Human-Computer Interaction Round Table

6 June 2019 Informatics Forum, University of Edinburgh

Report

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On the 6 June 2019, EPSRC held a round table in Human-Computer Interaction (HCI). The aims of the round table were to:

- Consider how the HCI research area and community has progressed since the [2012 EPSRC HCI review](#) and how the recommendations of this review have been implemented.
- Discuss new and emerging areas in HCI.
- Consider the future of the HCI portfolio in EPSRC and how it fits in with the strategic plan for HCI and EPSRC.

The attendees of the round table were a mixture of academics and industrialists from the UK HCI community, some of which were part of the 2012 EPSRC review panel. The following people attended:

Name	Organisation
Jessica Bonham	EPSRC
Samantha Francis	EPSRC
Gemma Adams	EPSRC
Shiny Mathew	EPSRC
David Robertson (Chair)	University of Edinburgh

Bob Anderson	University of Nottingham
Matt Jones	Swansea University
Eamonn O'Neill	University of Bath
Yvonne Rogers	UCL
Abigail Sellen	Microsoft Research
Steve Brewster	University of Glasgow
David Kirk	Northumbria University
Uta Hinrichs	University of St Andrews
Ewa Luger	University of Edinburgh
Mike Fraser	University of Bristol
Sri Subramanian	University of Sussex
Jason Alexander	Lancaster University

The following people were unable to attend the round table but have contributed to the report via email and / or telephone:

Name	Organisation
Andy Crabtree	University of Nottingham
Michael Evans	BBC
Ben Shneiderman	University of Maryland
Anirudha Joshi	IIT Bombay

The round table consisted of three main activities:

1) Identifying how the HCI research community has developed since the 2012 review, based on the recommendations
2) Discussing the current status of HCI research in the UK, through a SWOT analysis
3) Discussing how to overcome challenges in HCI research and develop a future HCI strategy

Chair's Foreword

Human Computer Interaction was and remains a key element in the design of systems, not only computing devices themselves but also the contexts in which computing is embedded. As HCI has matured it is becoming diverse in its approach to its science, even within the community, with some researchers emphasising core theory; others focusing on applications and empirical studies; others
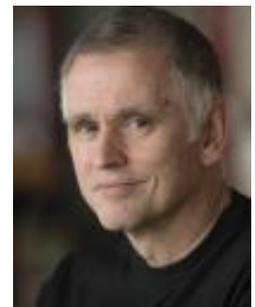
situated on "extreme" forms of human engagement with technology, etc. This makes it difficult to approach as a single subject, and perhaps its future is to be eclectic in this way, but there remains a broad sense of a community of researchers with primary interest in the human aspects of the systems we build. A great deal of its practical impact is through engagement with other disciplines in empirical and/or applied research. There is a need for HCI experts to exert influence across a broad range of technology activities, regardless of whether these are seen as "HCI projects". This is an opportunity, as it provides many points of contact from which to build careers, but can also be seen as a problem, because career credit for HCI leadership may be diluted. It takes continuing effort to maintain a sense of HCI community while also immersing HCI research within the domains in which it has impact. Some areas, such as design, are starting to build their own innovation cultures, although these are still at a low level of activity and frequency across UK universities. When promoting innovation through HCI we also must be sensitive to the new types of interdisciplinary researchers we are creating. These types of researchers accept an overhead in time spent building activities that need interdisciplinary and cross-domain working so funding actions, such as innovation fellowships, are a welcome stimulus at an individual level. At a broad community level, (building on programmes such as the Digital Economy) a more ambitious action might be to establish a grouping of the principal UK centres for HCI (analogous to the Turing Institute for algorithms, data and AI) so that these could work more collaboratively to introduce innovation in HCI via their existing interdisciplinary efforts, a bold move that would help keep the UK at the forefront of this discipline.

David Robertson, Chair

1. Introduction

HCI research in the UK has consistently been leading globally and is the second largest community, second only to the USA.[1] HCI is a highly interdisciplinary research area and the ability of the UK HCI community to collaborate with a wide range of applications and research domains is a clear strength. The HCI community in the UK is highly active, with many international leaders in the field hosting conferences and events, most noticeably, the annual ACM CHI conference, the largest international HCI conference, which was held in Glasgow in May 2019. UK HCI has always been strong at developing new interaction techniques and theories. 'Design led' research and 'research in the wild' techniques are

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[1] https://kashyaptodi.com/chi2019/

other clear strengths of UK HCI and the creative industries have benefited greatly from a close relationship with HCI research.

HCI has a significant contribution to make to society and is at the forefront of innovation and interaction, spanning technologies from Artificial intelligence (AI), robotics and data to virtual reality (VR) and augmented reality (AR) and other multimodal technologies. Furthermore, HCI is continuously shifting as new technologies are developed and incorporated into the HCI portfolio. HCI research can improve trust and security online, address issues such as fake news and online bias as well as improve accessibility of technologies and address sustainability of technologies. HCI can create a future where human abilities are amplified through computer interaction and this will only grow as new technologies are identified.

