



**BEIS Public Attitudes to Science
Public dialogues - Wave 3
Perceptions and acceptability of use of robotics technology with a
focus on the care sector**

Report

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1. Executive summary



This research has explored public attitudes to the use of robotics technology in the care sector

Public dialogue brings together members of the public, policy makers, and expert stakeholders on a subject to deliberate, reflect and come to conclusions about a policy issue; e.g. on new technologies and complex, sensitive, political or difficult issues. This dialogue has explored public perceptions of and attitudes towards the use of robots in the care sector.

The aims of the dialogue were to:

- Gain a greater understanding of what the public understand by the term 'robot'
- Understand perceptions of robotic technologies and aspirations and concerns about the development of these
- Understand perceptions of how robots are used in health and social care
- Understand the aspirations and concerns that the public hold toward the use of robots in the health and social care sectors;
- Understand participants' perceptions of organisations involved in developing and implementing robots for use in the care sector;
- Understand perceptions towards the use of 'social robots' to provide companionship or help towards elderly people and vulnerable children;
- Explore the drivers of acceptability of the development and use of robots in our society



One week digital dialogue

- 31 participants reflecting a range of demographics, 4 stakeholders, and 3 policy makers observing
- 7 day community with 3 waves of materials released and 2 homework tasks completed between waves
- 4th – 11th December 2018



Four focus groups

- 4 focus group with 31 digitally excluded participants in Nottingham and Belfast
- 90 minutes - a reduced version of the dialogue guide and materials were used
- 13th December 2018



Key Insights: Overall associations and acceptability of robots

Associations

Associations across the dialogue with robots varied and included:

- **Traditional** fictitious robots presented in films / TV
- **Mechanical** robots used for practical jobs,
- **Domestic** devices used for leisure or in the home
- **Humanoid** robots that resemble human beings

Fears

Some feared loss of control and robots 'taking over', driven by portrayals of robots in 80s-90s popular culture. This was also the case in the Wave 2 digital dialogue and Wave 3 social media analysis.*

Across the course of the dialogue, participants were able to critically engage with this narrative and some moved beyond it and focused on more modern utilisations of robotics technology.

Humanoid robots

Humanoid robots were widely perceived as 'creepy' and uncanny – and participants questioned the value of funding the development of these.

There was greater comfort with more traditional or mechanical robots and those that were 'cute' or animal-like.

Acceptability

Overall, there were mixed feelings about the development of robots for use in our society, across the digital dialogue and focus groups.

The key benefits were seen to be in the health sector; e.g. improving disease detection and carrying out monotonous tasks to free up medical staff to provide more holistic care to patients. Outside this, benefits included robot's ability to increase efficiency and carry out jobs that are dangerous for humans.

Concerns were raised about robots replacing workers, particularly in manufacturing, and care roles involving emotional support.

Participants were most comfortable with non-humanoid robots developed to assist humans with menial/repetitive jobs and where human intervention was still required (e.g. Roomba the vacuum robot and Iceman the industrial robot)

*Wave 2: Perceptions and acceptability of the use of artificial intelligence with a focus in healthcare: Digital Dialogue
Wave 3: Public attitudes to the use of robotics technology in the labour market: social media analysis



Key Insights: Perceptions and acceptability of robots in the care sector

Initial Concerns

Some initial concerns were raised about the use of robots in the care sector:

- Robots can't provide appropriate emotional care to vulnerable people
- Robots would take jobs from health and care workers
- Robots might malfunction and cause injuries to patients

Initial Benefits

After consideration participants recognised some benefits:

- Providing assistance to care staff and medical professionals on monotonous tasks to free up their time
- Improving care accuracy, efficiency, and quality

Persistent concerns

However two key concerns persisted:

- Robots might lead to job losses, reflecting findings from Wave 3: Robotics technology in the labour market*
- Robots would be unable to replace human emotional contact and care, particularly concerning when thinking about vulnerable people

Acceptability

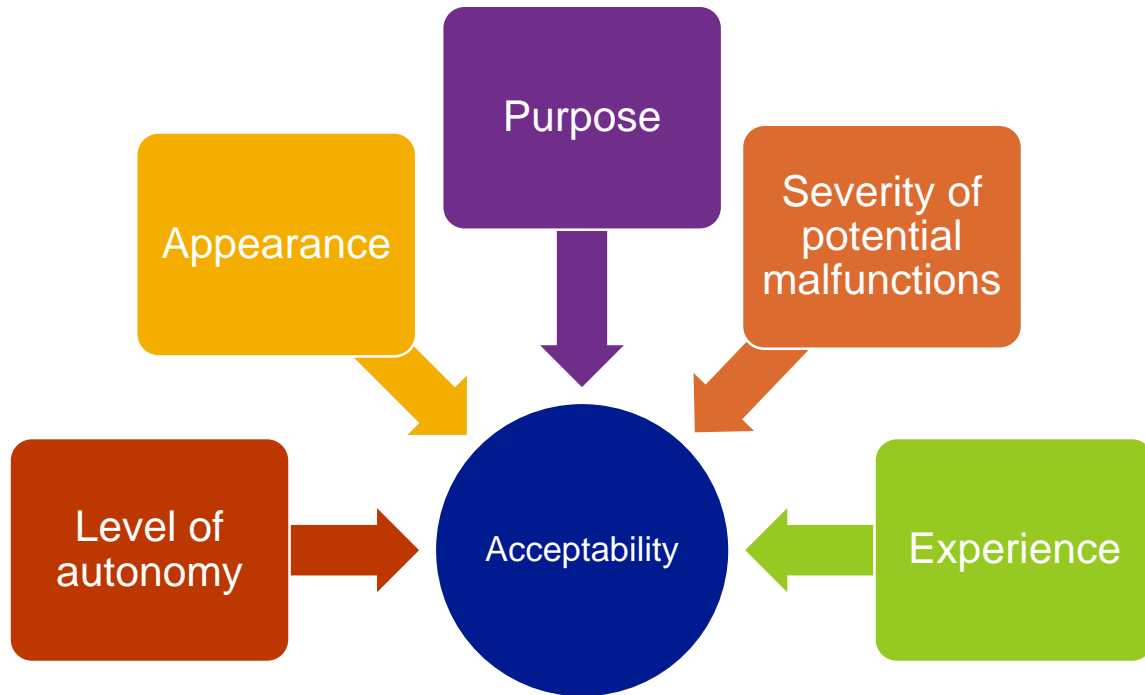
In the end, participants agreed that it is important to develop robots for use in the care sector, but there were mixed levels of comfort with this prospect, across the digital dialogue and focus groups.

Robots were more acceptable when they were seen to add value but not to be trying to replace traits that were seen to be inherently human (e.g. emotional support).

Humanoid and fully autonomous robots were less acceptable than 'cute' robots and those that required some level of human intervention because participants did not trust robots to operate without human oversight, especially when related to care for vulnerable people.



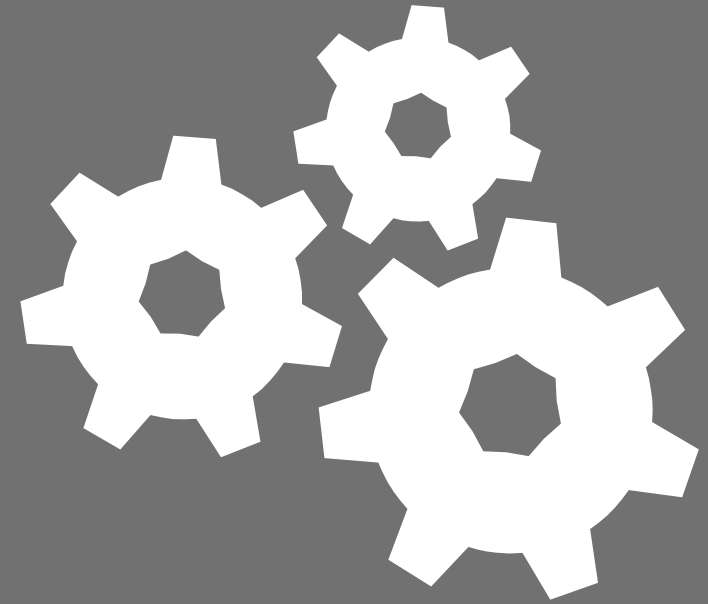
Key Insights: Drivers of acceptability of the use of robots in the care sector



Acceptability was driven by five key factors:

1. **Level of robot autonomy** – and whether or not it required human intervention
2. **Appearance of the robot** – and whether or not it was humanoid
3. **Purpose of the robot** – whether it was seen to add value (e.g. by increasing efficiency) or to replace essentially human traits and characteristics (notably emotion and ‘human touch’ and whether the **transparency of the purpose** was clear and they felt they understood why it was being developed
4. **Potential severity of malfunctions** – and whether these could seriously physically harm or kill a human
5. **Nature of participants’ experiences with robots** – and whether they had experienced the benefits of this technology

2. Research design





The purpose of dialogue is to inform government decision making, better facilitate two-way discussions about science, and contribute to open policy making



1

Public dialogue brings together members of the public, policy makers, and expert stakeholders on a subject to deliberate, reflect and come to conclusions about a certain policy issue; e.g. on emerging technologies and complex, sensitive, political or difficult issues.

