Tomorrow's tech, today

What the public think about five emerging technologies, and opportunities for future engagement





UK Research and Innovation

sciencewise

BRITISH SCIENCE ASSOCIATION

Preface

The purpose of this report

This report aims to outline what is known about public views, values, and debate on five key emerging technologies (EmTech), and to identify gaps and areas for further exploration through public dialogue.

The report is commissioned by Sciencewise, a UKRI funded public dialogue programme that supports government departments and other public bodies to listen to and act on diverse voices, to shape policy and priorities. Important benefits of the programme include:

- **Helping decision makers to formulate policy with a deeper understanding of public views, concerns and aspirations;**
- **Supporting high quality, best practice public dialogue; and**
- **Bringing credibility and independence to government-led public dialogue projects.**

Since 2004, Sciencewise has supported almost 70 public dialogue projects on often controversial technologies and cross-cutting issues of societal change, from AI, gene editing, and climate technology to low-carbon growth and the future of food production. The Sciencewise priority themes were updated in January 2022, drawing from key government and research council priorities, and the latest research and innovation trends:

- **Climate and Environment: How can society live sustainably?**
- **Data, AI and Robotics: How should society shape our digital world?**
- **Health, Ageing and Wellbeing: How should society live healthy lives?**
- **Life Sciences and Biotechnology: How should society shape the future of life?**

Sciencewise has built a strong reputation for innovation, inclusivity, and impact and successfully implemented several major online public dialogues during the Covid-19 pandemic.

This report on public opinion about EmTech is intended to identify opportunities for anticipatory public dialogues, where members of the public are invited to share their views and values on emerging technology topics. We present results from analysing sources of public opinion on five emerging technologies. This provides a snapshot of public views at the time of writing, December 2021.

The report will be useful to those interested in public views on new and emerging areas of science and technology and is particularly targeted at those involved in science and technology policy.

Acknowledgements

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Input on the technologies, themes, and sources was provided by UCL Department for Science and Technology Studies, the Royal Society, University of Wisconsin Maddison Department of Life Sciences Communication, and Ada Lovelace Institute.

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Executive summary

Emerging technologies will transform our world. We will encounter them as biological, physical, digital and virtual interventions in our lives. The impacts have potential to be felt in almost every aspect of society. It is vital that the debates that will shape the use and governance of emerging technologies involve people who will be affected by them.

An open discussion with people and communities who are representative of wider society can create new possibilities, allow policymakers to identify potential issues and build public support and trust for emerging technologies. It can also build confidence among policymakers that the public can and should be part of key policy and research decisions.

Inclusive engagement can also help to uncover the values and reasoning underlying people's views, and help policymakers understand what factors influence public opinion about science and technology.

Reactions to emerging technologies and the effects of their implementation are often hard to predict. Understanding the expectations, hopes and concerns of the public, and how they prioritise and make trade-offs, can help decision makers guide new technologies onto paths that take account of what helps and hinders their social desirability and acceptability.

The complexity of emerging technologies and the different impacts they may have on society makes it likely that individuals, groups and communities will experience or view them differently. People in historically marginalised groups have often been overlooked or even harmed by novel technologies - for example, there are many cases of discriminatory algorithms. Yet emerging technologies can be created in a way that benefits and involves all people. This is especially important given the current global focus on racial equity, and the social, economic, and health inequalities magnified by COVID-19.

This report considers five emerging technologies, identified through desk research and consultation with academics, policymakers, and technologists, that are key to the UK government's Innovation Strategy and may deliver major societal benefits, but are likely to play out in ways that cannot be totally predicted. Given their likely impacts, we wanted to find out what is already known about public opinion towards these technologies. We analysed social intelligence sources (such as dialogues, surveys, social media, mass media, opinion polls, and social research). We aimed to identify themes, possible concerns, affected communities and gaps in our knowledge around what the public think of each emerging technology.

For the technologies considered in this report we find some clear gaps in the current evidence base that we see as issues requiring urgent public engagement.

Social and ethical issues in emerging technologies

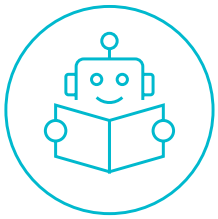
We found that several social and ethical issues appear repeatedly, regardless of which emerging technology is being considered:

Who governs the technology? How is the regulation shaped? How can people influence decisions, or control how it applies to them?

Who benefits from the technology? Are certain social groups favoured, and how might technologies widen inequality? Where are the costs and rewards felt?

Is the technology safe and secure? Are people's identities and health and wellbeing protected?

AI and automation in the workplace



AI and automation in the workplace has attracted a lot of research attention, and there have been many efforts to understand people's views and expectations for how it will affect them and where they feel the benefits are. Less research has focused on inequality at work. As the nature of workplaces change post-pandemic, there are opportunities to open up public discussions about how AI and automation could make work safer, fairer, more productive and more rewarding.