2. Fundamental vs Applied HCI Research

The current EPSRC strategy for HCI aims to promote both fundamental and applied HCI research and both aspects of the HCI research are crucial. The 2012 review split these two aspects of HCI into the following categories:

- Fundamental HCI research: theories and methods, evaluation, and understanding users.
- Applied HCI research: building, extending interaction, ethics and implications.

It was felt that it is becoming harder to distinguish between these two areas and many researchers are now working on the interface between fundamental and applied HCI. This research has transformed human culture by enabling access to mobile devices, web-based services and other technologies.

Nonetheless, there was a perception that fundamental research is being overcast by applied research. This may be due to a perceived expectation that HCI research must collaborate with industries and other institutions to demonstrate impact and get funded. This can push HCI into more applied research and there is a risk that fundamental research, that doesn't necessarily require collaboration, is not being supported. Fundamental research is also considered to be more risky and some researchers are moving away from it, as the community fears that it is less likely to get funding. The HCI community should ensure that both aspects of HCI continue to be strong so that the UK can maintain its strengths in this area. Fellowships have been a successful platform for fundamental research and could be a good way to ensure fundamental research continues.

3. Collaborations

HCI is a highly collaborative research area and the interdisciplinary nature of HCI research is considered a great strength in the UK, with collaborations spanning multiple disciplines, from healthcare, the creative sector and education to big data and AI. Indeed many HCI researchers are themselves multidisciplinary experts. Not only does HCI research work with companies such as Google, DeepMind, Microsoft and Intel, they also span third sector organisations such as Governments, charities and local communities. Furthermore, the HCI community have strong links with international collaborations, including developing countries in Asia, Latin America and Africa. As a result of increased collaboration, HCI principles, such as design thinking and methods, are now more widely distributed across disciplines and interdisciplinary teams are using them to design innovative products and services.

The emphasis on co-creation in HCI is strong and this has embedded collaborations across the field, consequently many researchers now feel comfortable to reach out and form new ones. Organisations have also set up new models for engagement. For example, some groups, such as the design informatics group in the University of Edinburgh have started using a consultancy type model to enhance engagement with new communities. The creative informatics and wider Arts and Humanities Research Council (AHRC) hubs have also provided a new way to meaningfully engage with the HCI community. The Newcastle Digital Civics Centre is another good example of HCI reaching into new areas.

There has been a noticeable increase in engagement with specific sectors, which can be seen at conferences such as ACM CHI Conference on Human Factors in Computing Systems. Material sciences, physics, photonics and the humanities are all areas that HCI has permeated recently. HCI also has a big role to play in AI and big data and there has been real momentum to integrate and shape these interactions.

Many of these collaborations occur organically but more could be done to design a support system for interdisciplinary research and bring together key research groups. The Interdisciplinary Research Collaboration (IRC) 'EQUATOR' project was a large partnership bringing together several research groups and such projects can help provide an identity and momentum for HCI research.

The multidisciplinary nature of HCI also has drawbacks for the HCI community. There is a risk that some groups are working in silos and it is important that HCI research remains truly

interdisciplinary, with disciplines integrating their knowledge and co-creating research challenges together.

HCI is often described as the 'glue' that brings multiple research areas together. This can result in HCI research not being acknowledged which can restrict the development of research careers in HCI. The increase in multidisciplinary HCI research can be seen to be diluting the HCI portfolio and in turn the HCI community is concerned about losing its identity.

3.1. Manufacturing and Hardware

The 2012 review specifically identified manufacturing and hardware design as sectors where HCI researchers could improve engagement. Progress in this area has been limited.
It was felt that the UK is less well positioned to lead in manufacturing and hardware, than in other sectors that HCI research has traditionally focused on, such as the creative industries and service design. Furthermore, innovation of HCI in manufacturing and hardware design is conducted by internal experts. IP issues are another challenge to working with these industries as it is difficult to maintain an audit trail for HCI research. The priorities of HCI and Manufacturing do not always align and the routes to market for these applications are unclear.

That said, there are some good examples of HCI collaborations with manufacturing and hardware designers, including Swansea University's 'Breaking the Glass' project and Cardiff University's 'Chatty Factories', as well as work at the University of Bristol, Lancaster University and the University of Sussex. Specific cross disciplinary calls in manufacturing, such as 'Active Building' and 'Factory of the Future' have promoted some HCI research, such as the University of Nottingham's 'Smart Products Beacon', however, this has been fairly limited.

It was felt that collaborations between HCI and manufacturing and hardware would be beneficial to both parties and there is potential to increase the work in this domain. Strengths in traditional industrial design in problem solving, creativity and synthesis methods can be leveraged to develop HCI research in manufacturing and hardware design.