2

Deliberative dialogue goes beyond exploring people's top of mind views about complex issues, to uncover how they form these views, and to debate issues in more depth using different information sources. They have more time and space to develop more informed and considered views.

3

Committed stakeholders who can communicate with non-technical participants and invest time in the research are crucial to the success of a dialogue. Their involvement allows participants to ask questions and witness stakeholder interest in the two-way dialogue process.

4

Digital deliberative dialogue brings participants and stakeholders together in an online community for a week rather than in a traditional workshop. The forum brings people together from across the UK and allows us to conduct the dialogue at a faster pace.



This dialogue explored perceptions and acceptability of the use of robotics technology in the care sector

This dialogue forms part of the qualitative work to support BEIS's 2018-19 Public Attitudes to Science Survey

In total, we will conduct four waves of qualitative research, each focused on a specific topic of interest and consisting of:

- 1 week digital dialogue with 30-33 individuals
- Four focus groups with digitally excluded individuals
- Supporting social media analysis for each wave

The focus of Wave 3 is the use of robotics technology in the care sector

- *Perceptions of robotics technology*
- *Aspirations and concerns about the development and use of robotics technology*
- *Perceptions, aspirations and concerns about the use of robots in the care sector*
- *Acceptability of the development and use of robots*

The aims of this digital dialogue were to:

- = Gain a greater understanding of what the public understand by the term 'robot'
- = Understand perceptions of robotic technologies and aspirations and concerns about the development of these
- = Understand perceptions of how robots are used in health and social care
- = Understand the aspirations and concerns that the public hold toward the use of robots in the health and social care sectors;
- = Understand participants' perceptions of organisations involved in developing and implementing robots for use in the care sector;
- = Understand perceptions towards the use of 'social robots' to provide companionship or help towards elderly people and vulnerable children;
- = Explore the drivers of acceptability of the development and use of robots in our society



We conducted a one-week digital dialogue with 31 participants and four focus groups with digitally excluded participants

One week digital dialogue



- 31 participants took part reflecting a range of demographics*
- 4 stakeholders participated**
- 3 policy makers observed
- 7 day dialogue (with a minimum of 3 hours participation)
- 3 waves of materials were released and 2 homework tasks were completed between waves
- Use of Recollective platform
- **4th – 11th December 2018**
- £75 incentive

Four focus groups



- 4 focus groups were conducted with those who lacked access to or confidence using the internet
- 31 participants took part reflecting a range of demographics*
- 90 minutes
- A reduced version of the dialogue guide and materials were used
- Nottingham and Belfast
- **13th December 2018**
- £40 incentive

Conversation flow

- Spontaneous associations with and attitudes towards robots
- Responses to current uses of and relationship with robots
- Awareness of robots in health and social care
- Responses to existing uses of robots in health and social care
- Perceptions towards organisations involved in developing robotics technology in health and social care
- Responses to issues that arise from using robots within health and social care including safety issues, employment, issues of accessibility, accountability, and data collection.

3. Perceptions of robots





There were four common associations with ‘robots’ - ranging from images represented in popular culture to recent humanoid AI applications

- **Traditional** – focused on more rudimentary silver, square images of robots. Included robots presented in 1980-90’s films and TV shows sometimes linked to childhood memories of simple, non-threatening depictions of robots (e.g. Johnny 5 from Short Circuit) and more threatening villainous representations (e.g. Ash from Alien). There was a common narrative about the threat of robots ‘taking over’ as they become more intelligent (linked to AI and humanoid robots), and this associated has developed through depictions of robots in films
- **Domestic** – devices used for leisure, in the home and on their mobile phones

Traditional



Industrial



Domestic



Humanoid



- **Industrial** – robots used for practical jobs in manufacturing (e.g. factory assembly lines and warehouses)
- **Humanoid** – robots that looked like humans - generally seen as creepy, uncanny and often seen as threatening to jobs or replacing humans (e.g. Ava from Ex Machina and the robots from iRobot)

Younger participants tended to be more critical about the threat narrative derived from popular culture of robots ‘taking over’ and were more focused on domestic and mechanical applications



Popular culture and real life personal experiences were the main ways in which participants had learned about robots

Popular Culture

Films, sci-fi stories, TV programmes - particularly Dr Who

Real life personal experience

Work related experience, experience in healthcare, word of mouth, visiting other countries (e.g. Japan, Dubai)
Conflation of robotics technology and AI applications

School

Some younger participants mentioned school as a source of information while older participants discussed helping children with homework related to robots.

Media

News and documentaries.
Older participants mentioned car manufacturing advertisements

Those who had personal experience with robots tended to move away from the threat narrative and be more comfortable with robots

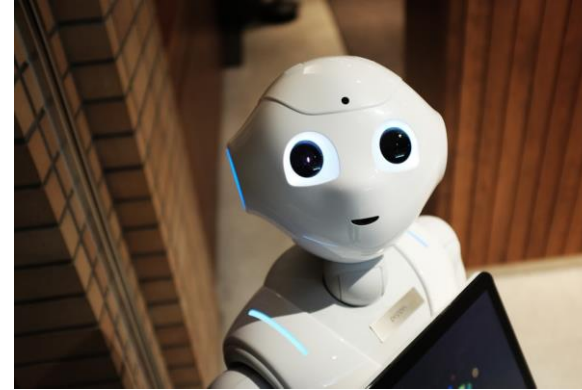


However, concerns were raised about humanoid robots – which were commonly seen as ‘creepy’

Participants were less comfortable when robots looked **human-like** – finding them **creepy and uncanny** and linked these with the **threat narrative** associated with traditional robot films. They **questioned why humanoid robots are being created** and what value this adds. Participants were **more comfortable with and less threatened by ‘cute’ and animal like robots.**

Digital dialogue participants were generally more positive than focus group participants about humanoid robots– describing them as ‘cool’ and ‘clever’ and were more excited about the prospect of the robots ‘learning’.

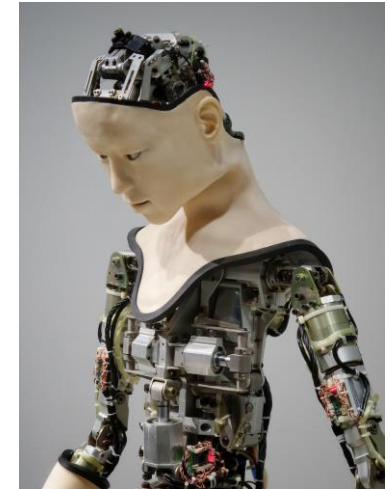
Older people tended to be more concerned than younger people by the idea of robots learning more and were uncomfortable with the robots that looked like humans describing them as ‘scary’ and ‘creepy’ - largely due to the fact that they have been **made to look like humans but lack real ‘personality’.**



Semi-humanoid robot – designed to be an innovative ‘kiosk’ at shopping centres, businesses, schools and doctor’s surgeries

“This looks like it wouldn’t be used for the wrong reasons” (*Male, focus groups*)

“I like [this one] as that’s how I picture them but [the ultra-humanoid one] freaks me out, it’s too life like!” (*Female, digital dialogue*)



Ultra-humanoid robot –known for its human-like appearance and behaviour

“Why are they in human form, do they need to be ‘attractive’ female characters? Ok, so far I just find them creepy especially [this one]” (*Female, digital dialogue*)

