Inform II

RESEARCH AT THE
INFORMATION SCHOOL

The power of information

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Written by Richard Spencer and Victoria Wood

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Introduction from Professor Peter Bath

Welcome to the 2nd edition of 'Inform', the research brochure for the Information School at the University of Sheffield. It has been a very exciting time for the School since we published the 1st edition in 2017: we hosted the iConference 2018 and welcomed over 470 delegates from iSchools around the world; we were ranked 1st in the world in the QS Rankings for Library and Information Management in 2018 and 2nd in 2019; and we have recruited a number of new staff to further our research and teaching in the field.

In my introduction to the 1st edition, I discussed how our research in the Sheffield iSchool is developing a better understanding of the power of information in today's world and how information is shaping the lives of people, organisations and society. In this introduction I want to discuss the challenges that society is facing and how our research in the Information School is tackling these issues and having an impact on society.

A major challenge the world is facing is the increasing number of older people. Although people are living longer, the additional years are not necessarily lived in good health, and the number of older people with long-term illnesses (such as dementia, arthritis, etc.) is increasing. Much of the support these people need is provided by informal carers, often family members or neighbours. This work is unpaid, and often goes unrecognised, but the support can be vital for the person with the illness. Dr Pam McKinney and Sheila Webber are undertaking research examining the information needs of informal carers, e.g., daughters or sons of the person or close friends living nearby and who provide care. Pam and Sheila discuss their research into the information behaviours and information literacies of these carers on page 32; given the increasing older population, and the increasing numbers of informal carers, this research will have a major impact for this group of people as well as on society as a whole.

With the demographic changes comes the need to develop a better understanding of health and well-being in populations. How health and well-being can be maintained and improved is a key area of research, and the School continues to have a major impact in this area. Over many decades, the Chemoinformatics Research Group has been collaborating with, and developing software for, the pharmaceutical industry to develop new drugs to combat diseases affecting the health of people throughout the world. The Chemoinformatics group, led by Prof. Val Gillet, undertakes research to utilise the information that is inherent in small and large molecules to develop programs for discovering new drugs that will benefit patients and this is described on pages 40.

Patients who are diagnosed with life-threatening or terminal illnesses and how they are supported through online health forums is the focus of research in the School as part of the "A Shared Space and a Space for Sharing" project, described in the 1st edition of Inform. On page 44 you can see how the research findings are being further disseminated to health care professionals and charities supporting patients, through the play 'A Space for Sharing' and through information sheets, which give advice to people about using online health forums.

“I want to discuss the challenges that society is facing and how our research in the Information School is tackling these issues and having an impact on society.”

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A further challenge the world is facing in the 21st Century is the need to develop more sustainable methods of living and energy consumption. One way this is being addressed is through the development of Smart Cities, whereby cities are designed to utilise data, information and technologies to make them more sustainable and greener environments. One of our new Lecturers, Dr. Suvodeep Mazumdar, talks about his new 'UrbanMapper' project on page 36. The project is developing a network of academics and experts from industry to understand how sensors and digital technologies can improve cities to make them greener places and also improve the health and quality of life of citizens.

These are just a few of the areas that we touch on in this edition of the magazine. Also covered is our research on areas surrounding Open Access, algorithmic bias, food and activity logging, electronic health records and technology foresight.

The future of our society and, indeed, our planet, is dependent on our changing what we do and how we do it: our research in the School is at the cutting edge of efforts to make the world a better, greener, safer and healthier place to live. I hope you enjoy reading about our research and how it is having an impact on the world and society.

Peter A. Bath
Head of School

A Note from the Director of Research

Information Science is a growing academic discipline which offers new perspectives on contemporary, real-world challenges.

The "stuff" of our subject is constantly in the headlines. From fake news and the recent accidental data losses by MySpace, to algorithmic bias, digital detox, and big data and AI.

In essence, in Information Science we open up the "black box" of information, data and knowledge. We investigate the processes around the creation of data, information and knowledge; how they are shared and used; how they are managed (or not managed!); how they are stored and preserved (or not preserved!). Of course, information is increasingly digital, but the subject continues to encompass all forms of data, information and knowledge — be that in printed texts, tacit knowledge shared through conversation, or traditional cultural expressions.

We are interested not solely in the technical aspects of data, information and knowledge, but the range of social, policy, economic, legal and ethical aspects. So our approach is distinct from computer science with its focus on computing technologies. We explore more broadly the relation of people to computing power. Yet our approach is also distinct from a sociological take on the digital because we engage directly with the practicalities of the technology.

Thus our research relates to everyone's lives

- It explores everyday information behaviour and practices - how people go about fulfilling their needs for information in different contexts and their information literacy to understand how to evaluate and use information;

- It investigates usability and trust in information, whether it is acquired through text or images, from other people, online or offline, or even from a robot or an intelligent agent;

- We explore the transformational impact of ubiquitous and personalised search and information retrieval on the web and on our mobile devices;

- We are fascinated by the way that people appropriate ICTs in unexpected ways, use them to support each other in natural disasters or when they suffer from life-threatening conditions, and the value they attach to the preservation of their digital possessions.
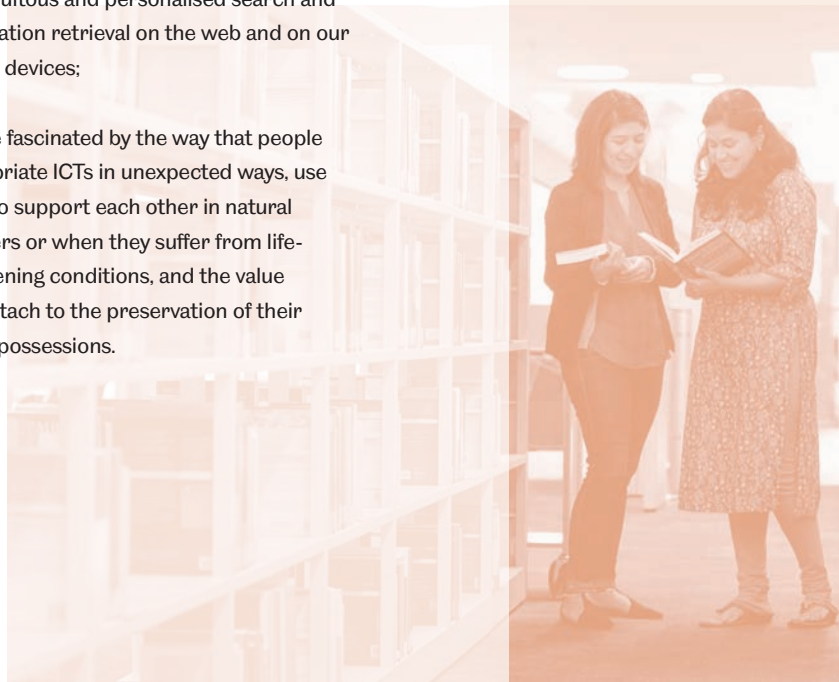
Information is critical for organisations of all types

- In this context our research investigates information governance to manage data, information and knowledge as a strategic asset;

- The role of information and knowledge sharing and absorption in innovation;

- Technology foresight and the strategic management of technology;

- The social impact of new business models such as those based on e-commerce or crowdsourced labour;

- We are also working to explore the potential of ICTs for development in the global south and for sustainability.

We are concerned with how knowledge is generated and circulates

- Our research looks at the role and the future of information services such as libraries to provide free and equal open access to knowledge - and to the unique role they play in achieving social justice;

- We are interested in new forms of digital scholarship and the insights of "research on research";

- We reflect critically on the impact of the new uses of data, information and information systems on wider society, and the issues of bias, privacy, inequality and power these raise.

To explore these questions we use a rich and innovative range of research methods: From big data analysis and visualisation applied to social media, or finding new chemical compounds for healthcare; through to auto-ethnographic studies and creative, participatory methods; and to work inspired by critical theory.

Interdisciplinary, diverse and collaborative

- Colleagues work collaboratively and in an interdisciplinary, multi-professional way across our seven research groups, and with a community of PhD students and research staff.

- We are international through being part of the global iSchool organisation and have strong links around the world from 50 years of being a world leading department in our field – with other information scientists but with scholars in many other fields too.

- Knowledge Exchange is an important aspect of our research. We have helped create new pharmaceutical products, offer foresight to SMEs and influence policy on open access.

- We are a unique kind of partner for your research, as a bridge and catalyst, spanning the range.

"Our meta-discipline of information science addresses fundamental questions for human futures and seeks creative solutions to the challenges of our time."

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I do hope that you enjoy the latest showcase of the excellent research undertaken by colleagues presented in this issue of Inform. The general public seems to have a growing awareness and concern with the issues that are addressed in our discipline and how information and data affects them and those around them. That makes it an exciting time for the School and we hope to build on our research and practice to empower people, organisations and society to use information, data and knowledge to shape an increasingly dynamic and complex world.

Dr Andrew Cox
Director of Research

Research Highlights

SEPTEMBER 2017 - MARCH 2019

Funding has come from:

- Arts and Humanities Research Council (AHRC)
- Economic & Social Research Council (ESRC)
- Defenition Limited
- Department Of Health
- European Commission - Horizon 2020
- Higher Education Funding Council for England - Indutrial Strategy
- Higher Education Innovation Fund
- Research England - QR GCRF - Pump Priming Awards
- Society of College, National and University Libraries
- The West and Central African Research and Education Network
- UK Research and Innovation

Top 5 places for publication:

1. Lecture Notes in Computer Science - 17 Publications
2. Journal of Documentation - 10 Publications
3. Journal of the Association for Information, Science and Technology
4. CEUR Workshop Proceedings
5. Aslib Journal of Information Management

Publications:

2 BOOKS **1** BOOK REVIEW **19** CHAPTERS **51** CONFERENCE PROCEEDINGS **1** DATASET

1 EDITED BOOK **114** JOURNAL ARTICLES TOTAL OF **189** PUBLICATIONS

Citations:

543 CITATIONS SCOPUS **589** CITATIONS DIMENSIONS **319** CITATIONS WEB OF SCIENCE

39 CITATIONS EUROPE PUBMED CENTRAL TOTAL CITATIONS **1490**

- In September 2017, Professor Emeritus of the Information School and leading figure in the information field Tom Wilson was awarded the ASIS&T (Association for Information Science and Technology) Award of Merit, the Association's highest award, for his contributions to the field.

- In October 2017, Sheila Webber was awarded Honorary Fellowship of CILIP, the library and information association, in recognition of the impact of her work and positive influence on the information field.

- In May 2018, Professor Peter Willett was celebrated at the 11th International Conference on Chemical Structures. The final session of the conference was chaired by Professor Val Gillet, and celebrated Professor Willett's outstanding contributions to the Chemoinformatics field over 40 years.

- In November 2017, Dr Jo Bates was invited to join the editorial board of Big Data and Society, the leading journal in the field of data studies.

- Two of our research projects were featured in UK Parliamentary publications. Dr Paul Reilly's CascEff research report on the role of social and traditional media in crisis communication was cited by the Office of Science & Technology POSTnote 564 in November 2017. Additionally, Professor Peter Bath and Dr Sarah Hargreaves wrote an article about their Space for Sharing project for The House, an apolitical weekly publication distributed to every MP and Peer in Westminster in March 2019.

- Dr Jo Bates, Dr Alessandro Checco and Dr Gianluca Demartini won the Best Paper award at the prestigious Human Computation (HCOMP) conference in July 2018 for their paper on crowdsourcing.

- 15 students successfully completed their PhDs at the Information School between September 2017 and March 2019, including Lecturer Dr Pam McKinney.

- The School funded three Graduate Teaching Assistant (GTA) scholarships in 2019, funding students to work up to 180 hours of paid teaching alongside their studies. Of the 12 applications, students Jenny Hayes, Stefan Hodson and Zhixue Zhao were successful and joined us this year.

- The School hosted 7 visiting researchers: Dr Amon Rapp (University of Torino), hosted by Frank Hopfgartner; Huang Yingsheng (Nanjing University), hosted by Dr Andrew Cox; Galen Ives, hosted by Prof Peter Bath; Dr Jahna Otterbacher (Open University of Cyprus), hosted by Prof Paul Clough; Dr Josephine Nabukenya (Makerere University), hosted by Dr Pamela Abbott & Dr Laura Sbaffi; Xiaofeng Liu (Nanjing Forestry University), hosted by Dr Ziqi Zhang; Dr Carlo Lancia (Leiden University), hosted by Dr Alessandro Checco.

- The School hosted 20 research seminars over the past two years, including talks from academics from Universities across the UK, Universiti Teknologi MARA (Malaysia), Syracuse University, Cortical.UI and the National Archives.

