. The UKRI plans to spend equivalent of 2.4% of GDP between 2022 and 2027. Its research investments are structured around themes and objectives, with cross-disciplinary work required to tackle large scale complex problems - such as better health, security and resilience, for creating opportunities and improved outcomes and for a greener future.

For example, security and resilience can be better understood and achieved through digital twinning techniques and research, with the Twinning Network Plus being run out of the Turing Institute and three universities (Cambridge, Exeter and Ulster). Future energy systems will be investigated through digital twinning techniques at a project in Strathclyde University. For another, creating opportunities and improved outcomes is illustrated with BRAID, a University of Edinburgh led project on AI and its 'eco-system'. Building Responsible AI Divides (BRAID) looks at how to make AI more responsible through notions of accountability and answerability. The project will fund the build of demonstrators of these goals and ensure along the way that these demonstrators go through processes of co design, amongst other concerns.

Along with this project the UKRI is funding projects on data, with the Smart Data Research programme, led by the ESRC, supporting £59.5 million of research on 'data' between 2022 and 2029. Here the presumption is that data is produced through everyday interactions and can enable insights into the nature of society and its constituent features. Just how, and with what methods and tools remains unclear, and with the complexities of rights of data access compounding concerns.

Conclusion of day one

The day ended with a short plenary discussion led by Professors Koleva and Ahmed-Kristensen. Open discussion remarked on the persistence of questions to do with privacy and trust.

Day Two

The second day of the symposium had an *invited* audience primarily drawn from the staff of the six DE centres incorporating some 80 researchers from across the UK. The aim of the day was to provide further enhanced networking opportunities and to provide a forum for discussion of emerging and developing areas of research interest that build upon the activities of the DE portfolio funded researchers. The day was structured around an 'unconference' approach to allow for the bottom-up generation of the day's agenda from amongst those attending.

Opening talk – The Digital Technologies Landscape for UKRI

To set the scene from the perspective of the existing research funding landscape the day was opened with a talk from Dr Kathryn Magnay, EPSRC Deputy Director in the Cross Council Programmes Directorate, offering an overview of the current funding intentions and how these variously map onto current, medium and long-term research themes and plans. This included discussion of existing funding allocations by research councils, highlighting of strategic themes and a discussion of UKRI activities in the DE space, with specific reference to how EPSRC delivers UKRI strategy through relevant programmes relating to Digital Futures and AI, Digitalisation and Data.

There was much presented on the ways in which the DE programme has led to lasting impact in terms of how research is funded, supported and delivered and how this is, for example, being fed into the very active programme of AI-focused research that is currently being launched. There was also reference to future opportunities through Smart Data Research UK, and the embedding of 'digital society' in EPSRC themes. The talk concluded with a call to the DE community to continue to engage with wider disciplines to explore how a DE perspective can be brought to bear on the challenges of digitalisation.

Identifying key research questions for future DE-type research

After the opening talk, Professor Kirk (Newcastle) led the audience in an exercise where audience members were invited to write down and share their emerging research interests and ambitions, focusing on topics of particular concern over the next five years. These insights on topics of interest were shared on Post-it notes and laid out across poster boards in one of the larger Institute rooms. This activity created several hundred individual responses. The audience was then invited to come together to conduct an at-scale affinity mapping process, in which the audience began to align the individual responses into clusters of interest. Whilst the audience then broke for refreshments, the DE Centre managers came together to collectively further refine and group these clusters into a set of five working themes which could form the basis for topics of discussion in breakout rooms. The five generated themes for discussion from this process were: Digital Health and Well-being; AI Trust and Transparency; Creative and Cultural Economies; New Perspectives on Data; and Radical Computing.

Breakout sessions

Through two rounds (before and after lunch) the audience of day two were invited to join the named breakout rooms to engage in discussion around the highlighted themes. This offered an opportunity for deeper reflection on the data generated in the clustering exercise in the morning. It allowed participants to find points of connection with other researchers and to extend discussion around these themes to help chart future critical research agendas that fall within each of these broad thematic areas and that offer opportunities for new and emerging research topics and collaborations. Participants were able to move rooms between the two rounds, thus ensuring that participants had freedom to offer discussion around multiple areas of interest. DE Centre leads facilitated each of the breakout room discussions and supported notetaking. They stayed associated with one thematic area to provide some scaffolding and consistency of

discussion between sessions. After each round there was a phase of collective feedback from each breakout room to the broader audience of participants.

