Children's Perception and Interpretation of Robots and Robot Behaviour

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Abstract. Technology is advancing rapidly; especially in the field of robotics. The purpose of this study was to examine children's perception and interpretation of robots and robot behaviour. The study was divided into two phases: phase one involved 144 children (aged 7-8) from two primary schools drawing a picture of a robot and then writing a story about the robot that they had drawn. In phase two, in small groups, 90 children observed four e-puck robots interacting within an arena. The children were asked three questions during the observation: 'What do you think the robots are doing?', 'Why are they doing these things?' and 'What is going on inside the robot?' The results indicated that children can hold multiple understandings of robots simultaneously. Children tend to attribute animate characteristics to robots. Although this may be explained by their stage of development, it may also influence how their generation integrates robots into society.

Keywords: children, perception, robots.

1 Introduction

As technology has advanced in the last two decades, social and behavioural scientists have considered the impact of these advances on children. During this period, the term 'digital generation' was coined and much used. According to Buckingham and Willett [3], children were often described as the digital generation, as they were the first generation to experience digital technology throughout their lives. Edmunds and Turner [6] suggest a generation is 'an age cohort that comes to have social significance by virtue of constituting itself as a cultural identity' (pg 7). Similarly, Bourdieu [2] argues that the characteristics of a generation are produced by its members and that these characteristics can include specific tastes or beliefs. One domain of digital technology that has advanced rapidly in the lifetime of the current generation of children is the field of robotics. In 2008 it was predicted that there will be over four million new robots for domestic use (e.g. for lawn mowing, for window cleaning and so on) and over seven million new robots for entertainment purposes (e.g. toys, personal companions) by 2011 [18]. One of the key characteristics of the generation who are currently children might be how they engage with robots. This

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generation characteristic is likely to influence the development and integration of robots within society as this generation of children become adults, and for future generations.

The development of such a generation characteristic will be influenced by the way children develop their understanding and relationships with robots. This study explores how children perceive robots and robot behaviour, in particular how children give meaning to robots and robot behaviour and integrate this with their understanding of the world and how it functions.

2 Method

Children from UK state funded primary schools were recruited for the research which was conducted in two phases. In phase one, the children were asked to draw a robot and write about the robot they had drawn. The second phase involved greater interaction between the children when, in small groups, they watched robots interacting within an arena. Ethical approval was obtained through the University of Warwick research ethics framework. All data was anonymised at the time of collection.

2.1 Phase One

144 children (aged 7-8 years) in groups of approximately 28 children were each asked to draw a picture of a robot and then write a story about the robot that they had drawn. Writing and drawing is a data collection technique appropriate for research with children because the activity is familiar to them and gives children time to think and clarify their thoughts [13]. This can aid communication between adult and child [9] as children may find it difficult to express their thoughts verbally especially when presented with unfamiliar researchers [8]. The write-and-draw exercise allowed us to explore children's pre-existing perception of robots before they were introduced to the particular robots that were used in phase two, and prompted the children to start thinking about robots so they were ready to engage with the phase two activity.

2.2 Phase Two

In groups of 10-11 children each, the children observed four e-puck robots (Fig. 1). E-pucks are Swiss designed, miniature wheeled robots that can run around on their wheels powered by their own motors; they include a camera and lights and can detect objects/obstructions. These robots were programmed to follow an illuminated light on the back of another robot. Due to both external and internal influences, such as other lighting in the room and the level of charge in each robots' battery, variation in robots behaviour occurs. This can appear to be spontaneous variation in the behaviour of the robots as the factors that bring about this variation might not be apparent to an observer.

After an initial period during which the children watched the robots and talked about them as a group, each child was asked to respond in turn to three questions: 'What do you think the robots are doing?', 'Why are they doing these things?' and 'What is going on inside the robot?' Field notes were taken and elaborated after each session. Thematic analysis was undertaken. As no new themes were emerging after ninety children had observed the robots, no further groups were held.