- In August 2018, Dr Paul Reilly and Dr Ioanna Tantanasi published an article on social media in disaster zones for The Conversation UK.

- In January 2019, Dr Antonio de la Vega de León attended the first data hack organised by Sheffield Data For Good, which brought together data enthusiasts to work on data from Sheffield homelessness charity Roundabout. The event was partially organised by MSc Data Science student Sarah Miller.

- In February 2019, Dr Dave Cameron took part in a panel discussion on social robots and loneliness, hosted at Manchester Cathedral by the Lincoln Theological Institute. Dr Cameron was also quoted in an article in The Telegraph on the same issue.

- In March 2019, Professor Paul Clough presented a talk with Professor Helen Kennedy (Department of Sociological Studies) for the Department of Work and Pensions, discussing the implications of apps, smart devices and other digital services on everyday issues such as gender, race, health and equality.

- The Eighth Joint Sheffield Conference on Chemoinformatics will be held at The Edge, 17-19 June 2019, organised by Profs Val Gillet and Peter Willett and Dr Antonio de la Vega de Leon. There will be around 140 delegates including researchers from the pharmaceutical and agrochemical industries, software companies and academia, from all around the world, addressing cutting edge research into the development of software techniques for the discovery of novel drugs and agrochemicals.

iConference 2018

In March 2018 we welcomed more than 450 delegates from around the world to the iSchools' annual international iConference at the University's Diamond building. It was the first time the conference has been held in the UK and, as the first UK iSchool, we were privileged to be able to host the event, with the iSchool at Northumbria University.

More than 420 of the iConference's delegates hailed from outside Sheffield, with people travelling from North America, China, South East Asia, the Middle East and Europe to attend the event at the University.

The iConference has grown year-on-year since the series began in 2005 and brings together thinkers and leaders from academia, industry and not-for-profit organisations to discuss emerging challenges and potential solutions for information and data management.

We also were proud to present delegates with the first issue of Inform Magazine, which was a popular addition and provided some great talking points!

"The keynotes were real highlights of the iConference", says Professor Val Gillet, Conference Chair and Professor of Chemoinformatics at the Information School. "We had three well-known figures in the field summarising their work and giving their perspectives on different aspects of the information field. The iSchools organisation often talks about the triad of information, technology and people, and we chose keynote speakers to focus on each of those three. They did an excellent job of addressing these different aspects of our field."

Professor Gillet added that "The response has been really positive" to the 2018 conference. "Lots of people really liked the venue and Sheffield as a place, and there have been lots of positive comments on the organisation and content."

"It's been a very positive event for the School, especially within the iSchools organisation", says Professor Gillet. "It was a great chance to showcase some of our facilities, our work and our PhD students – many of whom acted as volunteers, and did a fantastic job. Sheffield has a great reputation already, but many people hadn't had a chance to visit before."
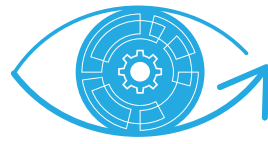

"Lots of people really liked the venue and Sheffield as a place, and there have been lots of positive comments on the organisation and content."

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# Setting Out Paths to Digitise Industry

REGIONAL TECHNOLOGY FORESIGHT

Regional Technology Foresight: Helping regions across the UK identify and make the most of technological innovation.

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The manufacturing industry continues to play a fundamental role in advancing the UK's economy. This is happening at the same time as a new industrial revolution, driven by emergent generations of digital technologies that transform products, processes and business models, and ultimately create novel industrial patterns. Across the UK, there is greater recognition that a resurgence in manufacturing and industry can enable regions to create jobs and grow economically. However, without the adequate capacity to identify innovation-driving technologies and integrate them into industry, regions will face stagnation and severe competition from other parts of the world.
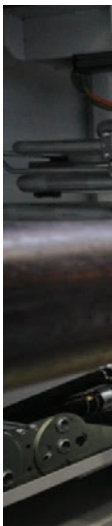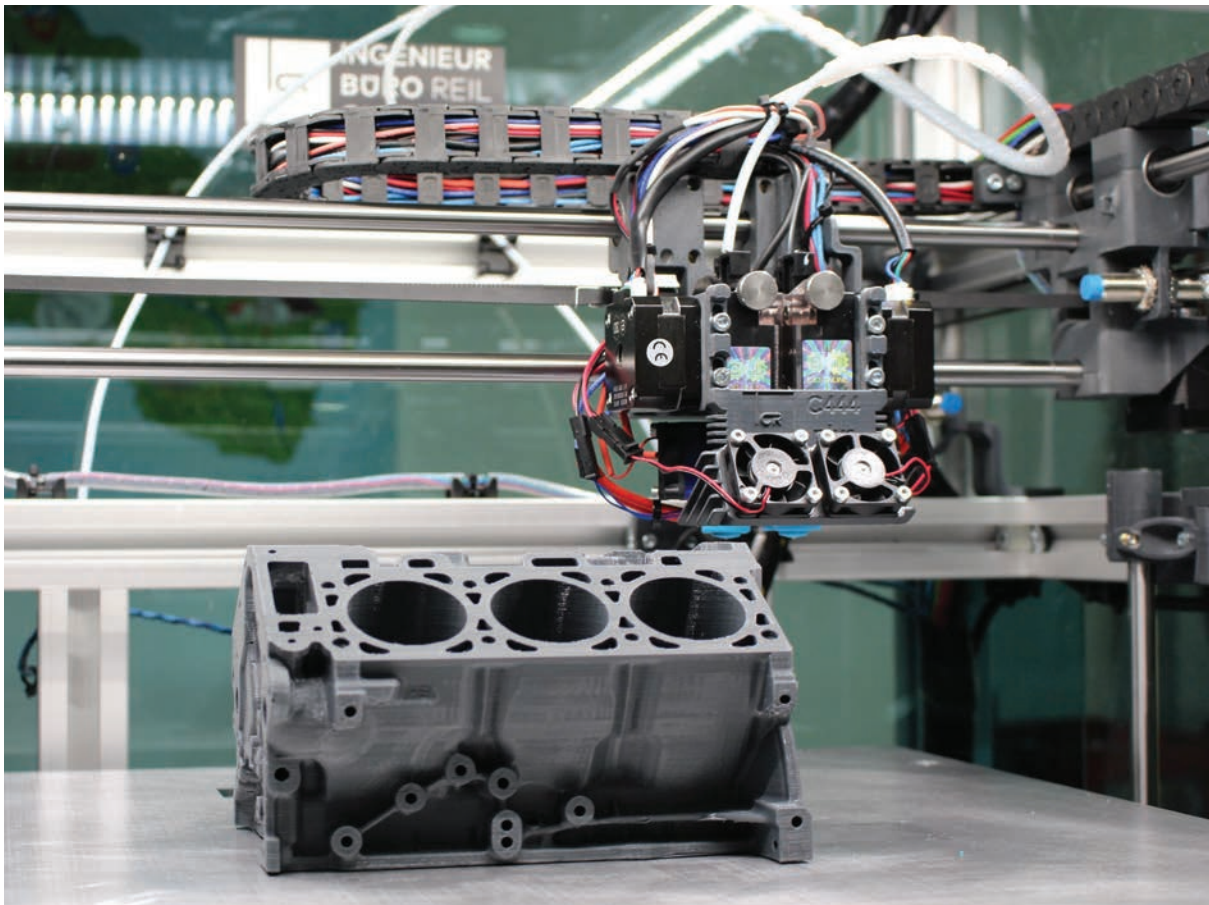
The Regional Technology Foresight (RTF) project is funded by the Economic and Social Research Council (ESRC) and coordinated by Dr Jorge Martins and post-doctoral researcher Dr Ivan Rajic at the Information School, alongside Professor Tim Vorley from the Management School. The project aims to tackle the challenges industry is facing through creating and mobilising a network of key stakeholders in the advanced materials and manufacturing sector. Through doing this, the project will develop a future-oriented dialogue, and through engaging with the institutional infrastructure leading the production and diffusion of transformative industrial technologies.

Working closely with firms, policymakers and innovators in the Sheffield City Region, the Regional Technology Foresight project is developing a set of practices and processes for identifying, transferring, and integrating technological innovations that can help regional firms maximise their capacity and capability. Advances in technologies such as the Internet of Things, cloud computing, data analytics and robotics are driving change in the advanced manufacturing and materials sector, but major efforts are needed to adjust to the challenges and maximise the opportunities. "The challenge ahead is for the industry in UK regions to seize fully and swiftly these digital opportunities. This is essential to ensure their competitiveness and stay ahead of the curve", says Dr Jorge Martins.

The sustained attractiveness of the Sheffield City Region as an internationally-recognised manufacturing hub will not be driven by lower wages, but instead by the quality of its human capital, its firms' innovative capacity, investments in research and development and technology leadership. Dr Martins says "It is the right time for a future-oriented reindustrialisation. This needs to help firms, public authorities and researchers make the most of the opportunities afforded by new technologies. The only way to achieve it is through linking up national and regional initiatives and, through strategic partnerships and networks, identifying which transformative technologies we should be boosting investment in".
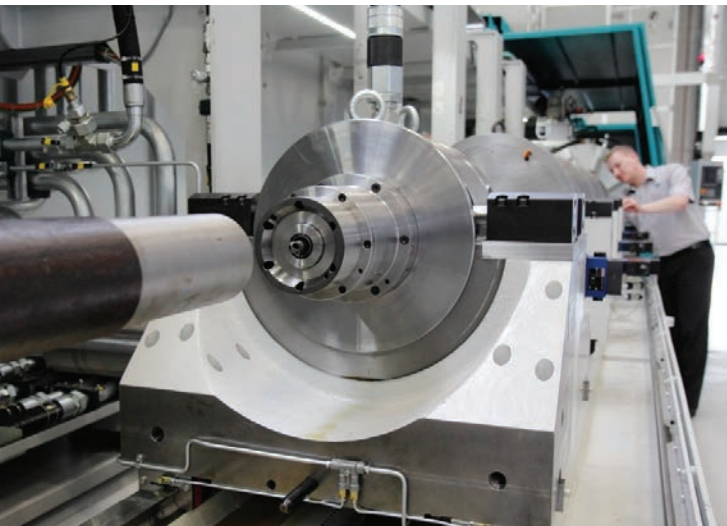
"It is the right time for a future-oriented reindustrialisation. This needs to help firms, public authorities and researchers make the most of the opportunities afforded by new technologies."

The two-year project began in May 2018 in Sheffield, and the team are focussed on identifying firms' needs and requirements and matching them to transformative industrial-technological opportunities. The process supporting these goals is a technology foresight exercise that is being co-produced in the Sheffield City region, involving firms, policymakers, academics and both national and international industrial technology experts. Once finalised, the technology foresight process will benefit the Sheffield City Region and other UK regions, as they will be able to use it as tool to periodically explore technological trends and set up priorities for investment in science and technology.

To achieve these goals, the project benefits from a broad and inter-sectoral network of partners that includes firms in the Sheffield City Region, the Advanced Manufacturing Research Centre, Innovate UK, the Confederation of British Industry, the Sheffield City Region Growth Hub and the Finland Futures Research Centre. Dr Martins says, "we stand on the brink of a new industrial revolution, driven by the Internet of Things,

robotics and 3D printing. With this project, we want to open new horizons for industry to become more adventurous, to improve processes and to develop innovative products, but that can only be achieved when you have the right set of actors in a region collaborating, setting the vision and translating that vision into action. The technology foresight process is this project's contribution."