Whilst there is a keenness for some research groups to get more involved in these sectors, it was not considered a major concern that HCI had not influenced the manufacturing and

hardware domains greatly as it was felt that HCI was leading in other areas, such as the creative sector and service design.

3.2. Arts and Design

A suggestion from the 2012 review was to increase collaborations with design and art institutions in both teaching and application of research. It was generally considered that there has not been a significant increase in these collaborations and whilst, some institutions have set up successful collaborations and included design elements to their teaching degrees, they are not ubiquitous.

One issue when collaborating with art and design institutions is that the conclusions from projects do not scale to marketable products or to other applications of HCI. Further issues with collaborations with art and design institutes is that contract structures of such institutions may not align with universities and some artists may be reluctant to get involved in HCI projects. UKRI could do more to encourage collaborations across different councils as well as providing clearer information on the how to submit research applications that span multiple council's remit.

4. Impact

There are numerous examples of how HCI research has had a direct impact on human culture and how new technologies infiltrate modern life, from mobile devices to educational opportunities and collaboration technologies that are used by 6 billion people worldwide. In particular, the UK HCI community has a clear strength in interaction technologies which has directly led to applications in these areas. Another successful impact of HCI research is in promoting a community of HCI researchers and methods in the UK. The talent pool in HCI has developed since the 2012 review and many students have moved into HCI careers in industry.

Nonetheless, it is often difficult for researchers to correlate their research activities to specific impacts and more could be done in certain HCI domains to boast the impact of the research. This is especially true for fundamental research, where often new frameworks or methods are published, but are either not widely used or not used immediately. Furthermore, some HCI results do not scale or translate to other areas, and therefore best practice doesn't disseminate into wider sectors. Scalable solutions on large scale systematic problems could help overcome this issue as well as advocating for HCI research and disseminating success

stories. There are also significant barriers to technology transfer in HCI, especially with institutional barriers in universities and corporate sectors.

There have been several initiatives to encourage acceleration of impact in EPSRC. The Impact Acceleration Accounts (IAAs) have enabled better translation of research as well as resources to create training courses and schemes to promote impact. However, the IAAs are given to Universities rather than individual projects and there may be institutional barriers to researchers receiving these funds. The Next Stage Digital Economy Centres have encouraged uptake and dissemination of research and the promotion of pathways to impact in EPSRC's grants has encouraged greater engagement with industrial partners and the wider community.

4.1. Business Engagement

Since 2012 there has been a shift in how businesses engage with HCI research. Companies such as Microsoft and the BBC have been strategic about their funding decisions, deciding to focus on specific research areas rather than maintaining a broad portfolio. This hasn't necessarily reduced the amount of funding available to researchers but has focused the scope of research that is supported through industry.

Industry engagement has been promoted through entrepreneurial training programmes such as [EPSRC Centres for Doctoral Training](#) (CDTs) and [EPSRC iCASE](#) awards which provide training in HCI. These awards encourage students to work on the boundary between research and industry and build on best practice. Examples of institutions where these programmes have been successful include Lancaster University, the University of Nottingham and the University of Bristol.

There has also been some traction in engagement from the HCI community with UK policy, in the context of internet regulation and ethics through 'Regulating in a Digital World' however there is room to increase the influence that HCI research has on policy.

4.2. Start-ups and Spin-outs

One of the suggestions from the 2012 review was that the HCI community needed to reach out to new funding sources, specifically through start-ups and spin-outs. Some universities have been successful at setting up start-up and spin-out companies, for example Emotech, which came out of UCL and Ultrahaptics which came out of the University of Bristol. The Next Stage Digital Economy Centres and CDT training programmes have also enabled an ecology of start-ups and have attracted new investment. Nonetheless, the overall growth of

start-ups and spin-offs in HCI has been minimal. This was considered to be due to a lack of awareness of the support and funding available, although this is not necessarily an issue that is unique to HCI.

Another perceived issue was that researchers are not always motivated to set up their own companies and become entrepreneurs in their field. There is a need to ensure that the HCI community attracts both researchers and entrepreneurs and that spaces are available for these two groups to exchange ideas and collaborate together. Some places in the UK are well-poised to do this, for example the Computational Foundry in Swansea.

Many HCI research products are considered to be more around principles and methods rather than specific products that can be marketed and this makes it difficult to implement start-ups and spin-outs in HCI. More awareness of the training and support opportunities that exist for pre-seed start-ups would be valuable for encouraging more start-ups and spin-outs, the Royal Academy of Engineering Enterprise fellowships are one such source.