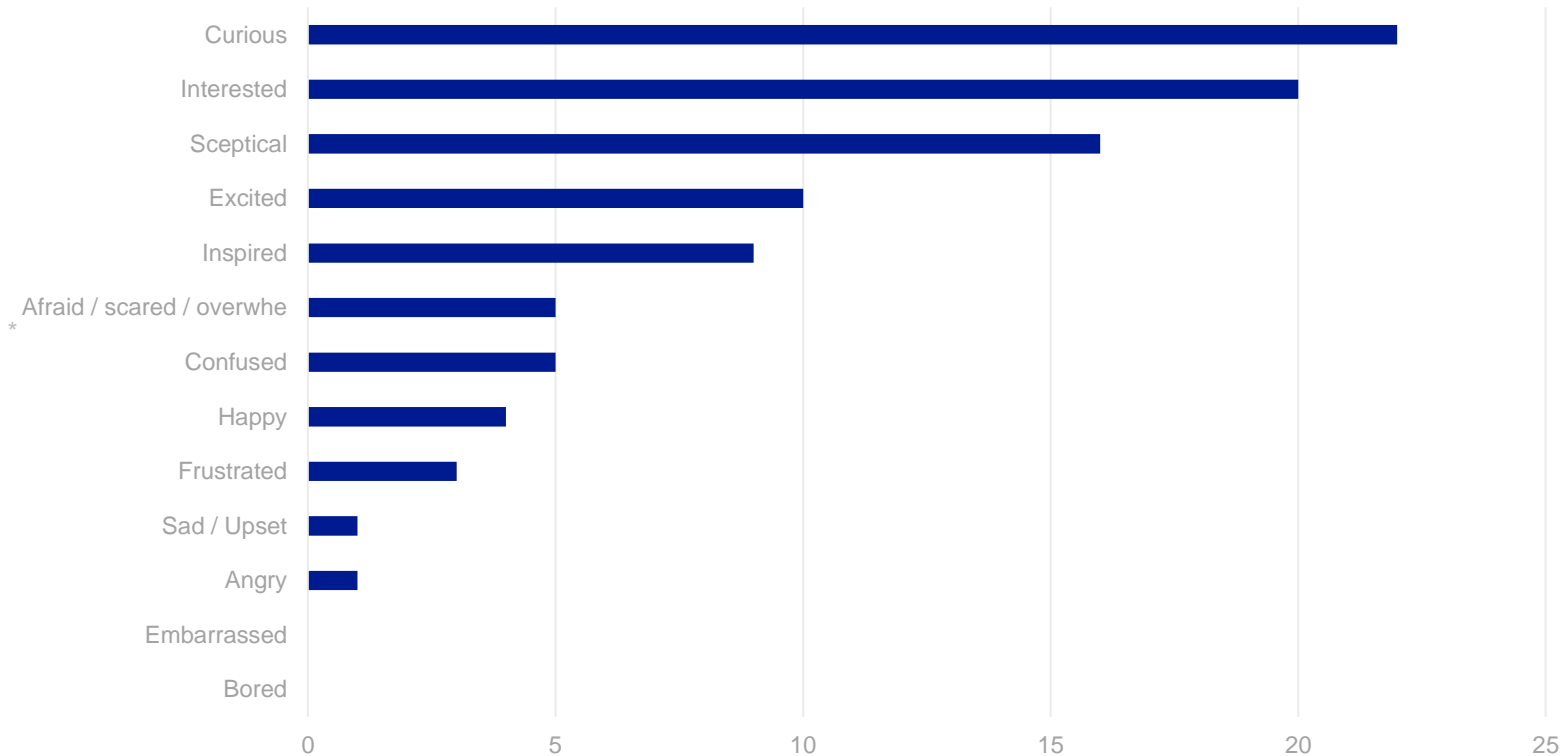
**4.
Aspirations and concerns about robotics
technology**





Participants typically felt interested and curious about the speed of development of robots, but some were also sceptical about the impact

How would you describe how you feel about the **speed** of development of robots for use in our society?



Curious

“I don’t know what the future holds – is it going to be better, is it going to be worse?” (*Female, focus group*)



Interested

“I take interest in the progress as we could do so much with robots in general if we continue the pace of development.” (*Male, digital dialogue*)



Sceptical

“I just feel that all these jobs can be done by humans so why spend thousands of pounds on robots that will one day have to be updated and also people like human interaction!” (*Female, digital dialogue*)

Threaded throughout these discussions was the concern that robots might replace human social interaction and put people out of work

Q: How would you describe how you feel about the speed of development of robots for use in our society?

*Afraid/ scared/ overwhelmed

Base: All respondents 31



Whilst participants thought it was important for the UK to develop robots, they also worried they may pose a threat to people and jobs

Some participants were concerned that the UK could be left behind by other countries (notably Japan) if it did not develop robotic technology, but a range of concerns were raised about their development and use:

- Robots leading to mass job losses – which was also found in the Wave 3 social media analysis*
- Malfunctions could lead to robots physically harming people – participants agreed they need thorough testing before release
- Robots could be developed to purposefully harm humans (e.g. for use in war or for self-interested and possibly criminal purposes)
- Digital dialogue participants spontaneously mentioned AI concerns that robots will learn more than humans and become a threat

“Every country has got to be well up on this or else you’re dead. . . You’ve got to be in it to win in it”
(Male, focus group)

“When does [the robot] learn to make it’s own decisions?” (Male, focus group)

“Afraid, scared, overwhelmed, am I being left behind? Maybe I have seen too many science fiction films where robots take over the world” (Female, digital dialogue)

“They are developing so quickly and it seems to be the way forward but it’s a bit overwhelming at times and you think what if it malfunctions and the implications” (Female, digital dialogue)

“These will take over in the end and then there’ll be [nothing] left”
(Male, focus group)

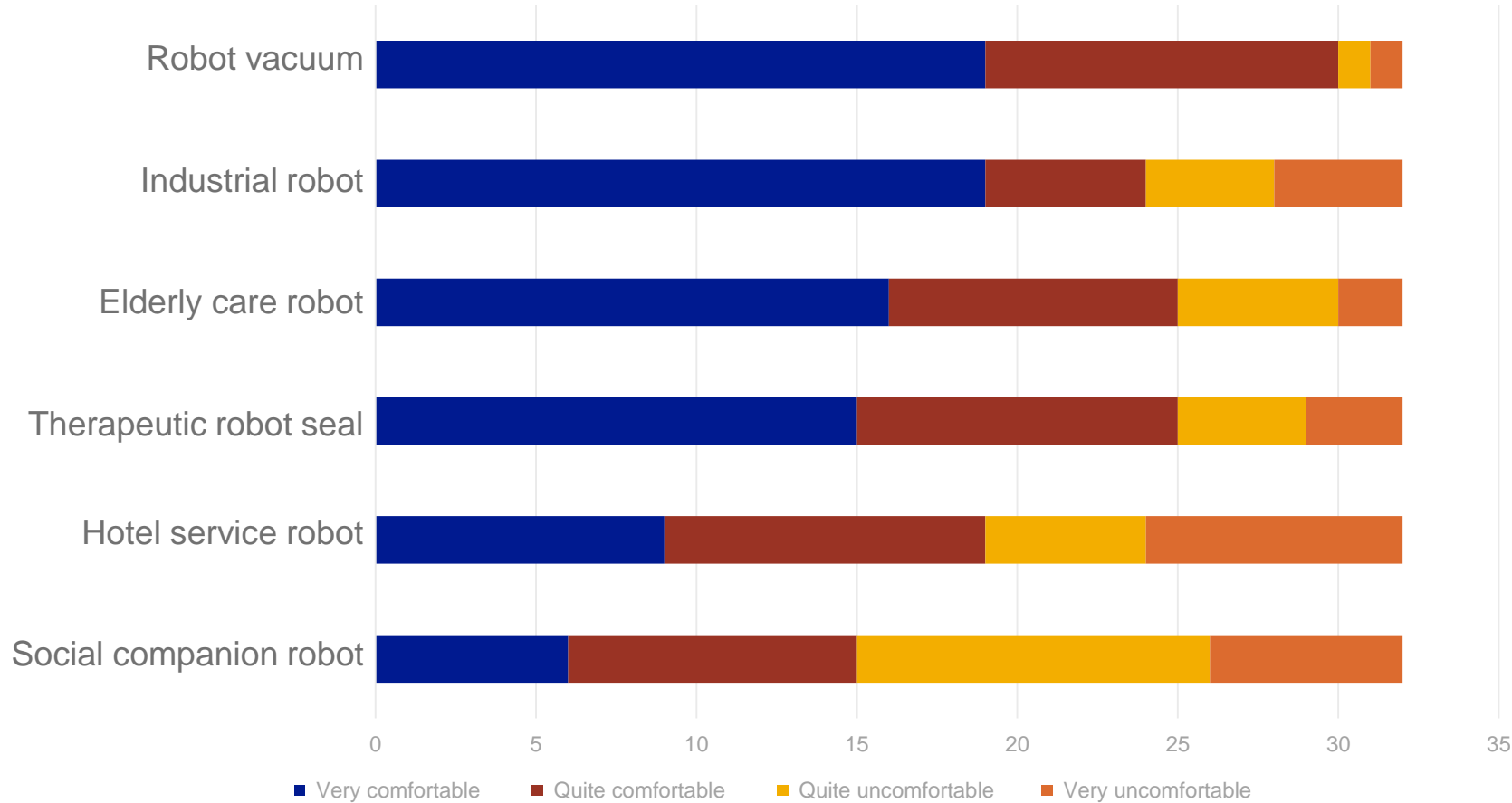
“I think this country is behind the innovation curve and that robots can bring great advantages” (Female, digital dialogue)