Below we sketch out key discussion topics raised and addressed in each of the breakout rooms over the course of the day – combining notes from each of the two rounds of discussion. It should be noted that in each case discussion may have addressed substantive areas of active and ongoing research and that the people discussing these topics were experts in their diverse fields (as befits the multidisciplinary nature of DE research). Hence some of the concerns raised were technical in nature, and not as might have emerged from the concerns of the general public whose interests might have been wider.

Digital Health and Well-being (facilitated by Professor Boriana Koleva)

A wide-ranging discussion covered several areas including barriers and opportunities for research, a variety of specific topics and application areas emerging of interest and with some specific concerns for how research can address issues around well-being in the workplace and well-being in academia.

Of note was a concern for the ways in which research questions in this space are formulated. Participants were keen to highlight the extent to which productive research questions around digital health and well-being must not only be user-centred, but actually stem from substantive and significant engagement with communities themselves.

User-driven research should be supplemented with community driven research. The ideas and notions of how we might define health and well-being, it was argued, should stem from communities, who should be scaffolded to help derive their own health and well-being agendas and with the support of researchers be able to shape research agendas – especially in the context of development of supportive technologies. This would arguably help address the health and well-being challenges that they see as vital to their lives. This was in particular seen as an important step in moving away from the provision of further digital interventions which weren't grounded in real need. Besides this, well-being is not just a matter of physical and mental health; it can be spiritual too. Hence understanding the values of communities is vital.

There was discussion of the importance of developing sustainable solutions with critical stakeholders including the NHS to ensure that research projects deliver long-term value. It was noted that this might require more "Slow Science" in which research activity and funding is paced to support longer-term engagements and that this should dovetail with broader public engagement and policy making activity – aligned with, or embedded into, the research[1]. **Slow science might deliver more sustainable longer-term impacts.**

Other emerging topics in the space included exploring green prescribing and supporting engagements with nature; scaffolding the connections between health and well-being (in ways which might support proactive healthy living rather than ill-health management and response); and this was also further tied to factors such as urban design and thinking spatially about the role of digital technologies in supporting the design of health and well-being focused environments (both natural and built). There was also discussion of data and AI (in particular AI literacy) and the personalisation of data-driven healthcare and the ways in which this can support and engage end-user communities, again supporting proactive lifestyle choices for supporting lifelong health.

Discussion in the second session highlighted the workplace. Health is not just a matter of domestic and private life, but professional life too. The work setting is a location in which there are productive future avenues of research as a site of intervention for research. Picking up on previously discussed topics there was further discussion of the ethics of interventions and the extent to which AI and data-sensing might support personalised health monitoring and intervention in the workplace – as this raised notable challenges around how designed interventions in the workplace should not focus on productivity and efficiency metrics alone – especially where well-being interventions are being advocated. **Well-being and health are all the more important to ensure when AI increasingly suffuses the workplace both as tool for research and for a tool in work**. There is a further responsibility on researchers to effectively communicate this through the conduct and dissemination of their research.

[1] Of note – it is relatively rare for NHS and/or policy engagement to be scaffolded by UKRI – this activity is more generally expected to be driven by the academic community through proposal and consortium generation, which is inevitably a barrier to entry for emerging research groups.

There was also discussion on health and well-being within academia, with a call to ensure that Universities and funding bodies (such as UKRI) engaged seriously with issues of researcher well-being. This could include renewed focus on work-life balance, career pressure, deadline setting, impacts of the review process (both workload and emotional in terms of recipients). There was also suggestion that well-being support should be embedded into early career research programmes, and there should be better flagging, awareness and support around engagement in sensitive research topics (which might have emotional impact on researchers). These issues should be further embedded within the EDI concerns of institutions.