One of the project's goals is to produce a toolkit that will allow other regions outside of Sheffield to adapt for their own needs the technology foresight methods developed during the project. In this way, the impact of the project has the potential to reach a much wider audience, as all regions of the country and beyond develop their manufacturing capabilities to match modern advances in technology.
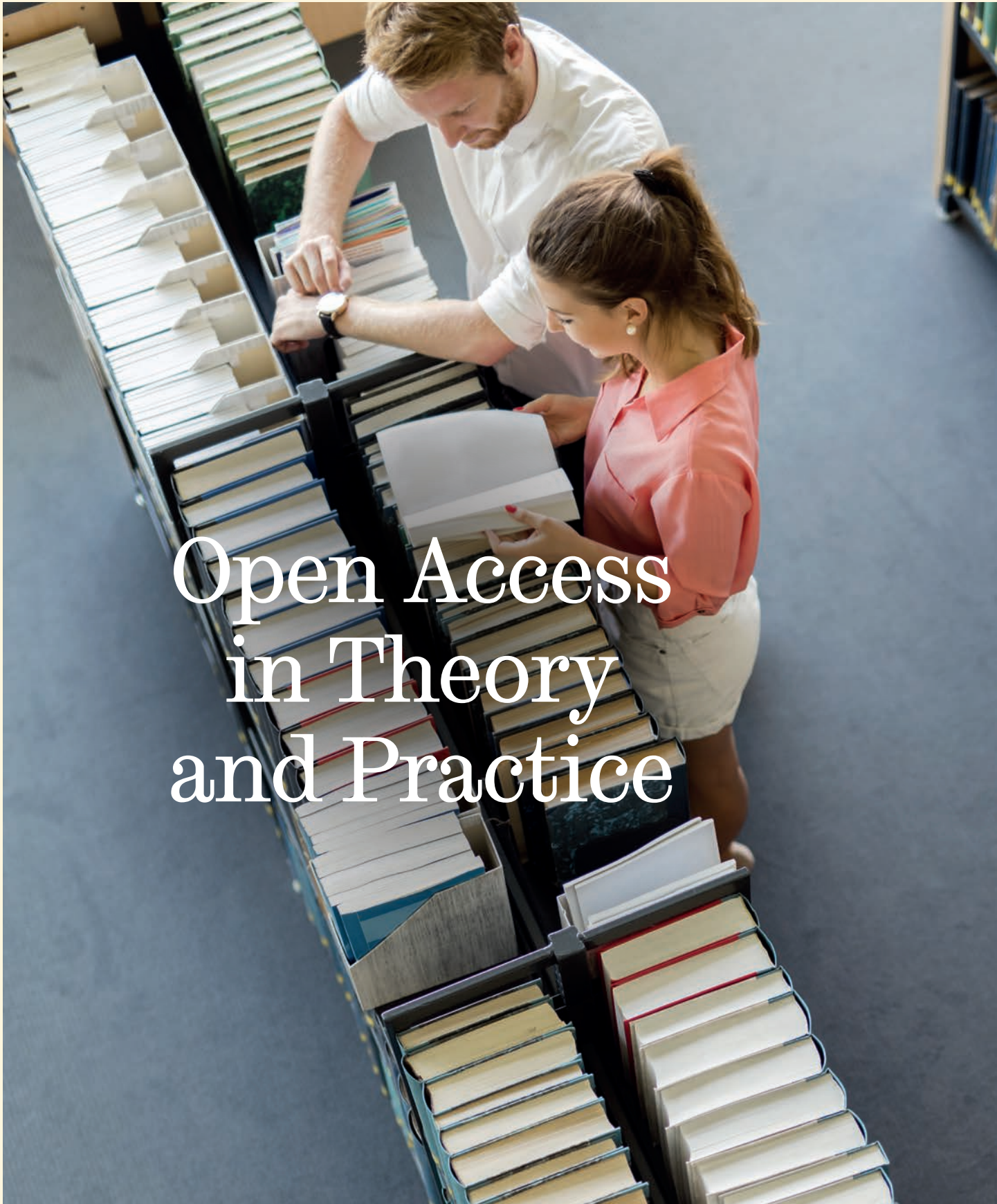
Open Access in Theory and Practice

Open Access, as a method of disseminating research outputs, continues to be a controversial topic in the field of academic publishing. More than that, though, it engenders a renewed focus on a wider issue: the perceived gap between theoretical research and its practical application.

"Open Access has been studied in very abstract, theoretical ways, but is also a high practical policy and practice problem", says Professor Stephen Pinfield, who is leading a project on this very area, with Research Associate Dr Simon Wakeling here in Sheffield, as well as Professor David Bawden and Reader Lyn Robinson at City, University of London. This project is funded by The Arts and Humanities Research Council to run between January 2018 and July 2019.

"As well as Open Access itself, the project is also about the theory-practice relationship in general, using open access as a case study", says Professor Pinfield. The research aims to enable a better understanding of Open Access by understanding how practitioners and policy makers have used theory as a way to understand what they do, whilst also gaining an insight into the theory-practice relationship as a whole. "Is theory something that is abstract and irrelevant to practitioners, or is it something they use and are informed by in the way they carry out their practice?" asks Professor Pinfield. Open Access has been suggested by many as part of the solution to the theory-practice gap (by making research more widely available beyond the academy), as well as a lens through which to look at it in general, so it seems an obvious choice of case study to put under the microscope.

The theory-practice gap is recognised in various fields, from medicine to management. Some people working across these fields complain that academic research doesn't address the issues that are important to them on the ground, instead focussing on impenetrable theory that is irrelevant in practice. "Very often, the pinnacle of academic achievement is to create theory", says Professor Pinfield. "If that's what incentivises researchers, is that something equally important to practitioners? Information Science is a practice-oriented discipline with a clear vocational link, and we are trying to understand the relationships between practitioners linked to Information Science and the producers of Information Science research, and whether there is a gap between them." The project also extends to other disciplines, particularly in Social Sciences and Humanities. Clearly, the implications of this are wider than the Open Access lens that this research is looking through.

The project itself does have a theoretical element. An engagement with theory in this area, including a detailed literature review, has revealed over 30 theories related to Open Access (OA) and its relation to practice, including well known ones like Innovation Diffusion Theory and various User Acceptance theories, as well as discipline-specific ones like Game Theory. Following this review was an empirical study. Interviews were conducted with senior OA researchers, practitioners who run OA services, library directors, policy makers, publishers and consultants. These groups were all asked about what is important to them when working in the field when it comes to theory and research, and the relationship between theory and practice.

The theory-practice gap is recognised in various fields, from medicine to management. Some people working across these fields complain that academic research doesn't address the issues that are important to them on the ground, instead focussing on impenetrable theory that is irrelevant in practice.

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'I've realised over my time in academia that "under-theorised" is often used as the ultimate criticism of practitioners' published work', says Professor Pinfield. 'My answer to people who say that is "do you realise that many practitioners would take that as a compliment?"

"One of the things we have asked is if there is a theory-practice gap - and almost everybody agrees that there is - how could it be bridged?", says Professor Pinfield. One possible answer is 'boundary spanners', mentioned both in the literature and in interview responses. These are people or roles who cross divides, in this case between the theory and practice communities. "In this context, these are often practitioners who are familiar with the research and are able to translate it into a practice-based context", says Professor Pinfield, "though they can sometimes be researchers who are familiar with practice and can translate it in the other direction."

There are other ways that academic researchers can help bridge the gap, by making their research more approachable. Disseminating their findings via means other than peer-reviewed journals is one option. Another is getting involved actively in policy and practitioner communities by giving advice and engaging in consultancy. "These are all quite challenging solutions because they all require people to operate outside of their immediate communities, and the incentives to do that are not always there", says Professor Pinfield. "We are looking at the responsibility of researchers to make their research accessible in a practice context."

The output of this project will be a book - available in Open Access, of course.

"I was a practitioner until 2012, latterly as Chief Information Officer at the University of Nottingham, dealing with the day to day problems of running an information service and trying to make things work in practice", says Professor Pinfield of his motivations to study this area. "As a researcher new to an academic role, I was surrounded by people who value theory. I've seen it from both sides, and I'm trying to reconcile the two worlds and see how they can relate better."

In extreme cases, some practitioners say things like 'academic research doesn't make any difference to me; I don't have time for theory; I just get things done'. On the other side, some academics say 'I create theory, and whether or not it is used in practice isn't important to me.' Professor Pinfield and the project team say there is plenty of room in the middle. "Any practitioner who has ideas about the way things work is actually working according to a theory, whether or not they are conscious of it", Professor Pinfield says. "Innovation Diffusion Theory, for example, is so embedded in practice that people don't even know it's a theory. People talk about 'early and late adopters' and the 'bell curve of adoption' - that's all Innovation Diffusion Theory." It seems that sometimes the theory-practice gap is smaller than people think it is.

There is a recognition across disciplines that theoretical study is very highly valued, robust and reliable, and yet, according to Professor Pinfield, there is huge disagreement and uncertainty about what 'theory' actually is. "When you ask someone what theory is, it is amazing to watch them struggle!", he says. "People say things are 'weak on theory', without a notion of what 'strong' would look like."

"I've realised over my time in academia that 'under-theorised' is often used as the ultimate criticism of practitioners' published work", says Professor Pinfield. "My answer to people who say that is 'do you realise that many practitioners would take that as a compliment?'"

There is undoubtedly a difference in language between theoreticians and practitioners; a researcher might say 'model' or 'framework' where a practitioner might say 'toolkit' or 'checklist', which might be the same thing. "It's very difficult sometimes to know whether the gap is there because it is in people's minds, or if there is actually a difference in the way that people are thinking", says Professor Pinfield. Either way, it is clear there is real potential value in encouraging a closer relationship between theory and practice and theorists and practitioners, both in the area of open access but also more widely.

"If you're giving away all this information for free and it's being stored in the app, what is happening to that data?", asks Dr McKinney. "Where is it going?"

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The Information Literacy of Food and Activity Logging in Three Communities

The popularity of devices like the FitBit still seems to be increasing, and playing into people's desires to track statistics about their daily lives and activities for reasons of health as well as pleasure. With that in mind, there has never been a more pertinent time to ask questions about how this data is stored, used and shared. Supported by Information School seed funding, Dr Pam McKinney, Dr Laura Sbaffi and Dr Andrew Cox have been looking into these issues by building a network with three organisations whose members have different needs and motivations for tracking, and looking for differences as well as commonalities between their practices.

Based on previous results, the researchers knew that people who log their food intake often have specific medical reasons for doing so, whether it be weight issues or conditions like diabetes or Irritable Bowel Syndrome (IBS). Coming from a Health Informatics background, Dr Sbaffi had existing links with global support community website Diabetes.co.uk. By contacting a trustee who works at the University of Sheffield library, the researchers were also able to make links with the IBS Network. To get a perspective on a different kind of activity tracking, Dr Cox used his personal connection to Sheffield Parkrun to access people who track their running.
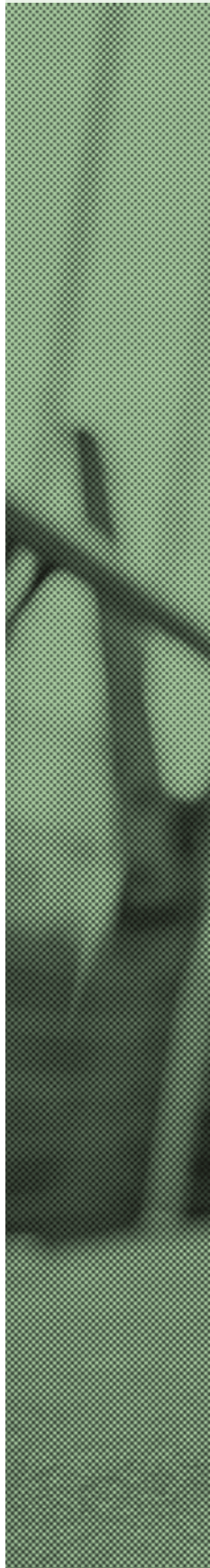
"The idea was to look at these three different communities and how they interact with applications for logging their daily activities and also their food intake", says Dr Sbaffi of partnering with all three organisations, who kindly gave the researchers the go-ahead to contact to their members.

In an online survey, members of all three groups were asked questions about what data they track, which devices and apps they use and how often they track the data, as well as more open questions about how confident they feel in interpreting the data, how they judge the quality of this data, any challenges they face, how they feel about their data being shared and whether they share it themselves. The questions brought in extensive and enthusiastic responses, which were analysed both in terms of quantitative demographics and qualitative freeform text . The quantity of the text received speaks to how important these acts of tracking and sharing are to people.

In writing a paper on their findings (now submitted to the Journal of Medical Internet Research), the researchers applied an Information Literacy perspective as a framework. This means considering users' understanding of the accuracy of measurements but also their understanding of privacy. "If you're giving away all this information for free and it's being stored in the app, what is happening to that data?", asks Dr McKinney. "Where is it going?"

One major difference in the way the groups used their tracking apps was in the practice of sharing. "There seem to be quite defined ways in which it is seen as acceptable to share your tracking data", says Dr McKinney.

"The parkrunners willingly share a lot of data with their online community of other runners, whilst the people affected by IBS or diabetes are much more cautious and likely to share just with their immediate personal circle", adds Dr Sbaffi.

"Runners love sharing their data; it's part of the interest of the hobby", says Dr Cox. One respondent even said "seeing what my friends are doing (and knowing that they see what I do) is a major motivator for me in exercise and encourages me to get out and do things when I don't necessary feel like it." In contrast, those with a medical condition often saw the data they collected as boring to others. For example, they did not want to make others feel self conscious about their eating habits.