Digitally excluded participants suggested that there is no need for people to fear the development of robots because people make them and they can only be as harmful as developers allow



Overall, there was most comfort with the vacuum robot and the industrial robot

How comfortable do you feel about the development of each of these types of robots for use in our society?



Preference for robots that do mundane physical tasks

Comfort was also determined by fear about the potential for malfunctions to cause injuries

Less comfort with humanoid robots especially those aimed at offering emotional support



Participants were most comfortable with domestic robots which removed the need for them to do menial, repetitive tasks and were not generally seen to be dangerous

Robot vacuum

- Vacuum-cleans the floor by detecting obstacles, dirty spots and steep drops with sensors
- Moves around the house automatically so the owner can be out during cleaning

“From the first washing machine to now robotics aids, automation frees up time for humans to value more worthy pursuits” (*Male, digital dialogue*)

Benefits

- **Design** - seen to be smart and practical
- **Efficiency** – reduces time spent doing menial chores and frees people up to do other things

Concerns

- **Idleness** - it could make people lazy
- **Effectiveness** – some questioned how it would reach hard to reach areas and whether it can understand the difference between dirt and other objects
- **Malfunction** – a malfunction could cause minor injuries in the home

Across all groups, participants were accepting of and excited about the continued introduction of these types of domestic robots to the market



Across groups, participants understood the rationale for the use of industrial robots to improve efficiency, precision and safety - but were concerned about job losses

Industrial robot

- Reduces the manpower needed in the factory
- Used to quickly but delicate move car bodies from one production line to another

Familiarity – what some expect when thinking about robotics technology, demonstrating that familiarity drives comfort

“Manufacturing robots will be to the detriment of manual labour but we have to accept that in certain fields” (*Male, digital dialogue*)

Benefits

- **Efficient and precise** - speeds up the manufacturing process
- **Safer** – carrying out difficult unsafe jobs to reduce the risk of accidents

Concerns

- **Job losses** – contributes to putting people out of work
- **Faulty products** – could develop faults in the assembly line and go unchecked due to the lack of human intervention

Participants appreciated that industrial robots could remove the need for humans to do dangerous tasks but there is a need to engage with the public about the potential scale and impact of job losses and what can and should be done about this



Participants were quite comfortable with robots giving health related reminders – but were concerned about the loss of the ‘personal touch’ in healthcare

Elderly care robot

- Watches its owner
- Gives a verbal warning if the owner tries to do the same action twice.
- For instance if the owner asks if he/she has taken their medicine, Mamoru can truthfully say “you took it 23 minutes ago”.

“I think the general idea of this is good in order to help take care of the elderly and ensure they are keeping to medication plans” (*Female, digital dialogue*)

Benefits

- **Therapeutic benefits** - seen as potentially helpful to those who live alone, have Alzheimer’s, and the elderly because it provides companionship but does not replace humans.
- **Lessen burden** - on family members with care duties
- **Human intervention still required** – described as ‘supportive’ rather than autonomous

Concerns

- **Impersonal** - lack of personal interaction removes the personal touch
- **Patient dignity** - concerns about how comfortable patients would feel with it in their home or that it could be ‘demeaning’ and ‘embarrassing’ to the patient
- **Dependence** - fears that people could come to rely on the device too much

Whilst these robots could serve a useful purpose, there was concern that they may also increase isolation and loneliness among old and vulnerable people if they are seen to replace the need to interact with these groups as often



Across groups participants were quite positive about the use of therapeutic robots - but there was concern about their lack of personality

Therapeutic robot seal

- Provides a form of therapy for dementia patients
- Actively seeks out eye contact
- Moves realistically
- Remembers faces
- Learns actions that generate a favourable reaction

“At the end of the day they’re still our mothers and our fathers and having a toy like that I think it makes it worse for me. For a selfish reason I don’t like it.” *(Male, focus group)*

Benefits

- **Therapeutic benefits** – could improve the mood of dementia patients
- **Stress relief** - relieves some of the stress and emotional pressure on family members and loved ones
- **Patience** - Therapeutic seal believed to have more patience than a real animal / pet

Concerns

- **Impersonal** - perception the elderly would benefit more from and prefer human interaction
- **Risk of confusion** - some concern the robot might confuse or scare dementia patients
- **Dignity** – as mentioned previously, some thought it ‘demeaning’ and ‘undignified’ for the patient
- **Long term effects** - unsure of the long term effects on mental health

Participants were comfortable with and ready to welcome robots that looked like cute animals to the market where they would provide additional support – as long as this did not mean elderly people would see a reduction in human contact



Participants were less positive about and comfortable with robots they perceived to threaten job losses without seeming to add sufficient value to justify this

Hotel service robot

- Provides room service – after a hotel customer orders something via their app. Run can pick the product up from the fridge and deliver it
- Shows customers the way to go
- Publicises events

“This sounds great in theory but unfortunately it’s taking jobs from people again” (*Male, digital dialogue*)

Benefits

- **Efficient** - thought to provide a faster more efficient service
- **Cheaper**- could potentially save customers at hotels from having to give tips

Concerns

- **Job losses** – replacing people
- **Human interaction** – preference to have interaction with a person as a hotel customer e.g. loss of ability to ask questions
- **Gimmicky** – compared to a toy or novelty item
- **Safety** – potential hazard if used in a care context

Older participants were less comfortable about the use of robots in the service sector where human interaction was more highly valued than in manufacturing



Meanwhile, participants were least comfortable with humanoid robots, which they found ‘creepy’ – because their faces were seen to lack empathy

Social companion robot

- Uses a range of facial and body expressions to interact with autistic children and break social isolation
- Plays interactive and education games with the children
- Responds to touch through sensors
- Undergoing trials to evaluate NHS use as an intervention

“They’d have to be 100% sure that this [robot] will add value to a child because otherwise it could do a lot of damage” (*Male, focus group*)

Benefits

- **Could have added value as an additional tool** – some positivity if considered an **additional** tool to help autistic children, rather than replacement of services
- **Therapeutic benefits** - helps address issues around isolation and loneliness
- **Patience** - has more patience than humans so would not get irritated by repetitive tasks

Concerns

- **Frightening** - commonly described as ‘creepy’ and ‘scary’ because of its human resemblance and empty eyes
- **Inappropriate** – not considered appropriate for autistic children who need eye contact and attention. Mixed views among participants who had experience with children with autism as to how useful this would be in aiding social interaction

Generally groups participants could not see the value in designing robots to look like humans and would be more comfortable with less human looking robots



Overall, robots that were seen to assist rather than replace humans were seen most positively - particularly in the health, leisure, and industrial sectors

Most positive about robots associated with ...

Pleasure and leisure

- = Robots were perceived to add value when they were thought to make people's lives easier by freeing them from mundane tasks e.g. AI and smart devices and semi-autonomous robots that completed domestic tasks like vacuuming.