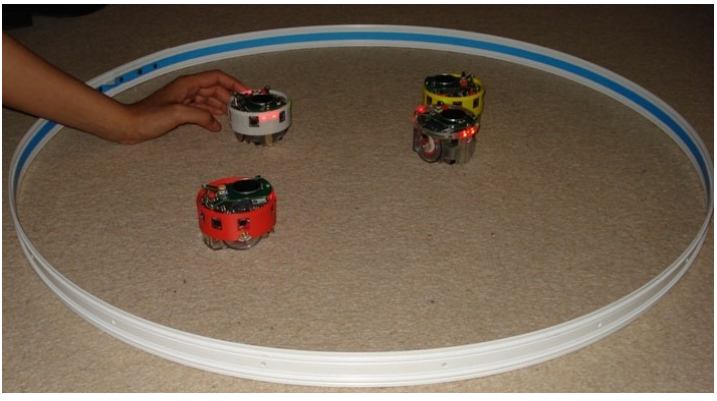

Fig. 1. Four e-puck robots within an arena

In the following results section, the data from each phase is presented separately.

3 Results

This section reports the results and discusses them in relation to existing literature. Figures 2 and 3 show an example of data collected from one child. All quotations from the children's stories are verbatim. All children's names are pseudonyms chosen to indicate the gender of the child.

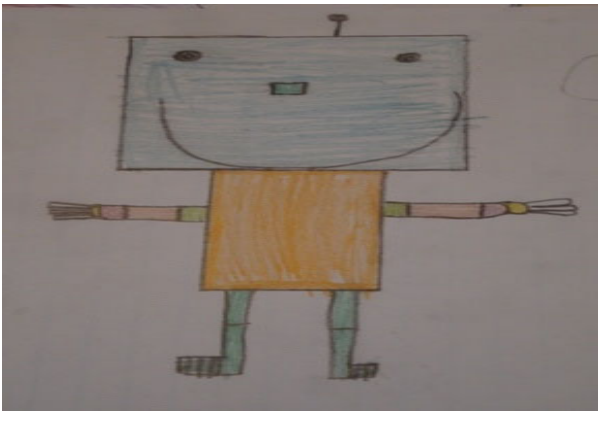

Fig. 2. A drawing by Jim

3.1 Children's Drawings of Robots

Humanoid robots (similar to the picture in Figure 2) were drawn by 122 of the 144 children. These drawings had a head, trunk, arms and legs. These 122 drawings were remarkably similar, yet each robot possessed distinctive features such as their colour

or accessories. Accessories included weapons, remote controls and keypads. The 22 drawings that did not resemble a human body depicted identifiable non-humanoid film or television robot characters.

Me and my sararaite robot

I have chose best robot because he would teach me the best karati moves and I would teach him the best karati moves I know. Even he would turn a car and dive me to school. Even I could show my friends how to do the karati moves my robot taught me. Even I could play Xbox games. He could cut the fruits instead of mum doing it. He is powered by a switch and that switch is powered by batteries. He is a good robot. He can fire misiles at my friends bad robot. He can make little robot's. I saw him in my garden shed. he is a medium robot.he can turn into a TV. He can have CCTV so I know what is going in my shop and Resturant.

Fig. 3. Story written by Jim about his robot (shown in Figure 2)

3.2 Children's Writing about Their Robots

The story in Fig. 3 gives a particularly in-depth account of the robot's nature and illustrates many of the themes that emerged from the data. Other children's stories were shorter.

Jim's story illustrates one of the most striking aspects of the data collected, that is, the ambiguities and contradictions within the children's accounts of their robots. Jim's story suggests that he considers his robot to be similar to a living entity, as the robot seems to be endowed with personality '*he is a good robot*', and the use of a male pronoun suggests the robot has a gender '*I would teach him the best karati moves I know'*. On the other hand, '*he is powered by a switch and that switch is powered by batteries'* indicates Jim also considers the robot to be a mechanical entity. Jim describes his robot as taking on many different roles that relate to different aspects of Jim's daily life. The ambiguities and contradictions within Jim's story were found in almost all the other children's stories.