'Interestingly, sharing with healthcare professionals doesn't seem to be a popular option in any group', says Dr Sbaffi. 'The literature tells us that this is because the healthcare professionals often don't need this overload of information - plus, it's not always reliable.'

Runners were found be primarily concerned with assessing fitness and improving performance. "They often have long histories of using trackers and might use more than one", says Dr Cox. "They might log quite a lot of things; how far they run, what they eat, their calories, heart rate and sleep." People suffering from diabetes were less focused on activity, and more likely to track aspects of diet, like sugar. This group were also most likely to share with their doctors, but also the most likely to utilise extensive spreadsheets over apps. IBS sufferers were also interested in tracking their diet, but it was found that this group actually had more of an interest in tracking mood. The literature confirms that state of mind and thought processes can be a trigger of IBS symptoms.

"I've got a lot of sympathy with people who suffer from IBS. There seems to be a lot of negative association with it and it could really do with a greater understanding", says Dr McKinney. "There's a lot of pushing back onto the individual, saying 'you can self-manage your diet, your sugar' etc, and the same is true of diabetes. Of course this is good in one sense, because there should be a level of personal responsibility in how you live your life, but there's a need to build support for people doing that, and this research is maybe one way we can help."

"Diabetes is a massive pandemic and it costs the NHS a huge amount of money every year", adds Dr Sbaffi. "This project was a match made in heaven because Diabetes.co.uk are incredibly active in research and always happy to participate, so not only is this a very current and relevant area to be researching, but our partners were wonderful to work with, too."

"It was a bit of a concern to us that people seemed in general not particularly fussed about what happened to their data once it was put online, so this is an area we'd like to focus on more in future", says Dr Sbaffi. Many tracking apps are provided free of charge, but the app providers often take the data in return, which can be passed on to third parties - and many people don't seem to mind.

As well as the journal article, the researchers have shared their initial findings with the users in the different groups already, who have reported finding the results very valuable. "At the end of the day it is all about outreach", says Dr Sbaffi. "It's important to let users know what is going on." The research has also been presented at conferences to the European Association of Health Informatics and the European Conference on Information Literacy.

The group, along with Dr Frank Hopfgartner, are now working on a bid for a £50,000 research grant from Pitch In, who fund projects around barriers to the adoption of the Internet of Things, the interconnection between computing devices and everyday objects and activities, via the Internet. "One of the things that came out of the research was a negative feeling towards food logging apps, which are perceived to be cumbersome, time-consuming and quite difficult to engage with", says Dr McKinney. "Spending loads of time searching through a database for a recipe for the spaghetti bolognese you made last night is just not realistic for many people. We will be looking at barriers to the Internet of Things adoption from the perspective of users, rather than developers." The group are also looking to take on PhD projects in this area.

Common across all three groups questioned in the research was an interest in data quality. With this technology already a big part of many of our lives, there is clearly a need to work towards the best possible solutions for users. "It's not just about information literacy", says Dr Sbaffi. "It's about the actual use of applications that many of us use."

'Parkrun encompasses everyone from the very serious runner to someone who has just done "Couch to 5k", so this is of interest to a lot of people.'

With a network of engaged organisations keen to provide the best experience for their users already in place for future research, hopefully it will not be too long before our food and activity logging apps are much more intuitive, secure and user-friendly.

Improving Healthcare Provision in African Countries Through ICT Development

Whilst many research success stories are told about projects whose outputs have been impactful on the world, the cross-continental partnerships that often underpin this world-leading research are not talked about so much. Without a strong basis of collaboration between great minds across the globe, many of the most important findings in academia would never have come to fruition. Dr Pamela Abbott and Dr Laura Sbaffi at the Information School are building one such network, and theirs is a story of hopeful knowledge exchange in the face of many frustrating barriers.

The story begins with Dr Josephine Nabukenya, Chair of Health Informatics at Makerere University in Uganda. After making initial contact with the Information School, Dr Nabukenya met with Dr Abbott, Dr Sbaffi, Professor Peter Bath and Dr Chris Foster over Skype to discuss her desire for a new collaboration. "[Head of School] Peter Bath said to me 'why don't you go to Uganda, meet with Josephine, and discuss what this collaboration would look like?'", says Dr Abbott. Thus began a fruitful relationship, focused initially on a bid for a grant from the Health Services Research Institute (HSRI) for a project on Electronic Health Records (EHRs). "We created the whole thing together as both teams, Sheffield and Makerere", says Dr Sbaffi of her and Dr Abbott's five-day trip to Uganda. "It was incredibly productive."

"Josephine introduced us to a lot of people", continues Dr Abbott. "We even met the Permanent Secretary to the Department of Health - albeit for about 30 seconds!" The pair also met with members of the World Health Organisation (WHO)-Uganda, Makerere's Infectious Diseases Institute and staff at its associated hospitals, many of whom deal with victims of the AIDS epidemic. All of these meetings fed into the grant proposal.

One particularly impactful conversation was with a Ugandan government official from the Ministry of Finance: "She was very angry that, as the person in charge, she could not put her hands on the data about the AIDS epidemic, how good or bad they were at supplying patients with the required treatments or how prevalent the virus is, just because there isn't a good way of capturing it", says Dr Abbott. In Uganda, various partial record systems exist in the health sector, but none of them talk to each other, or get the full picture of a patient's needs. "Uganda doesn't have ownership of its own health data", says Dr Sbaffi. "There are international partners who come in, collect their data, and take them with them when they are done."

"Of course, this means they end up looking like someone has to come in and take care of them", concludes Dr Abbott.

Building on the best of the existing systems, the all-female team put in a lot of work into their bid to design something functional and able to work at scale. "Our bid was to design an EHR to replace the bitty systems, capture all the information necessary to an AIDS patient and share it with whoever they need to, to get their treatments wherever they are", says Dr Abbott. Sadly, despite backing from the WHO-Uganda and Ministry of Health, the bid was unsuccessful.

Dr Nabukenya visited Sheffield in July 2018, supported by Information School seed funding, to discuss what could come next (as well as delivering a well-received research seminar to our Information Systems and Health Informatics research groups). "Josephine wants to introduce a Distance Learning element to her teaching at Makerere, as we do here", says Dr Abbott. "We discussed the possibility of sharing lecture materials and covering areas that we each do not cover ourselves, as well as the possibility of sharing supervision of some PhD students." Despite another failed bid for GCRF funding for a 'Global Engagement Network' after Josephine returned to Uganda (based on the discussions in Sheffield), the network was clearly already well and truly established.

During this time, Dr Abbott also met a recent PhD graduate, Dr Edet Otu, from Sheffield's School of Health and Related Research (ScHARR). Dr Otu's background is in geographical information systems and planning, and his public health PhD looked at locations of Malaria treatment services in developing countries, and how seasonal effects like flooding can severely impact people's abilities to access life-saving services. Dr Abbott and Dr Sbaffi were interested in this area, and applied for GCRF funding for a post-doc project for Dr Otu, building on his research and focusing it on prenatal women in Nigeria and their access to pre-natal healthcare services. "If this was successful, we would have had potential collaborations in both Nigeria and Uganda, and that ties in with where we want to go in terms of our long-term research", says Dr Sbaffi. "We are interested in developing countries; we are interested in solving major issues; we are probably idealistic, but at the end of the day that's what an academic should be." Despite noble intentions, once again the bid was unsuccessful. However, the team continue to be hopeful that their determination will set them in good stead for future GCRF funding which is confirmed as an ongoing agenda for the UK government.

During his PhD, Dr Otu struggled to gather data from Africa for his literature review, as the majority of African scholarship never makes it into Western publications. Dr Otu and a friend developed a tool called Afredat, a harvester of data from digital repositories where lots of these African publications are stored. "That's what links Edet's work to my other research interests on the digitalisation of African Higher Education Libraries", says Dr Abbott. "He was interested to know if his tool could be of use to the people I work with."

"At the moment we do not have anything concrete in our hands", says Dr Sbaffi, "but through a lot of work we are building this network of common interests, and we are trying to make it bigger." More plans are in the works, including joint PhD presentations between Sheffield and Makerere students, and the possibility of recruiting more PhD student projects in the area of health information in developing nations.

Despite their setbacks, Dr Abbott and Dr Sbaffi remain upbeat in the future of their work. "It's a happy story about creating collaborations, friendships and knowledge exchange from nothing", says Dr Sbaffi. "It started probably by chance, but we have put in a lot of work and come along way. We have the passion to keep this going."

"This collaboration started with literally nothing. Now it is growing and growing, and the possibilities of what we can do are increasing", adds Dr Abbott. "We can bring some real gravitas to Health Informatics here in Sheffield."

"It's a happy story about creating collaborations, friendships and knowledge exchange from nothing."

With links set up with Uganda and Nigeria, added to Dr Abbott's existing networks in other nations in the Global South, the future holds many possibilities for impactful research on the intersection between information systems and health informatics. If the sharing of knowledge around the world, with the aim of improving the lives of those most in need, is one of the aims of academic research, then this seemingly frustrating story actually holds the seeds of immense success from Sheffield.

Discovering
the Bias of
Algorithms
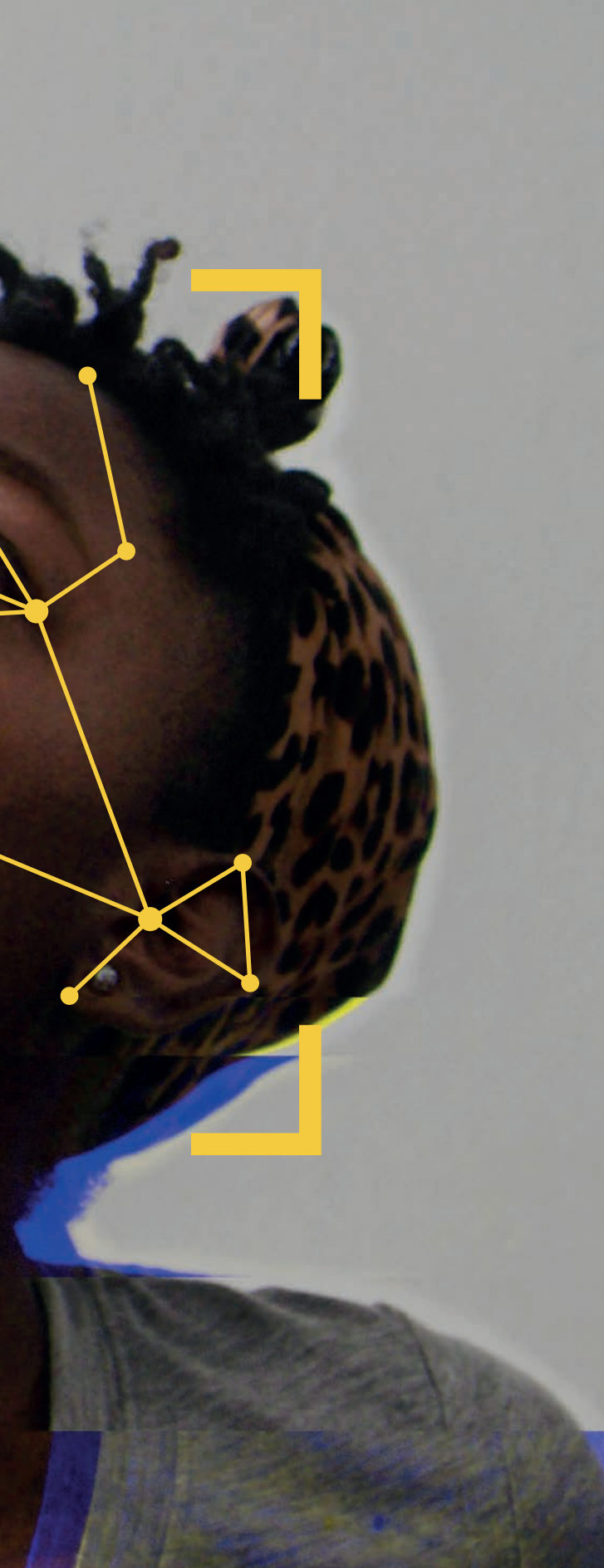
CY. center for algorithmic transparency

"If you do a Google search for 'doctor', then you're likely to get a lot of photos of white, middle aged and middle class men, rather than a more diverse set of results", says Information School Senior Lecturer Dr Jo Bates. "That's one example of algorithmic bias."

Together with Professor Paul Clough and Dr Frank Hopfgartner at the Information School, Dr Bates is involved in a new EU Horizon 2020-funded research project 'CyCAT', which explores algorithmic bias and transparency. Bringing together colleagues from Sheffield, as well as the Open University of Cyprus, the University of Edinburgh, the University of Haifa (Israel) and the University of Trento (Italy), the project is in its early stages, having started in October 2018, and is due to run for 36 months.