Health

- = Robots that enhanced quality of life for vulnerable people were considered important e.g. prosthetic limbs and robotic arms, helping elderly people, or people in disaster zones
- = For some, robots that supported medical staff were important because they reduce the risk of human error and were perceived to be more accurate as well as robots that freed medical staff's time so they could give more attention to patients (e.g. providing autism therapy).

Industrial robots

- = Robots that they thought would improve manufacturing efficiency, drones, self driving vehicles and robotic assistants in the workplace were all seen to be valuable.

"These have been used in hospitals for a while now and I know they prove very efficient both to surgeons and the patients that are receiving the surgery." (*Male, digital dialogue*)

"I think when it comes to doing a job/task more efficiently i.e. the production line then I am comfortable." (*Male, digital dialogue*)



However, participants were more negative about fully autonomous robots, humanoid robots, and robots used to replace human interaction

Most concerned about ...

Autonomous robots

- = Participants raised concerns about autonomous robots being used to replace human contact or that had been developed for war - but were more comfortable when autonomous robots were used to complete dangerous tasks or dramatically improved efficiency (e.g. industrial robots)

Humanoid robots

- = There was concern about humanoid robots being developed to replace human contact, particularly in the care sector and with vulnerable people because they felt those groups needed the most human support. However, in the focus groups some participants countered this by suggesting that robots could help with staff shortages in the care sector.

Data sharing concerns

- = Some participants raised additional concerns about AI, particularly regarding who has access to the information gathered and how this is used.

“I’ve recently seen articles on “Putin’s Terminator Robot” which was absolutely terrifying... these robots are being built to destroy... actually developing robots as killing machines it’s terrifying.” (*Female, digital dialogue*)

“How much autonomy are we going to give – they are very vulnerable to be left in the hands of a robot. They [should] always have to be someone there to oversee it.” (*Male, focus group*)

“Carers only come in for 15 minutes, [robot companionship] will still be company of some sort – same as having the television on.” (*Male, focus group*)



Overall, there was widespread concern about the social implications of the use of robots in general – notably about job losses but also who would have access to the technology

Key debates about robots in our society

- **While participants understood that robots can add value** by completing repetitive, low skilled tasks, they strongly disliked the idea of robots replacing people in jobs and considered the negative effect this might have on society (e.g. increasing dependence on technology and making social interactions redundant)
- **Perceptions of the current employment climate** led some to think it naive to believe that people replaced by a robot could easily find a job elsewhere.
- **There was some discussion about the need to upskill** the population for jobs of the future



Who would benefit from robotics technology?

- **Some explored the concept of a utopian future** where people were less concerned about employment and money because robots were doing their jobs. They felt this could enable them to prioritise other parts of their lives like family and hobbies
- **In the context of the care sector**, there were mixed views about paying for care robots through taxes
- **There was a perception that inevitably the wealthiest in society would have access** to the best care, but some discussion about what the best care involved; potential for human care to be valued more highly and care from robots to be made available to the public

“There is a lot of unemployment currently and so I don’t like the idea of more people losing their jobs to be replaced by robots, regardless of the job, there are many people out there who struggle to find work or have been redundant and would love the chance to work” (*Male, digital dialogue*)

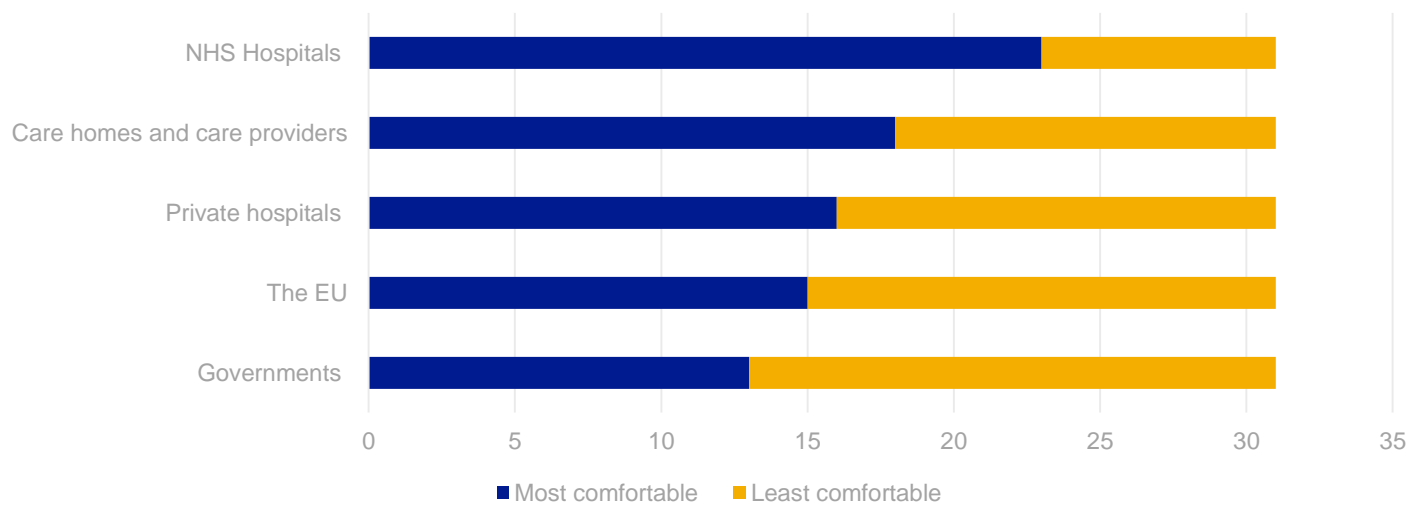
“Them at the lower end, they’ll be hit rotten...it’s the middle and upper class who will benefit” (*Male, focus group*)

“It is worrying...at some point soon people won’t be needed” (*Female, focus group*)



There was greater comfort with robots being used in hospitals and care homes rather than by the government

Which organisations are you most and least comfortable developing and using robotics technology in our society?



Participants were most comfortable with...

- robots being developed for use in the health care sector because they assumed they would be for public use and benefit

Participants were less comfortable with...

- robots being developed by government because they felt government might use robots to advance political agendas
- there was a sense of fear that governments might enforce the use of robots on the public and some participants were concerned about their right to choose, for example, making it mandatory for patients to accept care from robotics technology in NHS funded care homes

Participants' high levels of trust in doctors compared to government reflects the findings from Wave 1: Trust in Science



Aspirations for robots over the next 10 years included robots removing the need to do mundane tasks, carrying out dangerous jobs, and improving public health

Participants wished to see investment focused in three areas...

Remove mundane and repetitive tasks

Participants hoped that robotics technology will free up time and allow people to focus on other things; e.g. robots completing domestic chores leaving more time for people to spend with families and on leisure pursuits

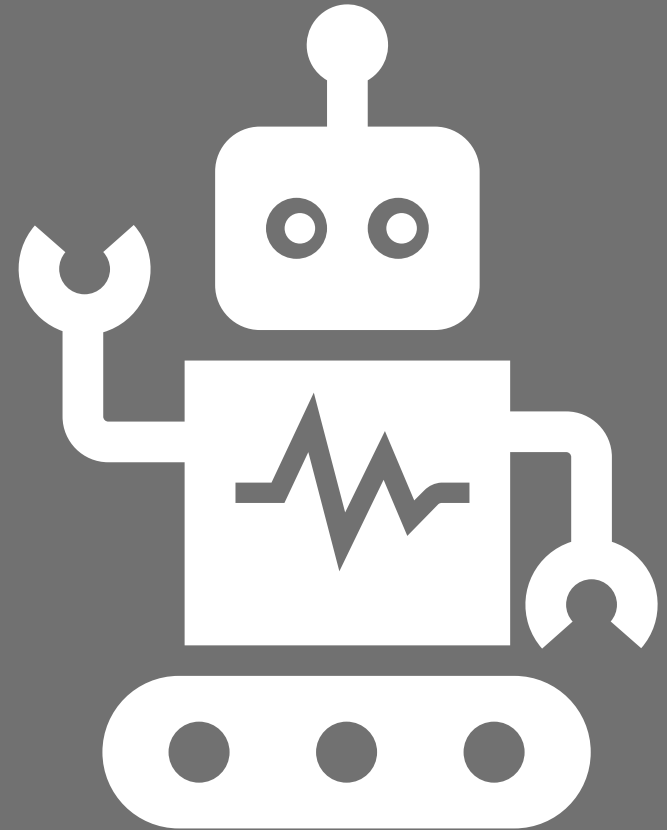
Dangerous jobs

Some would like to see robots carrying out more dangerous tasks such as disposing of bombs and lifting / hoisting objects

