Quantum Technologies
Public Dialogue Report Summary

Foreword

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New systems, devices and products that make use of the quantum properties of particles and atoms are beginning to emerge from earlier investments in science and engineering; and they promise to change many aspects our lives, from banking to construction, security to healthcare.

EPSRC has been funding research in this field for over twenty years and is a key partner in the UK National Quantum Technologies Programme (UKNQTP) to which the UK government allocated £270 million five years ago in 2013.

EPSRC as part of UKRI is committed to Responsible Research and Innovation (RRI) and has established a Responsible Innovation Framework. Researchers can use the Framework as a tool as they develop research and consider its implications.

As part of our commitment to RRI we decided that Quantum Technologies was an area that was still sufficiently new to the wider world that it would be appropriate to gauge what people perceived and how they felt about the potential impacts of new systems, devices and products involving quantum principles.

That is why we commissioned an independent company to carry out a public dialogue over a three month period. The full report is available on the EPSRC website but this summary gives the key findings and recommendations.

I hope you find it useful and informative and that it demonstrates how science and engineering can progress in an open and inclusive environment and promote understanding among society.

Background

The UK National Quantum Technologies Programme's aim is to realise the potential transformative impact the novel quantum technologies can make across business, government and society. The Programme is championed by the Quantum Technologies Strategic Advisory Board (QT SAB)[1].

As part of the Programme, the Engineering and Physical Research Council (EPSRC) launched a national network of four Quantum Technology Hubs in October 2014.

The Hubs are consortia of academia industry and government agencies working together to exploit the potential of quantum phenomena by developing emerging technologies, ultimately to benefit the UK.

These Hubs focus on different areas of quantum research and technological development: Sensing and Metrology Hub led by University of Birmingham; Quantum Enhanced Imaging Hub led by University of Glasgow; Networked Quantum Communications Hub led by University of Oxford; and Quantum Communications Hub led by University of York.

The Public dialogue

Despite national investment and interest in Quantum Technologies (QT) among the academic, technology and policy-making communities, until now there has been very little work to explore the public's views on this topic[2]. To address this gap, in December 2016 EPSRC commissioned social research agency Kantar Public to carry out a public dialogue to assess a representative sample of the general public's views on QT.

The overall aim of the dialogue was to explore public views on QTs, devices, and applications. Specifically, its objectives were to:

• Understand public perceptions of QTs, in terms of people's spontaneous, unprompted views, and more considered opinions in response to information, discussions, stimuli, etc.

• Explore public values in relation to QTs, including their aspirations and priorities, and concerns or dilemmas – uncovering the principles that underpin their views;

• Engage the public in a dialogue with experts and researchers, in order to:

    o Inform the public about the technology, services and devices which may emerge from the UKNQTP and the wider community;

    o Inform the quantum community of the public's views (through the dialogue and its outputs) about the social and ethical implications of quantum research and technologies.

The dialogue was highly exploratory in nature – contributing the first substantive knowledge of public attitudes to QTs and their applications.

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1 The QT SAB was set up to provide a visible focus for QTs in the UK and to act as a co-ordinating body for UK interests. It has an oversight of the UK NQTP and has drawn up a strategy for quantum technologies in the UK.
2 See Sciencewise, Public attitudes to quantum technology (May 2014), Section 2, p3, from http://www.sciencewise-erc.org.uk/cms/assets/Uploads/Quantum-Technology-Social-IntelligenceFINAL.pdf, accessed 9th November 2016

Methodology

The dialogue had several stages, consisting of a stakeholder workshop, followed by two waves of full-day public dialogue workshops in four locations (Oxford, Glasgow, Birmingham and York). Between the workshops, participants took part in interim activities in each location focusing on particular technologies and their potential impact.

The workshops were held between September and November 2017 and 77 participants completed both workshops. Participants were recruited to reflect the range of the UK population and capture a diversity of views. As qualitative research, the aim of the dialogue was to explore participants' in-depth views and responses, rather than to provide statistically representative views.