"If you do a Google search for 'doctor', then you're likely to get a lot of photos of white, middle aged and middle class men, rather than a more diverse set of results."

CyCAT, or the Cyprus Centre for Algorithmic Transparency, is also the name of a newly established research centre, hosted at the Open University of Cyprus with project coordinator Dr Jahna Otterbacher. The centre is focused on algorithmic bias and transparency in social settings, and the ongoing research project aims to establish this centre and expand its reach. One aim of the research is to build a working network of researchers and external partners through scientific networking events (including workshops and seminars at Schloss Dagstuhl, a renowned venue to facilitate communication and interaction between computer scientists, housed in a castle in western Germany), and foster ongoing research in this area.

Another important aim of the project is the effective promotion of digital and algorithmic literacy to the general public, through collaboration with educators, students and professionals. This Information Literacy slant to the project is enhanced by some of the researchers in Cyprus coming from the education field of academia. "The general public might not be aware that there are biases in things like web search results", says Professor Clough. "It's important to make both developers and end users aware of the inherent biases in algorithms, but also in human processes." Perhaps no decision process, human or otherwise, is entirely without bias, and that is where fairness, accountability and transparency come in - a topic the Association for Computing Machinery addressed in a recent conference, attended by Dr Bates.

"The general public might not be aware that there are biases in things like web search results."

One of the concerns that this project is trying to address is the rise of 'proprietary algorithmic processes' by giants like Google and Facebook; the hidden mechanisms that decide what they show you when you use their services. "Algorithmic processes are usually very closed down and it's hard to know how they work", says Dr Bates, who brings a vital social sciences approach to this tech-heavy project through her background in the politics of data. "The transparency element of this research is trying to make these biases visible and illuminate how they come about in things like online searches."

Various work packages on the project are working in different areas, including the development of a better cultural understanding of where these social biases actually exist. "One area where the Sheffield team have a lot of input is around designing and evaluating interventions that will be developed off the back of this foundational work", says Dr Bates. "Some of these will be technical interventions like browser plugins, but others will be more social, like the educational aspects."

A browser plugin for this purpose could be designed to highlight the biases in your search results, or at least to let you know that they are there. "We are working to raise awareness about these issues, but also to come up with methods that may aid transparency going forward", says Professor Clough.

As well as facilitating networking events and liaising with educators, the team will be surveying people on their attitudes to algorithmic transparency, providing online seminars and writing academic journal articles on their research. Through the CyCAT centre, the team also want to promote digital literacy policy changes, particularly to the Cyprus Ministry of Education. The idea is for CyCAT to be a hub for all this information, consultation and promotion of awareness.
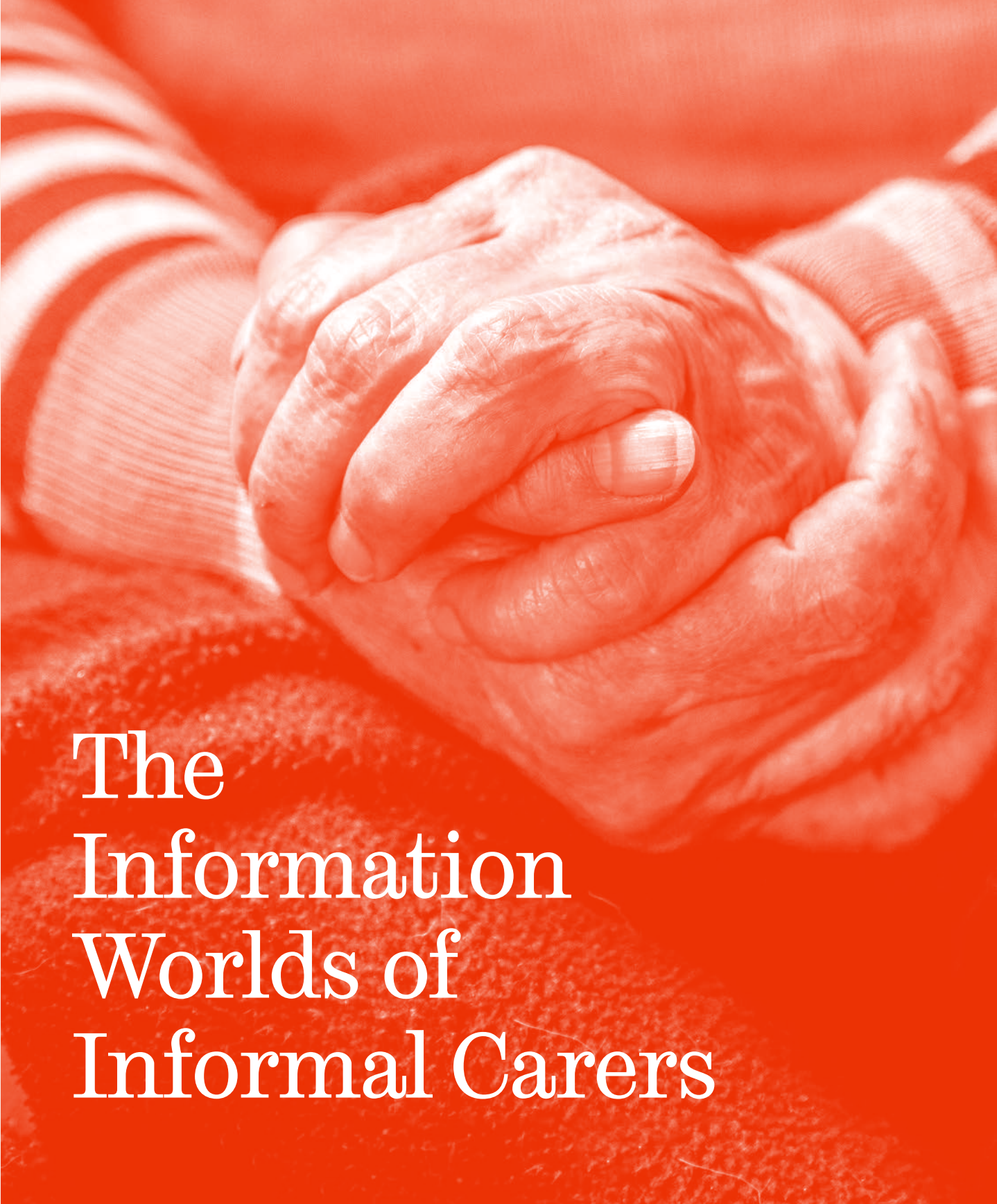
"Algorithmic bias and transparency is an ongoing topic of conversation", says Professor Clough. "Organisations like Google, Microsoft, IBM and even a 2016 report by the UK government are all talking about this issue, even if they're unsure on what to do about it."

It seems like every week a news article appears saying that another tool is biased. "One day it's claims against Google that their results favour certain political parties, next its Amazon with their staff recruitment tool that favoured male applicants, then it's UK police forces using predictive analytics that lead to discrimination against poor neighbourhoods as opposed to actual crime hotspots", says Professor Clough. "This is an important area across all sectors."

"There is a big debate in this field at the moment about whether it is technically possible to 'debias' these processes, or what that even means in practice", says Dr Bates of possible ways forward for a society increasingly reliant on algorithmic processes, machine learning and AI. "These are things that are now everyday technologies. We're all doing countless Google searches a day, and it's not just relevant to search technologies either. Anything that has a decision making or machine learning element can have bias, and there is very little awareness of that."

Stereotypes can be damaging, and it's easy to overlook how profoundly technology can affect and reinforce them. A quick Google search is our first answer to most problems, and most of us don't give a second thought to what process is creating the order of results we see, let alone the even more veiled processing underlying almost all of our interactions with technology. There are wider societal issues at play in this area beyond the processes themselves, of course, but raising awareness of the biases inherent in our information systems is perhaps one step towards a more ethical information society.

The Information Worlds of Informal Carers

The combination of an ageing population, and the increasing frequency of people moving around the country to follow their ambitions is causing untold numbers of people real difficulties when it comes to caring for their elderly or infirm relatives whilst in different locations. "The original stimulus for the research was my experience of caring for my own mother at a distance", says Senior Lecturer Sheila Webber, who is researching these issues with Dr Pam McKinney. "She was in Sussex whilst I was in Sheffield, and although I consider myself information literate, I was very stressed by the information problems I was having to face. There were all kinds of different terminology being used, and assumptions about how much I knew or didn't know because of our different information worlds."

Supported by internal Information School funding in 2017 and 2018, this research project is focused on the information needs of informal carers who do not live with the cared-for person. "What we mean by an 'informal carer' is someone who helps to look after an elderly person who lives in their own home but can't quite manage to do all the activities of daily life by themselves", says Dr McKinney. This is distinct from formal carers, such as 'meals-on-wheels' or carers who come into the home to help someone get up in the morning. Informal carers are unpaid and are usually an adult child or another family member.

"Most of the research in this area has explicitly focused on people who live with the cared-for person, like parents looking after children or spouses caring for each other", says Webber. "There are very few studies on informal carers who live elsewhere."

The initial study took the form of interviews with 11 stakeholders from different care agencies, including some local authority officials and charity workers in Sheffield, about their perceptions of the information needs of carers. It became apparent that some of these information issues are matters of regulation and policy, with local authorities given some devolved power, but not total control over the ways in which information is shared with informal carers. "A lot of the processes are based on the tacit assumption that the informal carer will be in the same local authority as the cared-for person", says Webber. In the modern world, this is often not the case, with increased mobility for career, family or other reasons often putting many miles between an adult child and an elderly parent.

"There are issues around finding out the kind of information you might be able to get easily if you were local and could just pop in", adds Webber.

"The Care Act 2014 puts the provision of information squarely in the court of the local authority and they are charged with providing it", says Dr McKinney, "but there's nothing said about what might be the best way to deal with this information. There's a patchwork of policies and procedures around providing this information, and nothing thought about holistically." The authorities in question are strictly measured against this imposed responsibility, which shows that the government is demonstrating some commitment to the seriousness of these issues, whilst still not providing any clear guidance. This research aims to fill these obvious gaps.
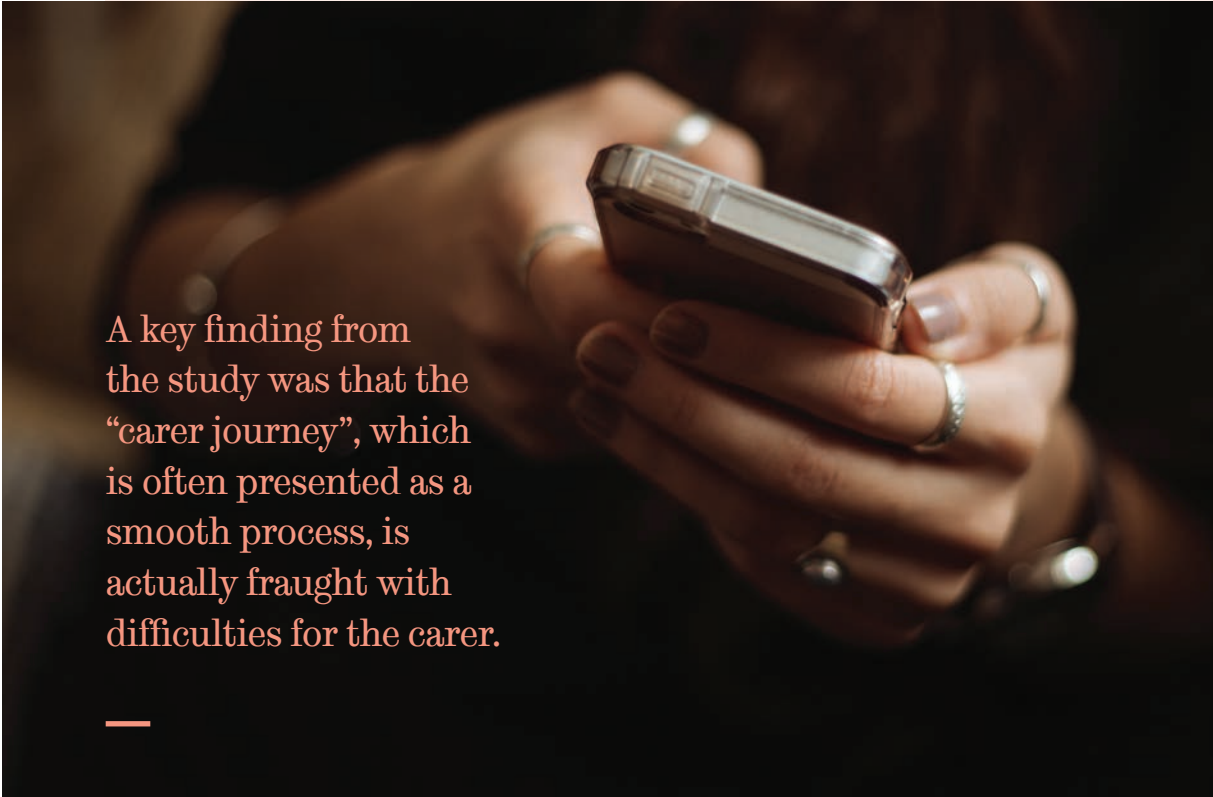
Previous research shows that these problems are well known. However, they have never been tackled from the information behaviour and information literacy angles from which the Information School is so well placed to investigate. Looking into how people interact with information in real-world contexts is at the heart of the research interests of both Sheila Webber and Dr McKinney.