Health

Recognition that robotics technology could be useful in the health care sector by freeing professionals from mundane tasks so they have more time with patients to detect illnesses, identify disease structures, and assist with recuperative therapy

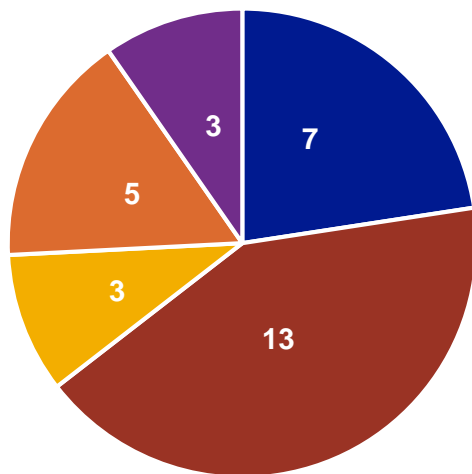
**5.
Perceptions, aspirations and concerns
about the use of robotics technology in
the care sector**





There were mixed views about how comfortable participants felt with the development of robots for the care sector

How comfortable do you feel about the development and use of robots in the care sector?



- Very comfortable
- Quite comfortable
- Neutral
- Slightly uncomfortable
- Very uncomfortable

Drivers of comfort

Appearance, purpose and the degree to which they are comfortable with the impact of malfunction drove comfort. Comfort was often nuanced - some described a 'fine line' after which they became uncomfortable. This line was often where robots were operating autonomously, where care or companionship was solely administered by a robot, and where participants had concerns about risks and the reliability of the technology

Some were undecided on their comfort level because they were unsure about whether the benefits outweighed their concerns, while others were confident that that the benefits *did* outweigh their concerns

Drivers of discomfort

Those who were uncomfortable were concerned about people's social responsibility for others, believing that care should be administered by humans with little to no intervention from robotics technology because robots are not capable of care in the same way as humans

Prioritising investment in people/social issues - some felt that robotics technology should not be a priority due to the cost of development. They felt funds would be better spent upskilling the unemployed or focused on social housing



Participants were asked mark up what excited and concerned them about the following four care robots – and which should be prioritised for development

Multipurpose semi-humanoid robot

- Can adapt conversations according to what it finds out about an individual over long periods of time
- Analyses expressions and voice tones to detect emotions
- One model is deployed in Essex care homes
- Concerns raised over security and potential malfunction

Surgical system

- Made to offer minimally invasive surgery
- Has been used to do surgery in different countries without the surgeon having to travel there
- The surgeon controls the machine at all times
- Apprehension around the level of training doctors receive to use the system

Puppy companion robot

- Barks and moves in response to people talking around it
- Responds to touch
- Studies have shown that interactive robotic dogs can reduce feelings of loneliness among elderly care home residents
- Could reduce the desire for human interaction and lead to isolation

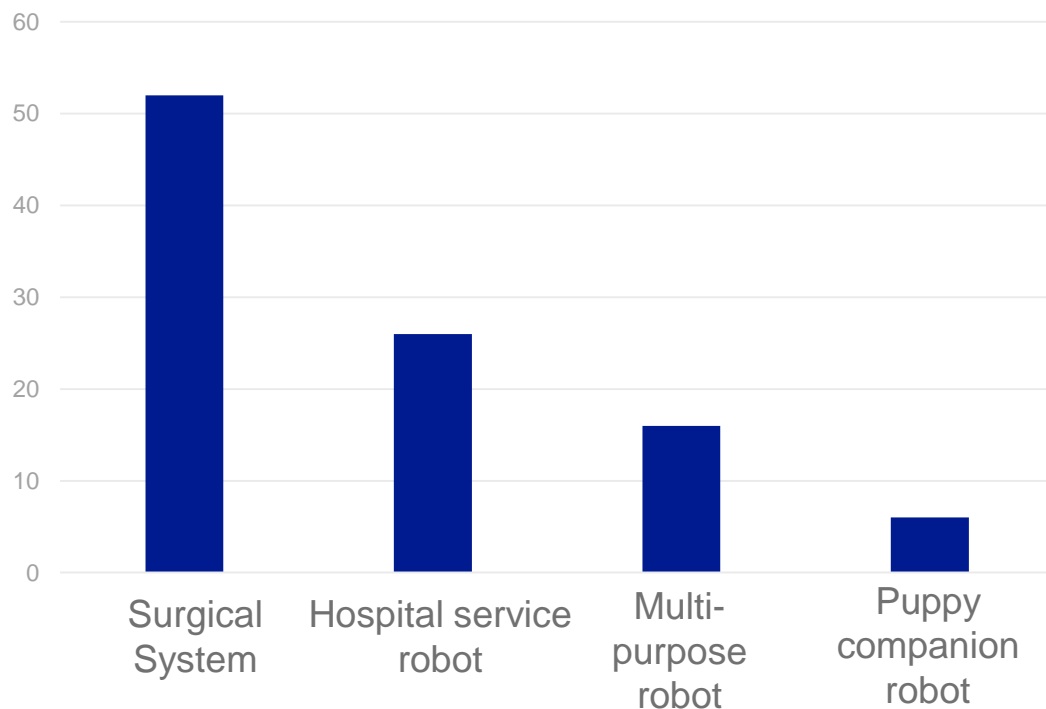
Hospital service robot

- Delivers drugs in hospital
- Moves autonomously through pre-installed mapping information
- Contains a sensor that helps it avoid obstacles and can deliver heavy loads that humans cannot
- Saves nurses' time by doing repetitive tasks
- Potential to malfunction and deliver the wrong medication to patients



Overall, participants prioritised developing the surgical system and the hospital service robot - because these were seen to assist healthcare professionals and increase efficiency

Which of the four types of robots is most important for our society to develop?



Why is it important for our society to develop these robots?

- The life saving potential of the surgical system and time saving ability of the hospital service robot were considered important
- Participants commonly thought it important to develop robots that were efficient and accurate - although they did not fully trust the accuracy of autonomous robots without human intervention.
- Limited risk of malfunctioning and less dangerous impact of an unlikely malfunction was a key consideration
- Robots that provided companionship were considered less important to develop because care was considered a human responsibility

“Advancing medicine in a positive way, assisting humans not replacing them” (*Female, digital dialogue*)

“Most comfortable for me meant least risk” (*Female, focus group*)



There were mixed views about the use of the four care robots – they were seen to improve efficiency but there was concern about the role of healthcare professionals

Benefits

- ✓ Help in **performing time consuming tasks more efficiently reducing costs** in the long run
- ✓ Assisting health care professionals so that they are **more able to provide ‘the human touch’** and emotional support to patients, or provide more support to patients in emergencies
- ✓ Reduce the risk of **human error and ill intentions**
- ✓ Could help **preserve patients’ dignity**; e.g. changing bed pans and bathing patients
- ✓ Could help **facilitate human interaction by connecting families who are unable to see each other in person, reducing loneliness**; e.g. robots that have video capabilities

“I personally don’t see a problem with robots undertaking some of the assistance tasks to free up perhaps more time for care givers to focus on checks and talking to the patient” *(Male, digital dialogue)*

“[Robots] should help us as people in our lives or as consumers but they shouldn’t take over our roles in society as humans need us” *Female, digital dialogue*

Concerns

- x **Replacing jobs and the risk of serious malfunction** were recurrent concerns here and from views about the use of robots more generally
- x For some, a critical aspect of patient care was the ability to empathise. There was concern that **robots lack the capability to express emotion or to act on instinct**, instead following a set of rules or a programme that may not be appropriate. This raised considerable concerns because health and social care robots would be **engaging with vulnerable people**
- x However, there was some tension between the views of this groups and those who thought that robots could provide companionship to vulnerable members of society, arguing that in an increasingly busy society there is a skills gap / shortage of people who are able and willing to take on caring responsibilities and robots could help fill that gap

There is an assumption that robots are being developed to replace humans and person-to-person contact, however, participants find robots more acceptable when they are used as a device to assist rather than replace humans



Participants prioritised this robot that worked alongside or was controlled by humans – finding it more acceptable than autonomous robots