5. Funding

Since the 2012 review there have been a range of calls that are relevant to HCI and address some of the challenges outlined in the 2012 review. For example, the cross disciplinarily and co-creation call addressed the issues around encouraging business engagement. In the past 4 years, there has been a consistent trend that HCI grants have higher success rates in such calls than in standard mode proposals[2] and this has been noticed by the community. There is a risk that the community start to rely on calls, which prescribe the remit of the proposals, for UKRI funding. This could limit the breadth of HCI research in the UK, particularly for 'blue skies research'.

HCI overlaps into other research councils in UKRI, most noticeable AHRC and the Economic and Social Research Council (ESRC), however, it was perceived by the attendees of the round table that funding was more difficult to get from other councils.

Many researchers are looking for funding from the EU Horizon 2020 as an alternative to UK Research and Innovation (UKRI) funding. It was felt that Horizon 2020 funding promotes high risk research and also provides traction for some areas such as Responsible Research and Innovation (RRI).

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[2] Internal data from EPSRC

Other sources of funding for HCI research include charities (for example Leverhulme) and the Alan Turing Institute. Internal University funding is also available for grand challenges and seed corn research. Universities can sometimes use EPSRC strategy to influence where these investments are made which can make them highly competitive. The Global Challenges Research Fund (GCRF) and the Industrial Strategy Challenge Fund (ISCF) have seen some engagement from HCI researchers but there is still an opportunity for the HCI community to engage further with these additional funds and to communicate the exciting investment opportunities that exist. Submitting [Big Ideas](#) could be a good way for the HCI community to input their ideas to EPSRC and potentially secure additional funding for ground breaking research.

5.1. Innovate UK funding

One source of funding that the 2012 review highlighted as an area that the HCI community could take advantage of was Innovate UK. However, it was generally felt that this funding does not align with HCI research. This was especially difficult as the community struggle to attain industry capital and resources. HCI research is often too low a technology readiness level (TRL) to be eligible for Innovate UK funding and to be directly developed into a product or service. That said, much of the work funded by Innovate UK involves some aspects of HCI, however, this work is often implicit and unacknowledged.

One area that had been successful in attaining Innovate UK funding was in the creative industries who have improved engagement through catapults. UKRI Innovation Fellowship schemes have also been a good way for the HCI community to get Innovate UK funding and have allowed the HCI community to engage with local companies, particularly in the design space.

6. The Future of HCI

HCI has a huge potential to improve the development and adoption of new technologies to deliver large scale societal changes. Any new technology or device that will be used by a human requires the input from HCI research, either in the original designs of the technology, developing the user interfaces, studying interactions with the technology or, most likely, in all of the above. The UK HCI community is world leading in all of these areas and is well placed to achieve these goals and maximise on new opportunities. Previous technology developments such as AR and VR are good examples of how HCI has been impactful and this will continue to happen as new technologies and applications are developed. HCI also

has the potential to spread further across multiple industries such as the transport and automotive car industries, medical devices, manufacturing and e-commerce.

People are now more aware than ever of where their data is stored and how it is used and human-data interaction is a growing area of HCI research and is a real opportunity for the HCI community to explore. Industry 4.0 and the AI revolution is another area where HCI has a huge part to play, enabling humans, robots and AI to collaboratively work together in the future. This will also include research into the ethics of AI and other new technologies and the RRI agenda is highly relevant to the future HCI community. Through this work, HCI has an important role in influencing future policies and governments and this advocacy for HCI and related issues is essential if we are to achieve truly pervasive computing.

The UK is world leading in HCI training and skills and there is potential for HCI groups in the UK to share their knowledge and experience to drive HCI education around the world. This in turn can feed back into stronger international collaborations and attract future international students to the UK.

Furthermore, HCI can help overcome societal challenges such as climate change and sustainability. As technology continues to use ever increasing amounts of energy, HCI research can help society find new, low power and efficient ways of interacting with computers. HCI research can also do more to develop accessible technology and evolve the future of work in a digital age.

7. Conclusion

HCI research in the UK is world leading and there are clear strengths, such as the number and type of collaborations as well as how HCI embraces new technologies. These strengths provide a solid foundation for future growth and there are multiple emerging opportunities that could accelerate the role of HCI in transforming everyday life while helping solve large scale societal challenges. There are, however, several barriers that could limit the potential of HCI research if they are not addressed, particularly around promoting fundamental research and achieving long term, sustained impact of HCI research.

HCI is highly multidisciplinary and is spreading to new technologies as they are developed. Whilst this is a clear strength in the UK, there is a risk of HCI being dispersed. Large-scale, visionary research on HCI research would unite the community and enable collaborations on major projects. This would also promote impact of HCI research and enable translation into

marketable applications. Possible ways for the community to do this are through programme grant applications and other large grants, Integrated Knowledge Centres and inputting into the EPSRC's Big Ideas. The Alan Turing Institute type model and the AHRC hubs were also identified as good examples of bringing communities together and the HCI community could consider these.