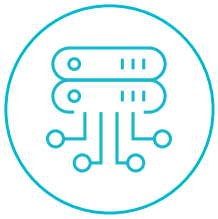
Key social and ethical issues associated with AI and automation in the workplace:

- Impact of power and bias upon workplace experience; value, innovation, and costs in terms of where jobs will increase and which sectors will benefit.
- Effectiveness, user experience and transparency, which are associated with who controls AI systems

Analysis of social intelligence of AI and automation in the workplace shows:

- People want to feel informed about AI and automation in workplaces.
- The UK public are aware of the potential implications of more automation, but are unsure what this means for them, or for the economy in general.
- Men, people in higher social grades, people with higher levels of education and younger people are more likely to feel informed, have positive views, and seek out information about AI and automation.

Data-driven technologies (DDTs)



Data, connectivity, and automated decision-making has mainly been explored with reference to the benefits and trade-offs associated with data-driven technologies, for example individuals providing their data in return for a more useful service. However, most of the sources we analysed for this report do not provide evidence about the transformative potential of data-driven technologies for people's daily lives and wellbeing.

Key social and ethical issues associated with data-driven technologies:

- Consent, control, privacy and surveillance, relating to where and how data is collected; personalisation, obtrusiveness, and individuality, around how data is used; and quality, influence, and accountability, with respect to how data-driven technology is applied.

Analysis of social intelligence on data-driven technologies shows:

- People have become used to their data being collected, but still feel uninformed and unable to influence how it is used and reused.

- There are patterns of exclusion of women, disabled people, older people, and racially minoritized groups when it comes to data collection, use, and sharing; and the systems for governance and use of data in public settings are not seen as trustworthy.

Therefore, future public engagement on data-driven technologies could focus on:

- Co-creating data-driven systems and regulation, and, in particular, involving marginalised groups in decisions about how data is collected, used, and shared.
- There is also a need for research into data in public services other than the NHS, or data collection in specific localities and communities.
- AI is relatively well-explored compared with other data-driven technologies such as 5G or internet of things (IoT) devices.

Human enhancement technologies (HETs)

Public engagement on human enhancement technologies (HET) to date has asked people about a narrow range of applications of human enhancement technologies, such as neural interfaces and "smart drugs". There are opportunities to consider how HET could impact societal inequality or physical health, and to explore a wider range of potential uses.

Key social and ethical issues associated with HETs:

- Safety and privacy of the user before, during and after HET; the impact HET could have on views of what's natural, or how diverse society "should" be; hype, costs, and dual-uses of the technology leading to unequal distribution of benefits.

Analysis of social intelligence on HETs shows:

- People are more negative than positive about life-enhancing technologies. Key concerns include commercial motives and governance of the technology.
- However, some people can see themselves using specific HET interventions like smart drugs, and would be more supportive of HET if it was used to create a fairer society.

Therefore, future public engagement on HETs could focus on:

- How HET might change ideas about physical and mental health, or prevent inequalities caused by HET.
- There are also opportunities to explore military use or dual-use implications of HET, and how to prevent misinformation about human enhancement technologies.

Augmented reality and virtual reality

Augmented reality and virtual reality (AR and VR) are largely treated as a consumer technology. There is little work looking at public views of safety and security, inequity and inclusion, or impacts on health and behaviour. With major global tech companies investing heavily in AR and VR, there is a need to involve a wider public than "early adopters" in conversations about how the technology should be used and regulated.

Key social and ethical issues associated with AR and VR:

- Efficiency, personalisation, privacy and surveillance of people's data and behaviour; the technology's role in producing empathy, therapy, connection, and isolation; safety, wellbeing, and exclusion of users

in AR and VR environments; manipulation, preparedness, and advantage as a result of emending real-world events; ownership, rights, and governance of the software and platforms.

Analysis of social intelligence on AR and VR shows:

- People have a high awareness of the technologies in the UK, but that knowledge is generalised and somewhat superficial.
- However, there are indications that inequalities could arise relating to cost, digital skills and confidence, and user inclusivity.

Therefore, future public engagement on AR and VR could focus on:

- Safe and responsible use of the technology, therapeutic uses, and preventing misinformation, might involve groups such as women, older people, LBGTQ+ communities, or disabled people when developing AR and VR technology.

New gene therapies

New gene therapies are a growth industry in the UK, but very little research has been done into public views and values, especially compared with related areas such as genomics and germline gene editing.

Key social and ethical issues associated with new gene therapies:

- Protecting identity and ensuring access; diversity, decision-making, and unknown effects associated with how new gene therapies should be applied and to whom; and since new gene therapies are so resource intensive, accounting for sustainability, regulation, and costs.

Analysis of social intelligence on new gene therapies shows:

- People are most likely to favour using gene therapies for chronic health conditions, and that men, younger people, and people without a religious affiliation are most likely to be supportive of new gene therapies.

Therefore, future public engagement on new gene therapies could focus on:

- Governance frameworks and equitable distribution of accessand involve marginalised communities in conversations about how the technology can be used in treatments.

UKRI Sciencewise welcomes further discussion with government departments, and public bodies who want to understand more about the opportunities for public dialogue on Emerging Technology.

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Disclaimer:

The views expressed in this report are not representitive of the views of UKRI.

Sciencewise, a public dialogue progamme delivered by UKRI, has conducted this research with a view to identifying areas of research and innovation and technologies where early public engagement would be useful, and welcomes further discussion with research funders, government departments, government agencies and other public bodies working on these issues.