Co-creating Museum Robots With People That Are Autistic and/or Have Learning Disabilities

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ABSTRACT

The integration of robots into everyday life is an increasingly common and mundane phenomena. Understanding how people regard and interact with these robots is a rapidly growing area of study, however, there is limited consideration of the attitudes of people that are autistic and/or have learning disabilities. This poster showcases preliminary findings from two co-creative workshops run with the input and guidance of these communities and their caregivers. Early insights from these workshops offer twofold contributions; first, the outline of a framework for embedding people that are autistic and/or have learning disabilities within research meaningful to them through reflection and iteration. Second, an overview of their attitudes towards robots, with specific insights into robots used in museums. Attitudes are broadly positive, although risk perception is seen to affect trust and therefore contextual engagement.

CCS CONCEPTS

• **Human-centered computing → Accessibility design and evaluation methods**; **Accessibility systems and tools**; *Participatory design*; • **Hardware** → Emerging technologies; • **Social and professional topics → People with disabilities**.

KEYWORDS

Autism; Learning Disabilities; Robotics; Museums

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1 INTRODUCTION AND BACKGROUND

Research surrounding people that are autistic and/or have learning disabilities [1] is a much established topic that produces numerous papers, projects, and reports every year. However, recent focus has begun to highlight how research into such topics is conducted *on* people that are autistic and/or have learning disabilities, instead of *with* them [21]. This approach is increasingly facing criticism from not just researchers and funders, but vitally and vocally from these communities themselves who do not see topics important to them emerging from the canon. This is despite an estimated population of 1.5 million people with learning disabilities in the UK [16], and 700 000 formally diagnosed autistic people [6], 33% of whom are also estimated to have a learning disability [27]. In order to embed them at the heart of this research surrounding them, participatory and co-creative research practices are increasingly being seen as a valuable alternative approach to autism and learning disability research.

As such, this project centres co-creative and participatory practices at the heart of our methodologies, involving communities of people that are autistic and/or have learning disabilities in the evaluation and ideation of future technologies. Specifically, this project draws future technologies into the museum - investigating how robotics might improve accessibility and engagement for communities with non-typical access needs.

Robotics is a complex and rapidly evolving area of development, one which has been researched in numerous settings from education [13, 17, 19], to healthcare [2–4, 11, 24], to museums [9, 23, 25] and beyond. The integration of robots into daily life is also becoming more and more common across a broad range of sectors such as domestic, cultural, medical, and governmental [8, 15]. However, the evaluation of the increasingly mundane presence of these robots is still limited, focusing primarily on the acceptance, trust, and usage of people that are non-autistic and with no learning disabilities. Evaluating the perception of and trust in robots from the perspective of people that are autistic and/or have learning disabilities is still an under-explored area of research [12, 20].

[1] We acknowledge that the language we use to refer to people with disabilities must be conscientious and respectful to the preferences of individuals, communities, and families. We refer to the guidance of Autism International Journal of Research and Practice and the preference of our participants to use identity first language throughout this document.

This paper reflects research undertaken within this gap, presenting the preliminary findings of two workshops undertaken with people that are autistic and/or have learning disabilities regarding their perceptions, trust, and attitudes towards the use of telepresence and autonomous robots within the museum setting. The workshops utilised a combination of interactive activities and discussion to investigate perceptions, including a modified version of the Negative Attitudes towards Robots Scale (NARS). Preliminary findings of the workshops offer an early vision of a framework regarding practical preparation and reflexive facilitation of co-creative workshops with people that are autistic and/or have learning disabilities, as well as practical recommendations and insights into the potential uses of robots in museums including improving engagement, trust building, and retention.

2 CO-DESIGNING CO-CREATIVE WORKSHOPS

Our workshops utilised co-creation to create a research environment that centres the expertise and lived experience of the research subject, in this case people that are autistic and/or have learning disabilities. Co-creation is "the collaborative generation of knowledge by academics working alongside stakeholders from other sectors" (p.393) [10] that works towards creating meaningful and impactful insights into a research topic to create a better future (p.12) [26].

2.1 Planning the Workshops

Contributions to the early stages of preparing the workshops came from a number of areas of expertise. Our research team is inherently multidisciplinary, benefiting from expertise in robotics, medicine, human factors, psychology, computer science, and human geography. We were also grateful to receive input and advice from a number of external experts with experience in working with people with Special Educational Needs, including teachers and researchers. In response to the input and guidance of all of these people, we designed a workshop that was interactive, flexible, and iterative. We lay out some of the core principles included in our design below:

- Introduction time which would be informal and relaxed, to allow for acclimatisation to environment and people, and to give space to unwind from travel time.
- Access to fidget toys for younger participants. There is limited scientific evidence around the positive, calming effect of fidget toys on people that are autistic and/or have learning disabilities [5, 22], however, anecdotal evidence from consultations with external experts suggested that providing access to fidget toys was likely to positively affect engagement and retention.
- Interactive activities that allowed for different ways of engaging and responding including verbal, written, or drawn contributions.
- The inclusion of facilitators familiar to the participants in the form of teachers from the participants' school. Teachers were able to act as interpreters and facilitators to ensure the comfort of participants and to help explain complex concepts in ways tailored to the participant's lived experiences and personalities.
- Flexible timetabling was deemed vital to ensure that breaks could be taken as and when required, and to allow for any unexpected interruptions or needs that arose.
- A break for refreshments.