Surgical system

- Made to offer minimally invasive surgery
- Has been used to do surgery in different countries without the surgeon having to travel there
- The surgeon controls the machine at all times
- Apprehension around the level of training doctors receive to use the system

Benefits

- **Human intervention** - participants felt comfortable because there was human intervention involved
- **Efficiency** – thought to save time and expense

Concerns

- **Malfunction** - malfunction during critical point in the surgical procedure which could lead to severe injury or death
- **Proficiency** - around competency of humans and regular training on how to operate the robot

“Why risk the potential malfunction? Medical staff can assess if a patient needs more/less medication and observe changes in condition. [They] can't be replaced” (*Female, digital dialogue*)

- **Familiarity** – was a driver of comfort and acceptability (as seen in Wave 2 digital dialogue*). Some had seen the robot used elsewhere or had personal experience through a family member being operated on



Participants were quite positive about the hospital service robot because it improved efficiency - but generally preferred robots where there was human intervention

Hospital service robot

- Delivers drugs in hospital
- Moves autonomously through pre-installed mapping information
- Contains a sensor that helps it avoid obstacles and can deliver heavy loads that humans cannot
- Saves nurses' time by doing repetitive tasks
- Potential to malfunction and deliver the wrong medication to patients

Benefits

- **Efficient** - can carry more medication at one time than a human. Considered an efficiency tool, freeing medical staff to focus on patient care. Younger participants were more likely to consider the hospital service robot to be a practical use of robotics technology
- **Assistance** – perceived to be a good example of robots doing tasks to help / assist professionals by completing menial tasks

Concerns

- **Dishonesty** - there was a perception that the hospital service robot could make it easy for people to steal or tamper with medication
- **Malfunction** - there was concern about accuracy due to the lack of human intervention to check dosages and that medication is delivered to the correct patient

“I don't think a robot should be trusted to deliver something as important as drugs to people. It could easily malfunction or make a mistake. People could die from this!” (Male, digital dialogue)

“If it helps hospitals run more efficiently then I agree with it (Female, digital dialogue)



Whilst there was some interest in the multipurpose robot learning – there was a high degree of concern about loss of control if it became more intelligent than humans

Multipurpose semi-humanoid robot

- Can adapt conversations according to what it finds out about an individual over long periods of time
- Analyses expressions and voice tones to detect emotions
- One model is deployed in Essex care homes
- Concerns raised over security and potential malfunction

“Not sure voice recognition is always successful... could a whisper of pain be equated to that individuals healthy voice?” (Female, digital dialogue)

Benefits

- **Therapeutic benefits** – for people who are lonely, have infrequent visitors/ feel isolated
- **Intelligence** – some discomfort about robots learning, some felt detecting emotions was a good example of technology being used to help the vulnerable
- **Integration** – excited by ability to adapt to conversations. Older degree educated men were more excited because they felt the robot would ease integration between robots and humans

“[It can] learn and adapt to specific people and their needs and show emotions, could be good company if it worked (Female, digital dialogue)

Concerns

- **Potentially confusing** to those who have limited experience with technology, particularly the elderly
- For some, the ability to adapt to conversations feeds into the idea that robots might **‘take over’** which is a scary prospect
- Voice recognition can be **frustrating** and temperamental



Few participants prioritised the development of the companionship robot – although they were more comfortable with animal-like rather than humanoid designs

Puppy companion robot

- Barks and moves in response to people talking around it
- Responds to touch
- Studies have shown that interactive robotic dogs can reduce feelings of loneliness among elderly care home residents
- Could reduce the desire for human interaction and lead to isolation

“Should be tackling loneliness in other ways, with real human interaction”
(Female, digital dialogue)

“The elderly like human interaction for many that’s probably the only interaction they have in a day is their carer coming in”
(Male, focus group)

Benefits

- **Therapeutic benefits** - could help address loneliness and isolation. Positive reactions were largely based on the idea that the robot does not replace the need for human interaction but provides a form of companionship
- **Appearance** - seen as ‘cute’ and considered non-threatening
- **Reduced burden** than a real pet for the elderly
- **Personal** - liked that it responds to human interaction

Concerns

- **Inauthentic** - there was a perception that the robot was not ‘genuine’ and looked too toy-like. This was linked to the idea that this type of robot reduced people’s humanity as the robot replaces interaction with a living animal which some described as ‘insulting’
- **Appearance** - described as ‘creepy’ and thought to look fake



A key tension emerged between a perceived moral obligation to care for each others and acknowledgement that caring for each other is not always practical in our society





In line with moral concerns, participants prioritised wanting to understanding who would be held accountable for malfunctions and data breaches

Accountability



Participants wanted a clear idea of who would be held accountable for malfunctions, especially where robotics technology was being used in the care sector.

Some thought it unacceptable to allow robots to make decisions, particularly where human life was at risk, believing that decision making is a human responsibility

Data protection



While some could see the advantage of robot toys for children (e.g. where children with additional needs found it hard to talk to people they could speak to a robot) - there were concerns about data protection and a desire to know how protecting data might be monitored

Robots as assistants to medical professionals



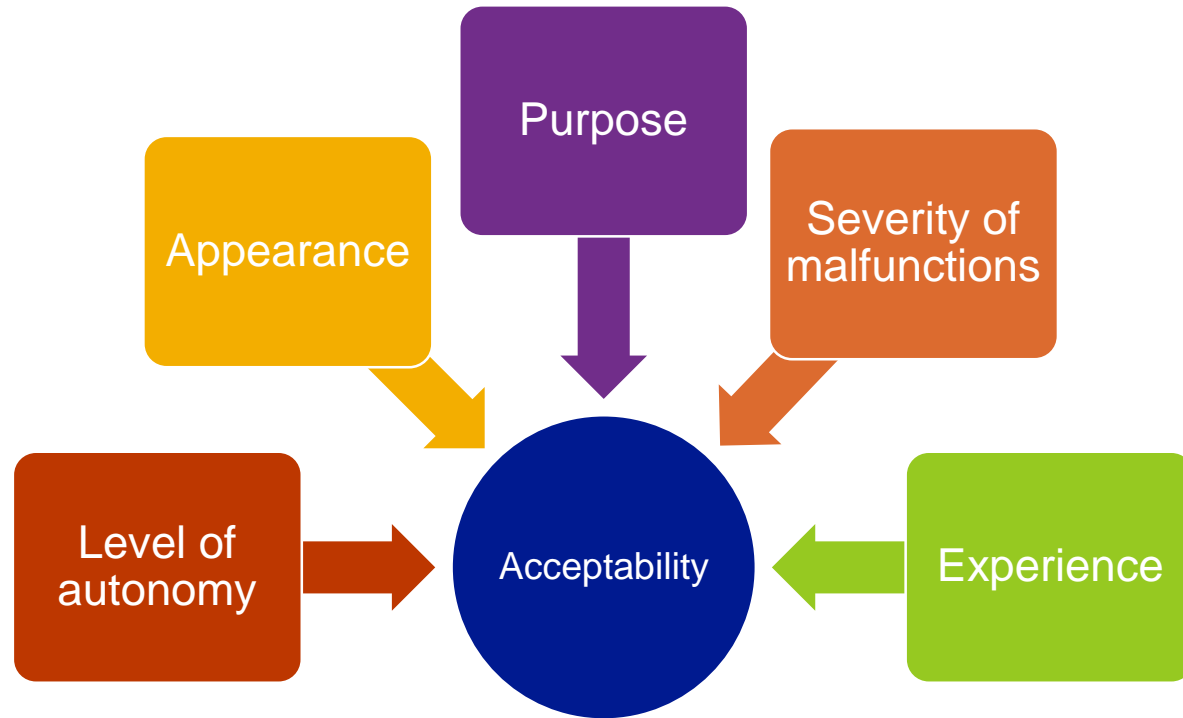
Participants were largely positive about the use of robots as assistants in medical spaces like hospitals to provide quick diagnoses or assist during surgeries.