AI, Trust and Transparency (facilitated by Prof Neill Campbell)

The first session on AI Trust and Transparency revolved around several key areas. The first foregrounds the challenges of enabling people to understand and explore the extent to which they currently frame AI in very human terms, especially with regards to discussions of ideas of trust, accountability and responsibility. Comparisons were made with tools, such as a hammer, where notions of accountability and responsibility make little sense. A far-reaching discussion noted how trust is something developed through experience, when framed in relation to the use of tools: use teaches trust and trust is then deployed for greater use of the tool. Trust is thus reflexively constitutive of action. More advanced services delivered by experts – such as policing, the legal system, medical care etc., also rely on a similar reflexivity, but here through socially derived indicators of esteem and reliability. The human sense of trust requires the navigation of a complex pairing of social signalling and learned insight married through reflexive processes of action, and which was argued it is potentially risky to try to replicate as a feature of interaction with AI systems through simply asserting that the AI technology 'is' trustworthy. Trust needs demonstrating ongoingly. A related area of discussion addressed the challenges raised by the speed of propagation of AI and its decision-making capabilities, and the extent to which this is out of sync with human decision-making capacity and hence can lead to an undermining of trust. There were suggestions that the speed of AI might need to be throttled to better enable human-in-the-loop decision making, as speed is a transitive property of trust – and should therefore be embedded as a key characteristic of consideration in the design of AI systems.

In summary, research needs to look at how AI systems can be designed to continually show and hence justify trust, including into the tempo of AI functioning and the speed of its introduction into human settings.

This led on to another theme in which the potential role of technological 'moderators' as a researchable object was discussed. Questions were raised as to the nature of these moderators their processes of moderation, and the ways in which they may be trained. It was also asked whether they might act as Privacy-Enhancing Technologies (PETs), mediating on behalf of users when dealing with more than one AI driven systems. Building on this, challenges were noted around the ways in which such technologies may seem 'black-boxed', and how this might affect the brokering of relationships between people and third-party agencies – companies, governments, and so on. **Would such AI moderators reduce or exacerbate socio-economic inequalities?** This is currently seen with human moderators in the current legal system where the person who can afford the better legal team is more likely to win in any given legal dispute.

In the second AI and Trust breakout session, there was further discussion of the nature of trust. There was again discussion of how we might go about training generations of people to better understand trust in relation to AI systems, and the ways in which this might necessarily lean on our socialised processes of learning to trust others and to recognise trust indicators, and/or develop awareness of the mechanisms (these indicators) through which we come to trust brands and institutions and the ways in which this insight might be leveraged to help foster trust in AI systems. (Although it was noted that overreliance on 'brands' may work at the exclusion of innovation and force out less prominent 'voices' in the tech ecosystem). There was also discussion of the different natures of diverse AI systems, for example robotics systems relying on sensor-based data having a fundamentally different kind of trust profile compared to something like a Generative AI (GenAI) system which is trained on internet data.

Considering the above, across both sessions it was felt that the question of 'AI and trust' reveals more about the fallibilities and the socialised nature of people and the ways in which humans build trusted relationships with each other. These processes cannot simply be transferred to a machine. However, there is evidently much that could be learnt from our human, socialised processes of inculcating trusted relationships for relations with machines. But these relations might not be best thought of as similar or even analogous. The discussions surfaced the ways we are currently approaching AI and that we are consistently applying a 'social' term to the technology – reflecting a change in our relationship with computers, towards more socialised relationships with them and expecting them to have enhanced kinds of agency in

those relationships. This may need investigating: it may not be that human-to-human trust is the right model for human-AI interaction. But if it is not, **what might the trust that people need to have with AI look like?**

Creative and Cultural Economies (facilitated by Professor John Collomosse)

In the creative and cultural economies breakout discussion participants broke the discussion down into three areas of significant research interest.

The first of these was discussing provenance and the extent to which, within the digital economy, technology is supporting people to understand where digital content comes from, how it is created, who has made it and the effort expended in its production. This included discussion of how and why people place value in digital content and the need for recognition of creative effort (attribution and to combat potential sources of dis- and misinformation). There was also discussion of scale and the extent to which co-ownership and co-creation rights could be maintained and managed where effort and co-authorship was at the community and group level. This also extended to thinking through potential for research around new models of ownership and the role of 'data-trusts' within this. These discussions naturally led to consideration of distributed ledger technologies and blockchain models, but also touched on the challenges and opportunities around dealing with new frameworks for remix culture (especially across social media platforms) and the extent to which this affects these discussions of provenance. In summary, these discussions emphasised the need to better understand the nature of value in digital content, and the ways that people understand that value, orienting to it in their practices.