Key findings

- There was wide familiarity with the word 'quantum' – however beyond this there was low knowledge of what quantum was or about QTs. Participants generally held a limited set of surface-level associations, broadly relating to 'advanced technology' and science/physics. No one talked about quantum being 'spooky' or 'weird' - as some stakeholders had anticipated.
- Limited exposure to information about QTs had led to an initial feeling of neutrality towards them which meant that participants were yet to develop an emotional response to the topic. Significant minorities felt otherwise: participants with lower engagement with science tended to express some anxiety going into the start of the dialogue, and those more interested in science generally felt curious and excited.
- Greater exposure to information about QTs generally saw participants become more engaged and excited by the range of potential benefits associated with QTs – particularly once they understood how various QTs could impact upon and be relevant to their own lives. Whilst no participants became more negative about QTs, there was a small number of participants who felt disengaged from science and their level of interest remained unchanged.
- QTs were seen to have a wide range of benefits for individuals and society. The most engaging QTs were those which participants understood to have the greatest potential impact on individuals and society – in terms of saving or extending life (i.e. health technologies and humanitarian applications); finding cost-efficiencies in healthcare; and improving national and financial security.
  - o While participants were often excited about these benefits, the technologies were regarded as an incremental improvement, rather than new and revolutionary
  - o Participants hoped that benefits would be realised for the public good, rather than private profit (particularly in the context of the NHS) - and did not cite wider economic growth as a benefit of the technologies.
- Throughout the dialogue some concerns were raised about the development and use of QTs, some of which related to the development of technology more widely:
  - o Who controls the development of QTs? – and how far decisions would be driven by company profit, potentially at the expense of the public interest;
  - o Who would have access to QTs? – and whether uneven access could drive a greater and less surmountable divide in society;
  - o Automation and job losses – this was an emotive and salient issue and job losses in driving, analytical, and logistical roles were seen as an immediate and relevant risk;
  - o Environmental damage – participants questioned QTs' overall contribution to climate change.
- Other concerns raised were more specific to the QTs discussed at the workshops and included:
  - o Whether QTs would spark a defensive international arms race – where nations felt compelled to invest in quantum computers defensively to ensure their security. While the development of this technology was thus perceived to be inevitable - not a matter of choice - participants were keen that the UK was at the forefront of quantum computing, and so supported investment;
  - o Misuse of QTs for the purposes of hacking and cyber warfare;
  - o Misuse of encryption technology to hide criminal activity (e.g. terrorism, organised crime, paedophilia, and tax evasion);
  - o Misuse of imaging technologies by criminals, companies and the state.

- While concerns were raised, overall participants were not overly concerned about the development and use of QTs and the risks associated with them. They saw the benefits as worthwhile and as positive progress for society. The following considerations also helped to alleviate participants' concerns:
  - o The risks associated with QTs were not perceived as new, but rather built on already existing risks with which participants were familiar (though quantum computing was the exception to this);
  - o The risks were not necessarily specific to QTs – but were seen to relate to technological advancement more widely;
  - o Misuse of new technology was seen to be inevitable.
- Remaining concern about access and control in the development and use of QTs could be mitigated through the establishment of governance mechanisms to reassure participants:
  - o Participants had assumed that societal implications were considered as standard by academics, which underpinned their high level of trust in this group. Participants felt strongly that wider public interest should be considered as standard in the development of QTs as well as company profit;
  - o Participants wanted to see an oversight body comprised of multiple voices to ensure the public interest was considered in development decisions.
  - o Participants wanted to see that forms of misuse that pose a threat to individuals or society would be planned for, deterred and punished. Restricting public access to some QTs was seen as appropriate when participants felt the risks of public access outweighed benefits.
- While good governance was important to participants, they did not want to see regulation stifle innovation in and advancement of this area or disadvantage the UK in the international area.

Recommendations from the dialogue

The following recommendations for the quantum community emerged from analysis of the dialogue data by Kantar media. They are summarised here:

- Participants wanted to see the UK investing in QTs and leading on this in the international arena – because they saw the benefits as providing progress for individuals and society and to ensure the security of the nation if other countries were developing the technologies.
- The neutrality felt by participants towards QTs suggests there is an opportunity and growing need for the quantum community to tell its own story and establish positive associations with QTs.
- Participants were excited about the potential benefits associated with QTs and there was interest in more information about these – particularly the QTs which have health, humanitarian, security and efficiency benefits.
- Discussions suggested there is a need to address concerns about quantum computing and encryption as these are seen to present the greatest step change and potential threat to society and therefore induce public fear.
- Discussions suggested it would be helpful for researchers to consider engaging with wider debates regarding concerns associated with technological advancement including automation, privacy and surveillance, and climate change – and the contribution QTs can make to these debates.
- There was a desire for governance mechanisms to be created which consider the public interest as well as profit; consider wider societal implications; and ensure there is adequate regulation and enforcement in place prior to commercialisation of QTs and to deter and punish perpetrators (including the government and public bodies as well as individuals and companies).
- Researchers should take responsible research and innovation more seriously.

In addition to these recommendations, some lessons regarding how to communicate effectively with the public about QTs; the possibilities and limitations of dialogue on this topic; and how participants wanted to be involved with decision-making regarding QTs in the future were drawn from the dialogue.

Oversight board for this project

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