Some were familiar with current medical services that use robotics technology e.g. internet services

6.
Acceptability of the use of robots



Overall, five factors contributed to how acceptable participants found the use of robotics technology in the care sector and our society more widely



Robots were considered most acceptable when:

- = **Level of autonomy** - there was a degree of human intervention and control required
- = **Appearance** - the robot was not humanoid – preference for **appearance** of robot to be non-threatening figures or animal styled robots
- = **They understood its purpose** – and felt developers were being **transparent** about this. They were more comfortable when its **purpose** was not perceived to be trying to replace key human traits and characteristics (notably emotion and ‘human touch’)
- = **Severity of malfunctions** – low risk of serious physical harm or human fatality
- = **Experience with robots** –had experienced the benefits of robotics technology

Level of autonomy and appearance were key drivers of acceptability – with fully autonomous and humanoid robots being less acceptable

Level of autonomy

- Participants feared fully autonomous robots could malfunction and cause serious or lethal harm
- In addition, some felt threatened by autonomous robots and feared that they could replace people in job roles – this was exacerbated when participants thought about popular culture films where robots gain control and take over
- Semi-autonomous robots were more acceptable, however, some argued that autonomous robots taking on menial, time consuming task could improve efficiency and accuracy, particularly in the health sector

Appearance

- Robots designed to look like animals or non-threatening characters were more acceptable than humanoid robots
- Robots that looked like humans were often described as ‘creep’ or ‘scary’ and made some participants feel uncomfortable
- However, some felt that robots that looked like animals were pointless and potentially patronising to the elderly

“I think if they were used as an extra help and extra pair of hands it would be a good thing but anything else is too much” *Female, digital dialogue*

There are two elements to purpose, these are purpose of the robot and transparency: understanding the purpose of a robot and appreciating its added value were key drivers of acceptability

Purpose

- Acceptability was higher when participants could clearly identify where the robot added value - robots were less acceptable where they were seen to replace humans without providing significant added value
- Reducing the need to do menial and dangerous tasks and providing greater accuracy and efficiency were highly valued
- Participants were often concerned about robots that were seen to be trying to replace key human traits and characteristics particularly in relation to caring for vulnerable people who were often perceived to need the most human care

“I just think there are so many humans to do the work, why do we need computers and robots that look like humans” (*Female, digital dialogue*)

The transparency of the robot's purpose

- Key to participant's acceptance of robotics technology in the in general and specifically in the care sector was their understanding of its purpose
- Generally, some felt less comfortable with robots being developed by government because they did not trust government to be transparent about its reasons behind the development of robotics technology
- They were often confused about the purpose behind designing robots that looked like humans as this fed into their fears about being replaced

“Why do they want to make robots? What's wrong with normal people” (*Female, focus group*)

Acceptability was shaped by the perceived potential severity of malfunctions and by previous experience of robotics technology

Severity of malfunctions

- Participants were more comfortable with robots where the risk of malfunction to human life and level of autonomy was low e.g. the vacuum robot
- They were less accepting of robotics technology where there was an increased risk of malfunction that could have fatal consequence to human life or the robot was fully autonomous
- Despite this, they accepted robots they considered 'risky' if there was some human oversight rather than the robot operating autonomously e.g. surgical system

Least severe
consequences
e.g. robot
vacuum



Most severe
consequences
e.g. surgical
system

The nature of participants' experiences

- Whether they had experienced the benefits of robotics technology either first hand or through a family member or friend or had heard or read positives stories about robotics technology
- Participants who had experience engaging with vulnerable people (family members or patients) had mixed views; some could see the benefits of robotics technology e.g. relieving the strain of the care giver or saving time while others were felt that care should involve a human element

“A friend recently had a scan involving robotics technology for his shoulder that may need an operation. He was impressed at the ability to map the area using a computerised scanning technology and the precision with which a robotic machine was used to inject the shoulder in the place needed...He considered it to be a great advancement, leaving no room for error” (*Female, digital dialogue*)

7. Implications



Recommendations

Area	Implications
Perceptions of robots	Greater exposure to modern applications can shift peoples' perceptions of 'robots'. A fear of robots becoming more intelligent than people and 'taking over' was driven by representations of robots in popular culture, notably film and TV shows. However younger people and those who had more experience of robotics technology were more critical of this narrative and had a more benign conception of robots. Exposing the public to diversity in robotics technology could help them to engage with the topic and technologies.
Job losses	There is a need for greater dialogue with the public about how potential job losses due to robotics technology will be managed. Participants were enthusiastic about robots which can increase efficiency, improve accuracy and precision, and reduce the need for people to do dangerous and repetitive/menial tasks. However, there was widespread fear about job losses – notably in the manufacturing and service sectors – and a desire for solutions to this problem. This suggests that there needs to be urgent debate about the role of robots in our economy and what this will mean for employment and our relationship with work in the future.
Safety and liability	There was initial and persistent concern about robots causing physical harm to humans due to malfunctions. There was a desire to ensure that robots are fully tested before they come to market, and for there to be clarity about who is accountable and liable for injuries as a result of malfunction – particularly when being used with vulnerable groups (e.g. children and the elderly). This suggests the public want to be know that robots will be fully tested before going to market.



Recommendations

Area	Implications
Humanoid robots	<p>There was initial and persistent concern about the development of humanoid robots. Participants found them ‘creepy’ and did not see what added value these designs provide. They questioned whether the investment being spent on these applications was worthwhile.</p>
Fully automated robots	<p>There was less comfort with fully automated robots. Participants were more concerned about safety risks associated with fully autonomous robots, and were also concerned that these would lead to greater job losses. They were more comfortable with robots being developed to assist and work alongside humans and that would allow them to spend their time focused on more meaningful tasks. Providing reassurance about safety of robots and sharing plans to address job losses could help to engage the public on this issue.</p>
Role in the care sector	<p>Participants were comfortable with robots being used in the care sector when they either added value by providing additional interaction for vulnerable people or freed up healthcare staff to focus on more emotional and care-based tasks. However, they did not want to see robots being used to reduce the amount of human contact patients/vulnerable people receive or to replace medical staff entirely – because they saw human contact and the personal touch as essential to good quality care. They did not believe that robots can fulfil this function as these are inherently human abilities. This suggests that the public want to be reassured that robots in the care sector assist rather than replace humans or are made aware of the value of autonomous robots in the care sector.</p>

8. Appendices

Stakeholder list

The Kantar Public team would like to extend our thanks to the stakeholders who participated in this wave of the dialogues. They helped with the development and review of the materials for the digital dialogue and focus groups and took part in the online forum to provide accurate, and up-to-date information and ensure that the dialogue was a two-way process.

- Matthew Egan (UNISON)
- Gergely Magyar (Technical University of Kosice, Slovakia)
- Sabine Hauert (University of Bristol)
- Mary-Anne Williams (University of Technology, Sydney, Australia)

Achieved sample – digital dialogue



	Target	Achieved	Scotland	NI	Wales	North East	West Midland	London
TOTAL	33	31	4	5	4	6	6	6
GENDER								
Male	MIN 12	16	3	3	1	2	4	3
Female	MIN 12	15	1	2	3	4	2	3
AGE								
18-34	MIN 8	12	1	3	2	2	2	2
35-54	MIN 8	12	2	1	1	2	3	3
55+	MIN 8	7	1	1	1	2	1	1
SEG								
ABC1	MIN 12	19	3	3	3	3	4	3
C2DE	MIN 12	12	1	2	1	3	2	3
INTEREST IN SCIENCE								
Low interest (2-5 on scale)	MIN 12	14	1	3	2	3	2	3
High interest (6-9 on scale)	MIN 12	17	3	2	2	3	4	3
ACTIVITIES								
Visited a science and/or technology museum	MAX 5	0	0	0	0	0	0	0
Visited a science and/ or technology exhibition								
Attended a science or technology conference								

Achieved sample – focus groups



	TARGET	Nottingham 1	Nottingham 2	Belfast 1	Belfast 2
TOTAL	8	7	8	8	8
GENDER					
Male	MIN 3	4	5	3	4
Female	MIN 3	3	3	5	4
AGE					
18-34	MIN 2	1	2	3	2
35-54	MIN 2	2	2	2	4
55+	MIN 2	4	4	3	2
SEG					
ABC1	MIN 3	4	5	3	4
C2DE	MIN 3	3	3	5	4
INTEREST IN SCIENCE					
Low interest (2-5 on scale)	MIN 3	3	3	6	4
High interest (6-9 on scale)	MIN 3	4	5	2	4
ACTIVITIES (PER GROUP)					
Visited a science and/or technology museum	MAX 2	0	0	0	0
Visited a science and/ or technology exhibition					
Attended a science or technology conference					