"There are obvious links with other disciplines, but we see this squarely as an information problem that is causing stress and anxiety", says Dr McKinney.

This is clearly a hugely emotional area to be looking at and one that is sadly relatable to many. As such, the researchers have found all through the project that it has resonated with people. "Anyone I speak to about the research who has been in one of these situations really empathises with what we're doing, and speaks of their terrible information problems", says Dr McKinney.

Decisions like which care home to admit your elderly parent to can have a huge impact on their life and can put a lot of pressure on an informal carer. "I wanted to know what the best care homes were for my mother, and I wanted someone who knew about care homes and had visited them to give me advice on this", says Webber. "The local authority had to be impartial, so all they could say was 'here's a load of care homes, off you go'. Visiting every one to try and guess whether my mother would like it would have been incredibly time-consuming. Problems with these kinds of far-reaching and important choices are common complaints." The literature shows that informal caring even continues once someone does find a place at a care home; many informal carers spend large amounts of time in care homes with a cared-for person, around their own lives, and so the information problems don't even always stop once the formal care has been increased.

> A key finding from the study was that the "carer journey", which is often presented as a smooth process, is actually fraught with difficulties for the carer.

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Dr McKinney and Sheila Webber presented their work at the European Conference on Information Literacy in 2018, and have many more aims for where their findings could have important uses.

A key finding from the study was that the 'carer journey', which is often presented as a smooth process, is actually fraught with difficulties for the carer. Firstly, there is the length of time it can take for them to self-identify as a carer, meaning missing out on opportunities to gather suitable information. Secondly, there is the disrupted nature of the caring process, with changes in caring roles and responsibilities.

The stakeholders who were interviewed identified that better provision of information was key to improving the carer experience. However, individual agencies struggle to provide all the information that carers need: the fragmentation of the care sector, and the inability to recommend services makes this problem worse. Agencies and formal carers feel constrained by confidentiality and privacy issues when trying to support carers.

Building on their original interviews, the next planned piece of work is collecting much more in-depth case studies of non-residential informal carers, using Sheffield as the location of the cared-for person. Sheffield has performed poorly for the Adult Social Care Outcome Framework score that measures how easy it is for carers to find information and support.

Both researchers agree that findings from the initial research leave them even more convinced that this is a worthwhile problem to investigate. With the UK population ageing and ever-growing concerns about how older people can be taken care of, it is also a research problem which is not going to go away.

UrbanMapper - Making Cities Smarter

"Traditionally, urban planning has always been a very lengthy process", says Dr Suvodeep Mazumdar, Lecturer at the Information School in the University of Sheffield and Investigator on the UrbanMapper project. "Plans are submitted to the government or other approving bodies, the infrastructure changes are eventually made, but then there isn't usually much evidence to show how well these plans have worked out." Funded by the EPSRC as a Researcher-In-Residence project, facilitated by the Connected Places Catapult, the project aims to develop a network between academics, researchers and industry, to create and test technologies to be implemented in the Smart Cities of the future and update this arduous process.

In the modern world almost all major cities have the ambition to eventually become smart cities; cities that are more connected and use sensing mechanisms to mediate and control various aspects of day to day city living. Smart cities enable changes to be made to the design and running of a city based on real data from its inhabitants and systems, and the UrbanMapper project aims to provide knowledge and technology to put these ideas in place right from the planning stages.

"This project is based around how we can use digital solutions to understand how well urban planning initiatives have worked", says Dr Mazumdar. The aim is to use digital solutions to gather evidence on an ongoing basis, to ensure that the plans have had their desired outcomes.

"In the past, planning permissions were just paper submissions", says Dr Mazumdar. "There would be a lengthy process of making changes, then going back for permissions and then making more changes and so on. Now, things can be done digitally and the process is starting to become quicker and more flexible."

The two-year project, started in April 2019, places a heavy focus on networking, with the Connected Places Catapult giving researchers direct access to industry, and vice-versa. Dr Mazumdar anticipates travelling to London every few weeks throughout the project to develop strong links within the academic community, urban planners and industrial partners. In Sheffield, Dr Mazumdar is receiving support from the Centre for Regional Economic and Social Research at Sheffield Hallam University in the form of workshops with participation of part-time students who are working in government planning departments, as well as access to experts in the domain. This extra perspective will help to ensure that the plans and prototypes are in line with industry planning processes and requirements.

Even at this early stage, Dr Mazumdar has ideas for the practical element of the project. "My experience in user-centred design and co-designing solutions with users and communities will be used to develop quick prototypes to deploy in various locations and contexts, to test what works and what doesn't", he says. Short-term experiments with these kinds of prototypes will then inform larger projects. All of this work will be based on information gathered through interviews and workshops with industry partners and stakeholders, to understand the kinds of solutions that might be required.

Dr Mazumdar will use Arduino and Raspberry Pi computer kits to quickly prototype low-cost sensors to see how they can adapt to different situations. "Because we can build these prototypes quickly, we can make several of them and see which ones work best", says Dr Mazumdar. Learning from this process, he even hopes to be able to procure some of the prototyping units to use with Information School students for use in dissertation projects and to give them a taste of the real-world applications of our research.

"In the past, planning permissions were just paper submissions. Now, things can be done digitally and the process is starting to become quicker and more flexible.'

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Examples of the kinds of technologies that could be developed in a smart city include sensors which monitor the volume of pedestrians or traffic. These could be used to estimate travel times or control road systems to ease the flow. Dr Mazumdar also talks of the potential use of geospatial data in virtual and augmented reality. Deliverables from this project will range from prototypes of wearable devices, to crowdsourcing activities and mobile applications, as well as possible development of visual analytic solutions which will enable communities to track and evaluate the outcomes of the technologies.

The project also aims to look at semantics and how information in the planning domain can be better structured to handle the large-scale data sets involved in this kind of work. "We want to see how we can use semantics within the context of urban planning evaluation", says Dr Mazumdar.

"At this early stage, the project is quite flexible, and that's by design", Dr Mazumdar continues. Whilst the outputs are many months away, the end result is intended to engage the public in the typically dry subject area of planning. Dr Mazumdar, together with the Connected Places Catapult, is planning to arrange a data challenge at a later stage of the project, inviting data enthusiasts among members of the public to engage directly with the research.

One of the key principles of UrbanMapper is to measure the success of urban planning initiatives by qualitative outcomes for city residents (happiness, quality of life, wellbeing etc), as opposed to more technical outputs (lawn cover, amount of green space, dimensions etc). In this way, UrbanMapper has the capacity not only to contribute to the efficient revolutionising of the cities we live in, but also to ensure that these changes really mean something valuable to their communities.

Recognising the Shapes of Molecules
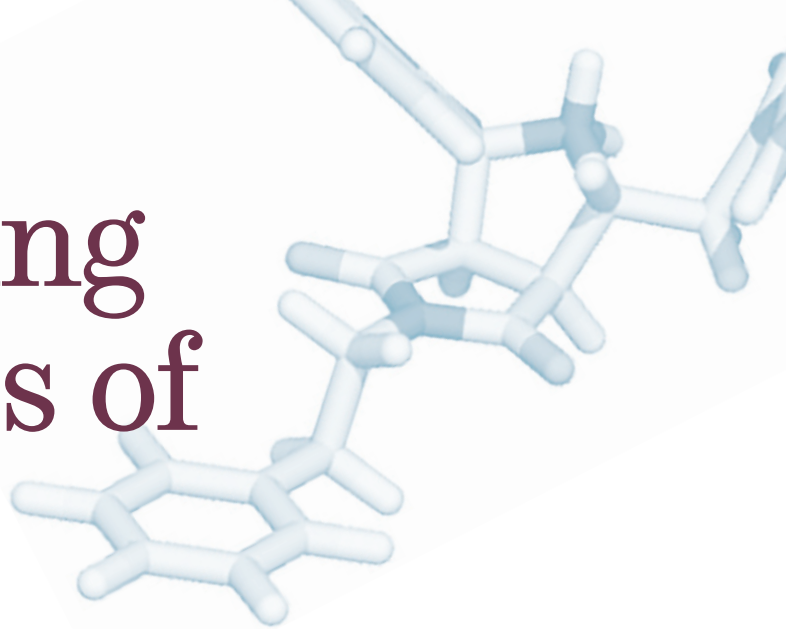
"A molecule is able to act as a drug because it binds to a protein, and it does that because it has a complementary shape to that protein", explains Professor Val Gillet, who led a BBSRC-funded research project to find a new method to compare molecules on their 3D shapes. Pharmaceutical companies need to be able to tackle this tricky issue in order to design their drugs effectively, but current methods are not always up to standard.

Until now there have been two main approaches to comparing the shapes of molecules. The first is to treat molecules as rigid versions of the 3D objects they are. To compare them in this fashion, two molecules have to be aligned, and this is very computationally demanding to simulate. The second method involves extracting some shape-related features from the molecules and representing these as one-dimensional vectors which can be compared directly. Such features include what are known as inter-atomic distances; measurements which are quite crude, and lose a lot of the rich information that the molecules truly contain. "What we've developed through our research is a method that is fast and almost as accurate as the computationally demanding methods, and that outperforms the quick methods", says Professor Gillet.

> "Representation of chemical information is the fundamental problem that prevents us from being able to predict whether a compound will make a good drug candidate."
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The original problem was posed by David Cosgrove and Martin Packer from the pharmaceutical giant AstraZeneca. They needed someone to look into a better computational method for comparing molecules effectively and efficiently, and the shape idea came up in discussions. Ongoing between 2016 and 2018 and in collaboration with AstraZeneca, the research was conducted by Professor Gillet and then-PhD-student Dr Matt Seddon, who subsequently graduated and began working at BenevolentAI (a UK-based AI company focused on medicine design and testing) as a result of his work on this project. Dr Seddon, who was funded by a BBSRC Case studentship, came to the project from a maths and economics background, bringing a whole different set of literature and expertise to the fold. "It was Matt who identified the methods and recognised that they had potential for molecular shape recognition", says Professor Gillet.