Children wrote about their robots as though they were living beings in a number of ways. For example, they attributed emotional experience to their robots: *'mummy robot gets shy'*; *'my robot is always happy'* and portrayed them as engaging in activities such as eating and sleeping.

All children indicated gender for their robot, suggesting they considered robots to be animate. Ninety-six children referred to their robot as male and three children referred to their robots as female. Children may be allocating the male pronoun to their robots due to traditions in grammar structures. According to Carpenter [4] when the sex is not known, it is customary to use *'he'*. It is possible that the use of the masculine pronoun was because the children were unsure of the robot's gender rather than because they viewed the robots they had drawn as male.

Most children gave their robots positive character attributes such as '*good*' or '*clever'*. Scopelliti et al. [15] found that younger people viewed robots positively whereas the elderly included in Scopelliti's study tended to be anxious, particularly about domesticated robots. Of the 140 children who wrote about their robot, 25 suggested their robots were 'evil' and were 'going to take over the world'. For example, Sam wrote:

> '*It was a evil robot. When I bought it went flying into space. Then is started to destroy the world but when he was about to shoot he went crash into the sun.'* and '*to take over the world and hypnotis all the people of the world to make them do what he wants. I flicked the swich on to make him work and then he started to walk around and crashed all the little dolls. Later on he said "I will extrminate all of you little people and then hipnatis you so you can all be over my control'*.

Children wrote about their robots as having a range of roles, from service robots to friends and toys. Some robots were described as having a number of roles, for example, the robot in this story was a friend and a service robot:

> *'My robbots are made to serve you and comevert you I fort that I would needed a friend that they can belive in you are the first ones that have been served.they do not hurt you'*.

Only 27 of the children wrote in their stories about mechanical characteristics of their robot such as batteries and remote controls. As the children were asked to write a story, many of them may not have thought writing about its 'mechanics' was appropriate. Jean wrote:

> '*My robot works just by spinning its spanner hand. This robot can transform from a robot to a human followed by this voice.everything thats metal is on him. Hes made of magnets. He can change colours. Hes made of metal and works by 1* AA batteries that never run out. My robot took me on a trip to Paris and then we went to sleep'*.

Although there is detail about the mechanics of the robot, the story indicates the robot has the ability to transform from a robot to a human. Similarly, Jim's robot can transform between animate and non-animate states. In phase two, the children were asked about what goes on inside a robot.

3.3 Children Talking about Robots Interacting in an Arena

When observing the e-pucks, children gave descriptions and interpretations of what the e-pucks were doing which often seemed contradictory. Many of their descriptions implied that the e-pucks were capable of intentional behaviour. For example, the children claimed the robots were bumping or bashing into each other, having a race, following each other, playing bumper cars or trying to get out of the arena that enclosed them. The children also suggested why the robots were doing these things such as bumping or bashing into each other because they were '*enemies*' or they were *'playing a game'*, and having a race because *'they are in the robot Olympics'* or

because *'it is fun'*. On the other hand, when the children were asked 'what is going on inside the robot?' many children talked about the robots as machines needing something external for them to work such as '*I think a sensor is something that kinda like controls what is inside it'*.

However, within the same group of children some children suggested control of the robot's actions was within the robot such as *'there is little man inside controlling the robot'*.

It is possible that children were trying to understand and conceptualize the robots as 'people' with beliefs and desires. Researchers have suggested that by the age of five [5,7] children have usually acquired this ability to take into account another person's perspective in order to comprehend what has influenced that person resulting in them to behave that way [12]. However, Beck et al. [1] proposes that when children do not have enough information to be certain, they guess rather than be cautious. Furthermore, Ironsmith and Whitehurst [11] argue that young children do not ask questions to clarify problematic messages (in our example the apparent spontaneous behaviour of robots). This may explain some of the children's responses. However, there were children in the groups who talked about mechanical aspects of the robots, for example:

> *'I think that there's batteries in there and there's little wires in there what starts from one bit then it goes to the other and the battery makes and there's the wires in there, you touch one and it goes to another and they go to all three of the robots and the battery makes them actually move'*.