The second research theme area considered the changing nature of the future creative workplace. There was discussion of the nature of intellectual property and the intersecting challenges around GenAI and the ramifications of this technology in creative workflows. Challenges were raised around whether originality and intellectual property are the most appropriate drivers of value/reward and whether GenAI is, or should act as, a disruptor with this in mind. Such technologies were also seen as being situated in an intriguing place to explore the democratization of access to such tools for creative production. This is arguably disruptive to current power hegemonies and may have far reaching consequences for creatives, through either the licensing and relicensing of creative content or the reconceptualization and reconstitution of creative teams /effort and the professionalisation (or otherwise) of creative talent. In short, do generative AI tools

imply a transformation of creative value business structures and individual roles within these? Will these transformations lead to greater equality or less?

The third research theme introduced into the discussion was around how the cultural economy as a whole may change in the future. There was consideration of the ethics around the repurposing of cultural content and there was detailed exploration of cultural heritage and its consumption. This crossed between the digitization and digital reproduction of content and the means whereby value is derived from this digitization and commodification, and the extent to which value may be lost when too much emphasis is placed on the digital, potentially at the expense of engagement with analogue artefacts and experiences. In short, **what is the complex relationship between generative AI and the potential harms and benefits of the technology as regards cultural outputs? Does it diminish the value of the non-digital? Is it creating new cultural cargoes?** Across discussions it was evident that again research value was observed in unpacking and exploring the turn to AI and the kinds of opportunities and tensions it brings to developments in the cultural economy.

New Perspectives on Data (facilitated by Professor Richard Harper)

This first of the two breakout sessions commenced with reiteration of the main claims made about data, and data science more generally - that with 'data' businesses can flourish, and through insights made possible by data, innovations will occur to the benefit of all.

Discussion soon flowed onto matters about data provenance. Who owns data, persons or businesses, affects the nature of the data, its use, and the values that might derive. Some participants suggested that data ends up binding organisations together at the expense of private or individuals and their rights 'to' and 'for' data. This narrows the potential values that data could provide for society as whole – data cookies about website usage service business needs, not individual or social need, as a case in point. This led to consideration of data production. Outside the organisational nexus, with, for instance, the case of self-employed plumbers gathering data about technologies they are servicing (e.g. washing machines) and making that data available to other self-employed plumbers, what comes to be understood as the essential relationship between 'user' and data alters – data no longer becomes a nexus of organisations.

Following on from this, it became clear that questions of provenance were not only to do with ownership. Other criteria could define data types. Are some data local, for example, and only usable locally – reflecting the place or context of their production? Are other data useful everywhere? The latter is most often assumed but does not need to be. Continuing the same analysis, do some data have short shelf life (when they refer to a technology that is soon replaced with other kit, for example)? Discussion then turned to typologies and ontologies of data and to the assertion that not all data are equally valued or easily and usefully composited in 'data sets'. Data are better thought of as produced in ways that reflects particular purposes – Facebook gathers cookies so as to sell screen real estate on its services; it doesn't gather this data to produce objective models of users. Or, rather, it is objective, but for the economic purposes of Facebook. To do anything with that data requires understanding why it has been produced, how, and with what framing purposes. In short, data can be said to be socially constructed - or at least it is social processes that frame the purposes of the data itself. **Are these social purposes of data production more important than the techniques used to process that data? Is AI constrained by these social processes or enabled?** When seen thus, it also became clear that **data ought to be understood in terms of various 'grammars of action' – expressing contexts of production and use.** Research into this would lead to better abstraction in data focused tools and better understanding in the public domain about what data 'are'.

The second breakout session focused on data and education, beginning with questions about whether there is a need for the public to be better educated on what data and data science might be. Some similar remarks had been made in the first session. Discussion turned to whether the term data and its cognate science over-sells what data and data science might be – data is a kind of evidence, computationally gathered, and though this can express analogue dimensions, the terms data and data science nevertheless constrain what evidence is thought to be and hence what science might investigate. This led to discussion of the claims that AI is offering about the use of data in its techniques and processes which seem to suggest that a new era of knowledge will emerge, when it should be clear that these data that AI process are quite limited in scope and that the kind of analysis AI provides is equally narrow. In short, a price that is paid with a focus on data and data-processing technologies is that it limits what counts as evidence. This is not just in the evidence-based trades from science to medicine but may undermine cultural practices that do not make data intrinsic to their functioning. The arts and the humanities can be seen from a data point of view, but not understood in ways relevant to the disciplines themselves. Data enables understanding but limits it too. What are those limits and what price is paid if they are not attended to?