2.2 Recruitment

Participants for both workshops were recruited with assistance from Oak Field School, a local school in Nottingham, UK, that specialises in education for children from diverse backgrounds with Special Educational Needs including autism and learning disabilities. The first workshop was attended by five students between the ages of 12 and 15. The second workshop was attended by six adult graduates of the school. All 11 participants have been diagnosed with autism and/or learning disabilities. Two members of staff from the school were present at both workshops. Participant consent was obtained prior to attendance to allow for parents or teachers to sign or help with signing the consent form as appropriate.

2.3 Running the Workshop

The workshops were undertaken between February and March 2023. Ethical approval was obtained from the University of Lincoln ethics committee [ref. 2023_9206].

Workshops followed a semi-structured series of activities facilitated by the research team and school staff present. Workshops were recorded to video and audio for analysis. Preliminary findings of the workshops are taken from facilitator notes, and researcher cross-validation of audio and video data.

Workshops utilised five activities:

(1) A drawing and writing exercise to explore what initial perceptions of robots were.
(2) A drawing, writing, and discussion exercise reflecting on activity one responses to explore what should be different for a museum specific robot.
(3) An emotion card game where participants were encouraged to think about different emotions, prompted by images displayed on a screen, and to assign each with a colour.
(4) Verbally responding to a modified version of the NARS survey.
(5) Interacting with the robot(s) and reflecting on perceptions, trust, and desirable changes during a drawing, writing and discussion exercise.

At the end of the workshops, participants and school staff were given the opportunity to reflect on the activities and overall workshop, to provide feedback for future iterations.

2.4 The Robots

The first workshop introduced participants to the Double 3 robot shown in figure 1. The Double 3 is a two-wheeled telepresence robot by Double Robotics [1]. It has a 9.7 inch display for videoconferencing that is adjustable from 47 to 60 inches. The robot has ultrasonic range finders and cameras for obstacle detection and navigation. The Double 3 can be controlled remotely from a connected device, on which the robot's environment can be seen.

During the second workshop, participants were also introduced to the Double 3, but were additionally able to interact with Lindsey, shown in figure 2. Lindsey is a robot developed by the University

Figure 1: A Double 3 Robot

Figure 2: Lindsey the robot at the Lincoln Museum.

of Lincoln based on a G5 robot manufactured by MetraLabs GmbH. Lindsey is an autonomous robotic museum tourguide that uses laser scanners and a depth camera to navigate the museum space. It has a touch screen, two speakers, a microphone, and a head with blinking eyes [7]. It is currently in use at Lincoln Museum in Lincoln, UK.

2.5 The Negative Attitudes towards Robots Scale

The NARS is a commonly used questionnaire in Human Factors research that aims to measure the attitudes the people have towards robots [14]. It was developed in 2004 in Japan by Nomura et al. [18] and utilises a five point Likert scale response mechanism. Whilst the NARS has been successfully used for some years by researchers, its origins both culturally and temporally limit its applicability to contemporary participants in a specific country. For instance, item 7 on the original survey posits 'The word "robot" means nothing to me', reflecting the relative obscurity of robots in 2004, something that has become moot by 2023 with the wide-scale visibility of robots. Further still, the complex emotional terminology utilised by the scale such as 'paranoid' and 'uneasy' make it even more limited in its usage for people that are autistic and/or have learning disabilities.

As such, it was deemed necessary by the research team and expert consultants to modify the NARS in order to make it accessible to participants. This process was repeated iteratively after the first workshop according to feedback from participants and school staff, in preparation for the second workshop. Initially, the five point Likert scale mechanism was replaced with colour cards. It was intended that the activity three - emotion card game would allow participants to assign simple emotions to colours, which they could then use to indicate their responses. During the course of running the first workshop, it became apparent that this was adding an additional layer of complexity to responding, and so participants were instead encouraged to respond to the item prompts with simple emotions. For the second workshop, this change was integrated from the beginning, with participants being encouraged to explain their attitudes as happy, sad, angry, or excited.

The wording of items was also adjusted to make language more accessible and to accommodate the change in response mechanism. A less complex version of the NARS questionnaire was delivered in the first workshop, and once again was iterated on based upon feedback from participants and school staff for the second. It was seen that participants typically required input from the school staff and facilitators to further contextualise the questions, relying on interpersonal knowledge of personality and interests to ensure questions were understood.

3 PRELIMINARY FINDINGS

3.1 A Framework for Iteration and Reflection

Running co-creative workshops with people that are autistic and/or have learning disabilities revealed important messages about the importance of reflexivity in centring the voice of those participants. Reflections from the research team, the school staff, and the participants themselves all contribute towards the early outline of a framework for working in such a way. Broadly, this framework will show the value of seeking insight from a diverse range of voices, and being able to iteratively reflect and adapt to those insights both in the moment and over time.