However, research has shown children find it difficult to resist making interpretations even when they are uncertain or have insufficient information even when an adult reminds them of this [1, 14, 17].

The children watching the robots in the arena may have been behaving in a similar way to both adults and children shown a silent animation of two triangles and a circle moving within and around the triangles [10, 16]. The participants in these studies tended to attribute elaborate motivations, intentions, and goals, based solely on the pattern of movements of these shapes.

4 Conclusion

When considering robots, children appear to blur the distinction between what is animate and non-animate. However, children can concurrently express contradictory ideas, talking about robots as if they have minds of their own and in the same story or discussion, talking about them as machines that need people to design and operate them. It may be children's stage of development that explains the apparent contradictions. It is unclear whether children might continue to attribute animate qualities to robots into adult life. However, children are creating their view of robots; one that is enriched with animate as well as mechanical qualities. Children are members in society who define the norms and customs of their generation [2] therefore their perceptions of robots may dictate how well robots are integrated into society. This research may also have implications for future technological literacy

programmes which may seek to narrow the gender gap in relation to technology and educate children about capabilities and limitations of robots as they become an integral part of today's society.

References

1. Beck, S.R., Robinson, E.J., Freeth, M.M.: Can children resist making interpretations when uncertain? Journal of Experimental Child Psychology 99, 252–270 (2008)
2. Bourdieu, P.: The Field of Cultural Production. Polity Press, Cambridge (1993)
3. Buckingham, D., Willett, R.: Digital Generations: Children, Young People and New Media. Lawrence Erlbaum, New Jersey (2006)
4. Carpenter, G.R.: English Grammar. Bibliolife, London (2009)
5. Dunbar, R.I.M.: The Human Story. Faber, London (2004)
6. Edmunds, J., Turner, B.: Generations, Culture and Society. Open University Press, Buckingham (2002)
7. Flavell, J.H.: Cognitive Development: Children's Knowledge about the mind. Annual Review Psychology 50, 21–45 (1999)
8. Gauntlett, D.: Creative Explorations. New Approaches to Identities and Audiences. Routledge, London (2007)
9. Goodman, G., Bottoms, B.: Child Victims, Child Witnesses. Understanding and Improving Testimony. Guildford Press, New York (1993)
10. Heider, F., Simmel, M.: An experimental study of apparent behaviour. The American Journal of Psychology 57, 243–259 (1944)
11. Ironsmith, M., Whitehurst, G.J.: The development of listener abilities in communication: how children deal with ambiguous information. Child Development 74, 1275–1296 (1978)
12. Kinderman, P., Dunbar, R.I.M., Bentall, R.P.: Theory of Mind deficits and causal attributions. British Journal of Psychology 89, 191–204 (1998)
13. Pridmore, P., Bendelow, G.: Images of health: exploring beliefs of children using the 'draw and write' technique. Health Education Journal 54, 473–488 (1995)
14. Robinson, E.J., Robinson, W.P.: Knowing when you don't know enough: Children's judgements about ambiguous information. Cognition 12, 267–280 (1982)
15. Scopelliti, M., Giuliani, M.V., D'Amico, A.M., Fornara, F.: If I had a robot at home. People's representation of domestic robots. In: Keates, S., Clarkson, J., Langdon, P., Robinson, P. (eds.) Designing a more inclusive world, pp. 257–266. Springer, Heidelberg (2004)
16. Springer, K., Meier, J.A., Barry, D.: Nonverbal bases of social perception: developmental change in sensitivity to patterns of motion that reveal interpersonal events. Journal of Nonverbal Behaviour 20, 199–211 (1996)
17. Taylor, M.: Conceptual perspective taking: Children's ability to distinguish what they know from what they see. Child Development 59, 703–718 (1988)
18. World Robotics Executive Summary (2008), http://www.worldrobotics.org/downloads/2008_executive_summary.pdf