This was followed by examination of the terms and frames of reference used to research data. In the case of schools and digital education, it was explained that using data gathering tools with Year 5 kids (or thereabouts in a cohort) was not best thought as teaching them what data and data science might be, as teaching them that how they orient to the natural world in a more evidence, science-based way. It teaches them to be more sensitive to the features of that world, and thereby make them more like 'naturalists' in their orientation – digital naturalists if you like. With this as a skill learnt at school, they would be more able to appropriate the tools of data science alongside other tools of empirical enquiry when they grew up – for they would recognise that there are many tools in evidence-based thinking, not only data science ones.

Radical Computing (facilitated by Professor Saeema Ahmed-Kristensen)

The final area of breakout discussion was around the notion of radical computing. This area was seen as a vehicle for introducing and discussing new approaches to computing and new areas of the digital economy which had previously been little considered. In the first session much of the discussion revolved around ideas of 'Rewilding the Internet' as one approach to radically altering our conceptions of some fundamental underpinning technology that currently drives the digital economy. The idea of rewilding (drawing on the ecosystems metaphor) was offered as a way of arguing for supporting new kinds of diversity and plurality of providers and technologies in our digital ecosystem. A problem here is enabling this rewilding without it seeming to be a renaming of the dark web. If the dark web is defined by that content which is not indexed by crawlers, how will content be accessed and shared? What new technologies for data finding and sharing will need to be devised? Certainly, moving beyond the crawler/index/browser model will challenge the increasingly monocultural nature of current internet technologies, in which nearly all of it is currently managed by a few companies (with Google, Microsoft, Amazon and Meta carving up the internet, and with Apple and Samsung owning the majority of the hardware platforms for interacting with the mobile web). In short, **what would the technologies of digital rewilding of the internet look like? Will new techniques of data access and sharing need devising or will regulatory factors loosen the monopolistic constraints current operating in the internet?**

There was interest in what would need to happen to foster smaller firms being able to operate in a rewilded landscape (or digiscape), perhaps with more agile supply chains. This was seen as a means to enable greater equality, democratising access to resources across the internet, developing new socio-economic models (computing beyond borders), offering

opportunities to explore how value is created (both economic and societal) and increasing resilience and privacy. How would the current digital platform monopolies be forced to allow this? Through technological innovation or regulatory change? This also further included discussion of more-than-human thinking about radical reinterpretations of internet technologies and was seen as a means of offering resistance to the human-centric algorithms currently dominating much of our experience online.

Within the radical computing session there was also discussion of alternative computing frameworks such as the development of non-Turing approaches to computing, including the emulation of cellular systems, analogue computing and biologically derived (as opposed to bio-inspired) computing. There was also discussion of new models for metrics for computation which move us away from an overt concern with computational enhancement underpinned by efficiencies of speed (temporal framings for computation) towards metrics such as energy efficiency (computational load), alternative data representations and security. Authentication and security itself, was also seen as a critical topic for future research, presenting opportunities for new cryptographic approaches to consider and mitigate the impacts and threats of existing systems and emerging technologies such as fusion, quantum and GenAI. In short, what is the future of computing when computational speed is not the only criteria used to define efficiency and purpose?

And finally, there was discussion of the importance of open-source technologies for innovation and the potential value of open-source for crowdsourcing diversity of engagement with technology and as a source of skills development. Obviously, this further underpins the discussion in the breakout session around the rewilding of the internet, and the means by which this might be done. This is an untapped area of significant potential economic productivity and evident research interest.

EPSRC-led Breakouts

During the breakout sessions derived from the interactive mapping sessions through the main part of the day, both before and after lunch, EPSRC staff led two parallel workshops. In the morning the workshop was focused on discussing how early career researchers might best understand and engage with the EPSRC and their funding schemes and around challenges, barriers and opportunities for engaging with UKRI more broadly. In the afternoon the session focussed on exchanging ideas from DE researchers around best practices for public engagement. This specifically tried to document

and explore what experiences people had of approaches that had worked particularly well for engaging public audiences with UKRI-funded research, and the ways in which this can be further supported through the research councils.

Symposium closing

Day two of the event was drawn together with a brief summary led by Professor Harper (Lancaster), in which the discussion outlined next steps from the symposium, including the preparation of summary report and video. Participants were encouraged to create further networking opportunities across and between the centres. All participants and the EPSRC were thanked for their support and involvement.