"Representation of chemical information is the fundamental problem that prevents us from being able to predict whether a compound will make a good drug candidate", says Dr Seddon. "This has been where the Chemoinformatics Research Group at the Information School has pioneered the field. My experience in the Chemoinformatics Research Group has been important for my current job at BAI, where we are really interested in chemical information representation."
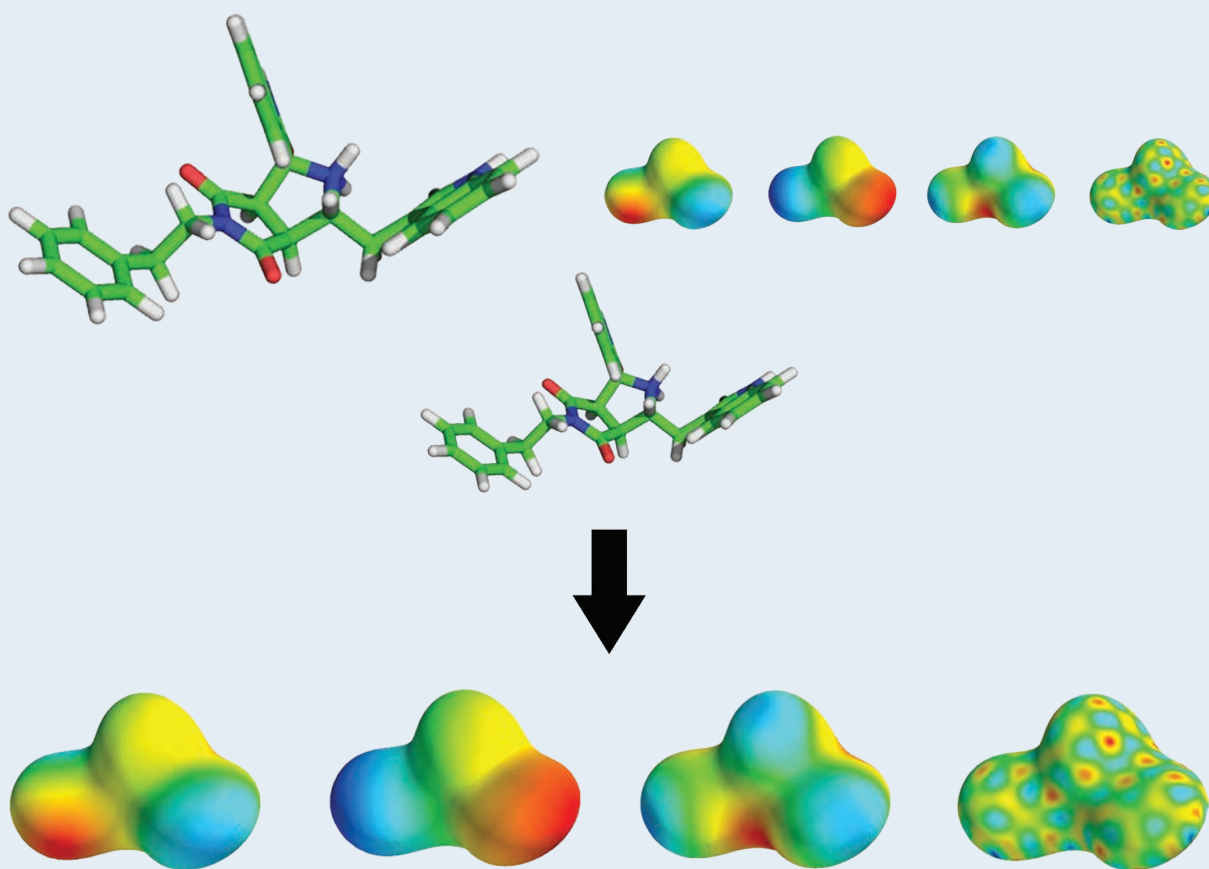
▲ *Spectral geometry descriptors at different levels of resolution are mapped onto the surface of the molecule shown above. The colours represent local curvature over the molecular shape and differentiate convex, concave and saddle regions.*

The solution that Professor Gillet and Dr Seddon developed involved borrowing a technique from the field of Computer Vision, an interdisciplinary area dealing with how computers recognise image and video content. Computer vision work allows computers to recognise animals and people in different poses. "It's about recognising them as 3D shapes", says Professor Gillet, "but also recognising that a person is the same person regardless of whether they are standing or sitting."

"There are two ways to measure the distance between my head and my feet", continues Professor Gillet. "One is called euclidean distance; the 'ordinary' straight line distance. If I'm sitting, my head is much closer to my feet than when I'm standing. The other way is the geometric distance, which measures the distance over the surface of my body, which is the same whether I'm standing or sitting. Spectral geometry, developed in computer vision, measures distances using this second method and is the technique that we adopted. By putting a mesh over the molecule and measuring distances over the surface of the mesh, the resulting geometric measurement gives a much richer description of the shape than other simpler measurements would provide. With this method, one can capture all the distances over a molecule's surface into a single vector representation, to compare molecules without having to align them."

"What we've shown is that there's a basic representation method that works extremely well compared to existing methods", says Professor Gillet. "We started by treating flexible compounds as if they are rigid objects, which is the same as the other methods, but with the results we have shown we are really excited to be taking this work further." In real life, 3D molecules are flexible and do not stay rigid. The previously existing methods of comparing molecules were forced to treat each possible configuration of a molecule's shape as if it were a different molecule and take measurements for each separate shape. By taking geometric measurements instead, this new method allows the necessary information to be captured in far fewer representations, and this is an area of current research.

> "We started by treating flexible compounds as if they are rigid objects, which is the same as the other methods, but with the results we have shown we are really excited to be taking this work further."

A paper on the research has now been published in the Journal of Chemical Information and Modeling (DOI: 10.1021/acs.jcim.8b00676), and the software developed from this research is now available as open source (available at github.com/SheffieldChemoinformatics/molsg), so pharmaceutical professionals can start using it now. "The idea is that, using our methods, pharmaceutical companies could prioritise compounds that they wanted to test as drugs in a much faster and more effective way than they could before", concludes Professor Gillet.

"Our proposed solution has potential to revolutionise not only activity prediction but, more importantly, provide a framework for exploring other aspects of molecular shape, such as solubility prediction through intrinsic symmetry", adds Dr Seddon.

Using the tools of one field to solve a problem in another, the Chemoinformatics team at the Information School have continued to create innovative solutions for immediate uptake in the pharmaceutical industry. More efficient molecule comparison leads to faster and more effective drug testing, and more rigorous testing, and most importantly getting medical aid more quickly into the hands of those who need it.
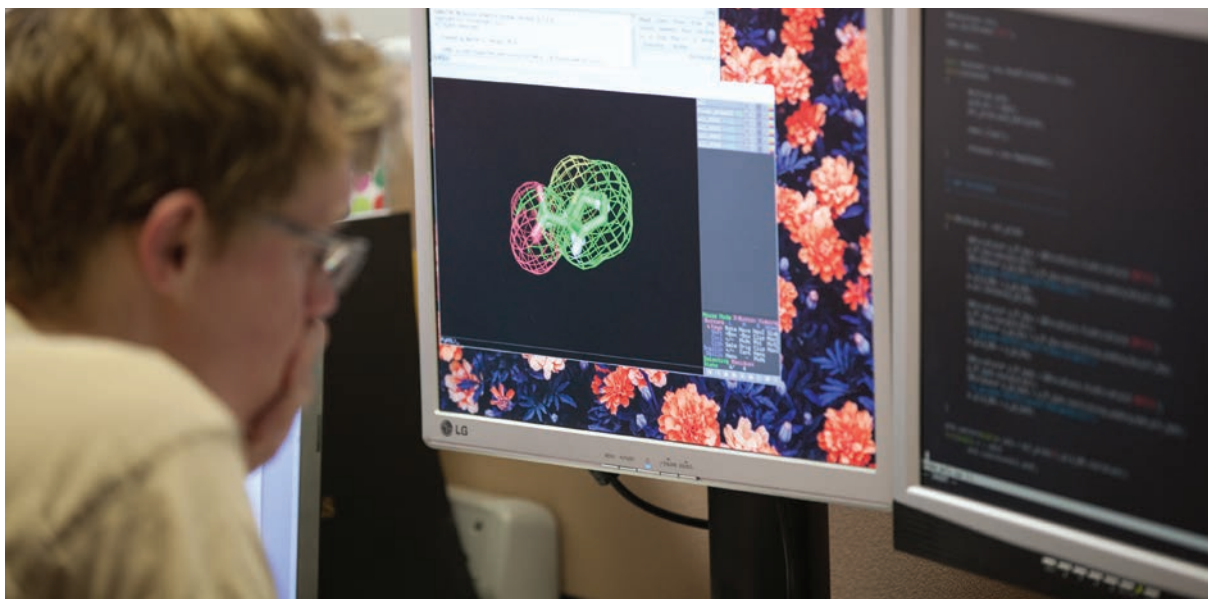
Space for Sharing

IMPACT UPDATE

Since the last edition of Inform, impact work following from the research on the 'A Shared Space and a Space for Sharing' project has continued apace, reaching new audiences and bringing together different communities of people affected by life-threatening diseases.

The play that was based on the research conducted in Sheffield, written by Charlie Barnes and performed by the Dead Earnest Theatre Company, has been performed for several new audiences. These more recent performances have included group discussions and workshop sessions afterwards, encouraging deeper thought into the important issues raised in the play. "It got the audience to think about how they might encourage patients to use these online health forums and what they are as a resource", says Professor Peter Bath, Principal Investigator on the project, of one particular performance to healthcare professionals. "Some of them weren't aware of them before."

The schedule of performances has included a performance at the Annual General Meeting of Cavendish Cancer Care in 2017 and one for healthcare professionals invited from across South Yorkshire at the Northern General Hospital as part of the ESRC Festival of Social Sciences in November 2018. The play was also recorded at the Lantern Theatre and is available for online viewing (www.space4sharingstudy.org).

The play was also performed twice for the staff at St Luke's, the Sheffield hospice charity, in their newly acquired and refurbished day centre, a grand manor house owned by the original benefactors of the charity. For these performances, the play was adapted and lengthened based on feedback received from St Luke's themselves that there should be more in the play about how people respond to death and dying on the online forums. Charlie Barnes revisited the script with this in mind, and created a new version with this important and impactful angle expanded upon.

Following an appearance by Professor Bath on BBC Radio Sheffield to discuss the research, one further performance was given at the Cancer Experience conference in Sheffield in June 2018, to an audience comprised of academic researchers, healthcare practitioners (including the Chief Nurse at Macmillan Cancer Care), and also members of the public. "From the discussion with the audience after this performance, it emerged that there was one group of women affected by breast cancer that were not represented in the play", says Professor Bath. "People who have had secondary breast cancer and are living under life sentence with it, knowing it could come back at any time." There are plans to include this aspect in another future version of the script.

There are plans in motion to take the play to London and perform it to Breast Cancer Care themselves, the organisation whose online forums the research project was primarily based on and who have been consulted all the way through. The hope is to host a large event inviting staff and volunteers, healthcare workers, benefactors and also patients, and to hold a live social media event alongside, with those unable to attend watching the recorded version and tweeting their live responses during the event.

Alongside the play, the Sheffield Space 4 Sharing team (also including Research Associate Dr Sarah Hargreaves) have been developing a suite of information sheets. Initially in two versions - one for patients and members of the public considering using the online health forums, one for healthcare professionals who might direct patients to such forums - the information sheets provide tips, advice, things to avoid and other useful information about engaging in these online communities. "We've distributed copies of these at the performances of the play and people have taken them away with them", says Professor Bath. "Breast Cancer Care saw them and wanted to be actively involved, so we developed a new version specific to them, using their pictures and mentioning their website, forums and resources." Breast Cancer Care and the Motor Neurone Disease Association now have their logos on the generic versions too, endorsing this outreach work.

Breast Cancer Care have expressed interest in putting a PDF version of an information sheet on their website, where their forum is located, for use by potential forum users. The team also compiled a list of breast cancer nurses across the country to contact, in order to distribute the sheets to their patients.

Additionally, Professor Bath and Dr Hargreaves have presented research posters from the Space for Sharing project at three Motor Neurone Disease Association conferences. All of this work, together with collated feedback from audiences who have seen the play, is being collated for a REF impact case study. It's easy to see how this research is continuing to have a tangible impact on groups of people who are in great need of kindness and support.

"Amazon is growing", says Dr Alessandro Checco, Lecturer in Business Analytics and investigator on the FashionBrain project. "They are building an Alexa with a camera that can be with you in your bedroom and tell you if you look good. We still want to bring a European approach to this idea, and bring more choices to the customer. It's a huge challenge with such hard competition, but we are on track with our goals."

Since the article in the last edition of Inform, work on the FashionBrain project has been mainly focused on producing output. To date, 22 papers have been published across journals, conferences, workshops and other platforms. Members of the project team have also attended more than 40 industrial events in various locations, with the intention of building links with potential future partners. So far, conversations have started with companies like Schwarzkopf and ASOS, as well as smaller European startups.

Some of the technologies being developed within this project are now available as demos. Swiss startup Fashwell, along with the University of Fribourg, have developed a technology for image recognition, trained on images of clothing and fashion items from Instagram. A neural network is able to locate images of products that are similar via the use of various categories and attributes.

FashionBrain

IMPACT UPDATE

Fashion giant Zalando has released FLAIR, an open source software framework for language processing. The software understands and collates a product's reviews, popularity and other information in multiple languages to allow its use by people across Europe. They have also released a multi-modal corpus of fashion images and text in German. This is a new concept and will act as a starting point for more of these kinds of multipurpose corpora in other languages. Finally, Zalando has also built a demo of a search engine based on a neural network. The network, trained on various different image and content inputs, is able to answer very complex queries and is resilient to spelling mistakes, language mixing and nonspecificity in user questions.

fashion BRAIN project

"They are building an Alexa with a camera that can be with you in your bedroom and tell you if you look good."

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The focus of the Sheffield team (led by Dr Checco, with Project Officer Kathryn MacKellar, Project Manager Jennifer Dick, Postdoctoral Researcher Soufiana Mekouar, and in consultation with Dr Gianluca Demartini) is on crowdsourcing techniques. "For example, could we train these neural networks using humans?" asks Dr Checco. "These automatic models have limits, and having to train or teach them is one of these. Of course, humans have the ability to disambiguate, and understand complex ideas that computers cannot." In the domain of fashion, this is not easy, as different individuals have different fashion tastes as well as different cultural backgrounds that might affect how they interact with fashion. "Since they are training an algorithm, this could create bias; if there is bias in the crowd, there would be bias in the algorithm."