Reflection and adaptability were shown to be vital in responding to the needs of the participants as and when they arose - clarifying and contextualising certain elements, and changing route when it became clear that current methods were inappropriate. This could only be done by carefully listening to the expertise of all three voices represented:

- *The Researcher Team*, who bring external knowledge of the broader research picture and ensure that findings are able to answer research questions.
- *Facilitators and Experts*, ideally who have some connection to the participants, but more importantly who have wide-ranging experience in ensuring that people that are autistic and/or have learning disabilities are able to meaningfully understand questions posed and can ensure that the voices of the participants are properly heard.
- *People That Are Autistic and/or Have Learning Disabilities*, who bring absolutely vital lived experience and novel insights to research as experts in their own needs, wants, and opinions.

Spontaneous and long-term reflexivity and responsiveness to the expert input of each of these groups created a research environment in which research questions could consistently be addressed, albeit in ways that were occasionally unexpected or off-course.

Importantly, through the collaborative and co-creative inputs described, it also became possible to deliver reflexivity and adaptability that was carefully weighed to ensure that reliability and validity of findings were not impacted; either by sticking rigidly to a plan that was not working, or by moving the goalposts too far mid-way through. As such, we were able to successfully adapt our workshops in the moment, and to iterate on it to improve flow and outputs in the next.

3.2 Participant Attitudes Towards Robots

Across both workshops, participants expressed a complex tapestry regarding their attitudes, understanding, and trust in robots. During activity one, most participants opted to draw what they thought a robot might look like. Typically, these robots were humanoid with a head, arms, and more often than not, legs. Robots were also overwhelmingly drawn to have facial features including eyes and a mouth. When prompted to discuss changes needed to make these robots suitable for museum environments, the most common change suggested was colour or some kind of branding related to the museum. It was more common for participants to not want to make any changes to their robot, as long as it could move around the museum and deliver information to visitors either verbally or on a screen. When asked whether the robots should have robotic style voices or more human ones, the majority of participants expressed a preference for a humanistic voice.

While responding to the modified NARS, participants also shared insightful information about how they perceived robots. When asked if robots should feel emotions, all participants across both workshops agreed that robots should be able to feel happy, although only a very small number wanted robots to be able to feel other emotions as well such as anger, sadness, or excitement. For those who did want robots to have a broader range of emotions, it was desirable that the robot would feel the same way that the participant did e.g., being sad at the same time. This was explained further in a later item that asked if participants would want to be friends with a robot. Again, almost overwhelmingly the answer was yes. When prompted to explore this further, most of the participants envisioned the robot's primary purpose to be friendship, explaining that they would want a robot companion to make them feel better when they were sad, and to do social activities with such as going to the pub, attending fun fairs, and watching football. Other activities deemed appropriate for a robot were to complete day-to-day tasks that participants did not enjoy such as shopping, or to help in the workplace, although a number of participants said that they would not want a robot to do anything unrelated to companionship.

One of the more divisive questions delivered through the NARS regarded decision making. The initial question of 'would you let a robot make decisions for you' was a fairly even split, with some participants saying yes, and others saying no. However, when this prompt was explored further, it emerged that participants would not want to have to oblige any decisions made by the robot, and would rather be able to choose whether to agree or not on their own. As the NARS prompts were delivered according to the order of the original NARS, this question was directly followed by discussing if the participants would feel comfortable being around robots. For a small but vocal number of participants, their attitudes to the robot had changed after discussing how a robot might try to enforce a decision on them, and some trust could be seen to be lost. One participant in particular who had been keen on the idea of a robot friend was no longer willing to allow a robot in her home, as she explained she had young family members near her and she did not trust it to be near them.

In both workshops, the last activity participants undertook was to talk about whether a robot museum guide would be useful, and if they would like it. The first workshop participants answered this question after interacting with the Double 3, although they were not able to see the robot in the museum context. These participants were evenly split on the concept of a museum tour guide robot, with two responding very positively to the idea, one responding very negatively, and the final two opting not to comment. The participant with the negative response explained that he was scared of how the Double 3 moved. The second workshop participants were able to interact with Lindsey and the Double 3 in a museum context, and were given chance to have a short tour of an exhibit with Lindsey. These participants were generally warmer to the idea of a robot tour guide, with all except one participant happily following Lindsey and listening to it speak. The disengaged participant preferred to look at the museum content by himself. At one point in the tour, Lindsey became stuck on an obstacle and stopped moving. Participants showed concern for the robot, with one participant saying "it should say help me, I'm stuck". This warmer reception from the second workshop group suggests that physically contextualising the robot may reduce fear and mistrust.

4 FUTURE WORK

The findings from these workshops can aid in the development of a template for future co-design workshops with autistic people and/or people with learning disabilities in a robotics context. The tools in these studies can be further developed, especially the NARS. Running an in-depth analysis and more co-design workshops with more participants from this group can enable more modifications to robot behaviour and morphology to be identified which will increase the accessibility of robots in cultural experiences. These modifications can be implemented, where feasible, and then evaluated with groups of people that are autistic and/or have learning disabilities.

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