The Sheffield team are developing tools to understand, address and correct bias in different contexts, as well as running workshops on bias. Algorithmic bias is an important issue to consider in general, even outside of fashion (see our article on the CyCAT project on page 28 for more), but the tools used could be the same across different areas.

Another facet of the work in Sheffield is understanding how to improve the wellbeing of the crowd being used in the crowdsourcing; can the time spent searching for jobs be reduced by studying how they search? Can tasks be scheduled depending on a user's skillset, rather than automatically by a machine? This interface between the human and the machine remains at the heart of the FashionBrain project.

Dutch IT company MonetDB is building an open-source database system that is the backbone of many of these technologies. The system's tools allow machine learning techniques to be applied directly to a database. "At the moment everybody's working with artificial intelligence and neural networks, but the ability to work with these techniques directly in a database really changes the possibilities in terms of accessing the data in real time", says Dr Checco.

Zalando and Fribourg worked together with MonetDB to predict sales and trends from this database, and Beuth University of Applied Sciences are working on data integration between the various vendors and partners.

"All of these tools are being released as Open Source so they can be used by the community", says Dr Checco. "It has been nice to see all the partners coming together. In the beginning, we all worked on our own parts before we started to integrate."

Our Advisory Panel

The Information School's Advisory Panel is a group of respected information professionals who meet with our own staff once a year to assist with the School's strategic planning and provide their insights on current trends and how we can fit in.

Coming from a wide range of organisations, the panel members each bring their own experiences to bear on our approaches to research and teaching.

Panel Members

Bella Abrams

Director, Corporate Information and Computing services, University of Sheffield

Andy Ball

Managing Director, Peak Indicators

Leanne Fitzpatrick

Head of Analytics, Consultancy & Solutions at Hello Soda Manchester

Sarah Gates

Cabinet Office

Anne Horn

Director of Library Services and University Librarian, University of Sheffield

Anthony Lee

Partner, DMH Stallard LLP

Dirk Lewandowski

Hamburg University of Applied Sciences & Editor of Aslib Journal of Information Management

Alice Mathers

Good Things Foundation

Eleanor Mitchell

Entrepreneurial Growth & Grant Appraisal Management Director, Scottish Enterprise

Ian Oldershaw/Nicola McHugh

Sheffield City Council

Arjun Panesar

Co-founder and CEO, Diabetes.co.uk

David Pearson

Director of Culture, Heritage and Libraries, City of London Corporation

Daniele Quercia

Bell Labs

Ian Radmore

Big Data Specialist, IBM Analytics

Liz Thomason

Senior Solutions Developer

Martin White

Managing Director, Intranet Focus Ltd

Trends and Challenges in our Field

Our advisory panel discussed upcoming trends and challenges in the information field of today and these are some of the themes that emerged from the discussion.

Big Data in Healthcare

The healthcare sector has started to embrace the benefits of big data. Agencies around the world, including the NHS, have demonstrated an appetite to utilise big data and its predictive capabilities. Over the last 5 years, the analytical methods utilised to mine this data has led to the development of predictive systems that can predict risk of future disease to high accuracy. What's more, at a population level, this provides insight into the behaviours of populations - whether grouped by geography, demography, health status or otherwise. The ethics surrounding the insight developed through this information is a source of much interest and provokes passionate response. Now with our homes, clothes and cars all connected to the cloud, the regulators are catching up to predictive use of such information and how it can be used for both good and bad.

Information Management

Information management research is typically carried out on a vendor-neutral basis, with a focus on defining good practice in information quality management and collaborative working. Two IT vendors dominate this market: Microsoft with Office 365 and Google with Google Works. Both companies are in a race to offer a continual flow of cloud-delivered enhanced functionality, leaving organisations with no option but to adopt each new functionality.

There needs to be a shift in research to understand whether this functionality (often sold on the basis of 'enhanced productivity') means that organisations are not in the position to adopt 'good practice', just 'vendor practice'. Furthermore is the improvement in productivity actually having an impact on organizational performance? This will inevitably mean that research papers could be critical of vendor roadmaps, raising ethical and methodological issues that will need careful consideration.

Search

Over the last couple of decades since the dawn of the Google era, thousands of research papers on the optimization of web search have been published. In the case of enterprise search (the practice of making content from multiple enterprise-type sources, such as databases and intranets, searchable to a defined audience), the number is fewer than ten. At the ACS SIGIR event in 2019 there was just one paper out of 200 specifically on enterprise search. At present there are three important research-bereft areas.

An immediate research opportunity is to understand the balance of these factors in other sectors. Multi-national organisations invariably need to search content in multiple languages. No research has been undertaken to assess the extent to which poor search results are an outcome of employees having to search for content in a language that is not their primary language. There is also an assumption by search vendors that AI/machine learning assisted 'cognitive search' is the answer to all enterprise search problems, but there is no evidence to support this assertion.

Business Intelligence and Systems

Public sector systems and processes are often outdated and difficult to replace, against a backdrop of public spending challenges. Therefore, data often remains siloed and cannot be shared within or between public sector organisations.

In order to get the most out of the data held by organisations the biggest challenge is changing ingrained behaviours and cultures to ensure quality and consistency of data entry. People need to be persuaded that changing brings benefits - information and reports gleaned from input data are much better than repeated requests of individuals. This also extends to SMEs interrogating their data to strengthen customer relationships and build new markets.

Our Research Environment

The Information School is proud to foster an active and welcoming research culture, supported by world-class facilities.

The Information School is currently home to 49 PhD students - we've highlighted just a few of them in the following pages.

We also currently have 4 research staff, undertaking a range of projects alongside our academic staff. All of our research-active staff and students are aligned with one of our seven research groups, to bring them together with experts in their field.

The iLab

"The iLab suite presents state-of-the art data capture for research projects for both academic- and industry-led work. The flexible recording spaces in the Digital Media Lab and Usability Lab are well-suited to a range of methods from interviews and focus groups to controlled experiments and usability testing. The facility offers a variety of data collection technologies for use, including: audio and video recording, screen capture, one-way mirrored windows, EyeLink® eye-tracking, and FaceReader's automated emotional expression coding. These can all be operated in parallel or isolation to gather as rich or targeted data as needed."

Dr Dave Cameron

"The iLab suite presents state-of-the art data capture for research projects for both academic- and industry-led work."

Suzanne Duffin

A study of information needs and information sharing amongst people on the autism spectrum, using online support and discussion groups.

Prof Peter Bath, Dr Laura Sbaffi

Bedour Alboloushi

The development of administrative innovation in relation to post-adoption usage of human resource information systems in public sector organizations.

Dr Jorge Martins, Dr Angela Lin

PhD students

Here is a selection of the Postgraduate Research students currently studying at the Information School.

Sukaina Ehdeed

The emergence of Libyan networked publics: social media use during and after the Libyan uprising.

Dr Jo Bates, Dr Andrew Cox

Paul Fenn (staff)

Social media as a tool to enhance Higher Education learning and teaching experiences.

Dr Paul Reilly, Dr Ziqi Zhang

Gianmarco Ghiandoni

Reaction-based molecule design.

Prof Val Gillet, Prof Beining Chen

Emily Nunn

Open Access outside academia: exploring access to medical and educational research for non-academics.

Prof Stephen Pinfield, Prof Peter Bath

Lily Sepulveda Garcia

An interpretative phenomenological analysis of informal caregivers use of assistive technologies to care for people with dementia at home.
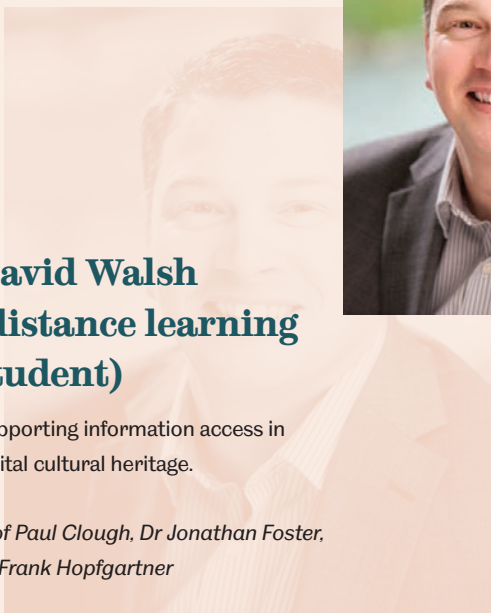
Dr Pamela Abbott, Prof Peter Bath

Sally Sanger

Alcohol online support groups: the role of discussion forums in constructing users understanding of their condition/disease.

Prof Peter Bath, Dr Jo Bates

David Walsh (distance learning student)

Supporting information access in digital cultural heritage.

Prof Paul Clough, Dr Jonathan Foster, Dr Frank Hopfgartner

Ciara Eastell, OBE, Honorary LittDn

More people visit public libraries each week than go to the cinema – 60% of the UK population had a library card in 2017. Libraries play an important role in social and digital inclusion; they are now one of the few remaining public spaces that are free to use.

UNESCO estimated that a total of 2.5 million new books were published last year, including over 200,000 in the UK alone. Alongside those books were millions of new articles, published in thousands of learned journals. At our winter graduation in 2019, we chose to honour one of our country's leading public librarians, and indeed a successful alumnus of the Information School, Ciara Eastell OBE.

Ciara Eastell is the Chief Executive of Libraries Unlimited. She has over 20 years' experience as a Chartered Librarian and is the former Head of Libraries, Culture and Heritage for Devon County Council. She has previously managed libraries in Gateshead, Cambridgeshire and Somerset.

Ciara is passionate about the potential of public libraries, the value of reading and the power of information to transform lives. She was President of the Society of Chief Librarians (SCL) from 2014-2016; is a member of the British Library's Advisory Council and was the first librarian to participate in the Clore Leadership Programme. Ciara was awarded an OBE in the New Year's Honours 2017 for services to libraries.

Head of School, Professor Peter Bath, said: "Ciara Eastell is an inspirational figure to many in the library profession, as well as to information professionals. She has worked tirelessly to ensure that libraries are protected and still around for future generations. I remember when Ciara was a student at the Information School and it's wonderful to see how she has developed her career and how she continues to inspire future generations of library and information professionals."

Libraries play an important role in social and digital inclusion; they are now one of the few remaining public spaces that are free to use.

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"Throughout her career, Ciara Eastell has received many honours and accolades: Devon Libraries was named Library of the Year in 2013, she was voted one of the top 100 women in social enterprise and was appointed OBE in the 2017 New Year's Honours. It is now our turn, as the University where she first studied her discipline and profession, to honour her. We hope that Ciara's career and love for her discipline will encourage others to keep our libraries alive and enable them to flourish."

Ciara Eastell, OBE, Honorary LittD, said: "I'm really delighted to have been awarded an honorary degree from the University of Sheffield. I was a student on the MA Librarianship course in 1993/4 and have very happy memories of my time in the Department of Information. My time at the University gave me a great platform to develop my career in public libraries, one of our most important of our public services. I'm looking forward to maintaining my relationship with the University and am really delighted that the School continues to support the development of the next generation of library and information professionals."

Work with us

The Information School works with a wide variety of high profile organisations from all sectors, including Universities, commercial companies, charities and government bodies.

As you have read in this magazine, we currently have ongoing collaborations with pharmaceutical company Astrazenica; health support networks such as the IBS Network and diabetes.co.uk; and Innovate UK. We are also working with a range of other higher education institutions in the UK and internationally, including the Open University of Cyprus, City University of London, Makerere University (Uganda) and Sheffield Hallam University.

Previous research projects have included successful collaborations with Eli Lilly, UK National Archives, Unilever, the Leibniz Institute for Social Sciences, Sheffield Libraries, Online Computer Library Center (OCLC), Blast Theory, Research Libraries UK, Peak Indicators, Ordnance Survey and GlaxoSmithKline, as well as academic institutions including the University of Toronto, the University of Manchester, the University of Lisbon and the Technical University of Athens.

The Information School has had a close relationship with CITY College Thessaloniki, Greece, for over 10 years, through the South-East European Research Centre (SEERC). We have co-supervised many PhD students with the College throughout our relationship.

We are always looking to build new collaborative research relationships. We are also able to offer consultancy and training in our specialist areas. If you would like to discuss working with one of our research groups or individual academics on a future research project or to discuss any ideas you have, please get in contact at **is@sheffield.ac.uk**, or find our individual staff at **www.sheffield.ac.uk/is/staff**.