Kindergarten Children Attitude Towards Humanoid Robots: what is the Effect of the First Experience?

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***Abstract*—Possible applications of robots are growing in educational contexts, where they can support and enhance the traditional learning at any level, including kindergarten. However, the acceptance of such novel technology among the kids is not fully understood, especially for the youngest ones. In this abstract, we present an experiment that investigates the attitude of 52 preschooler children before and after the interaction with a humanoid robot in kindergarten setting. The main hypothesis is that ideas and prejudices can change after a controlled interaction with a physical robot. The study found that children exposed to the robot decrease their distress and positively change their attitude toward the technological device. The results suggest that an early, controlled exposure may facilitate future acceptance.**

Keywords—Attitude toward robot; Educational robotics; Kindergarten setting; Social Robotics.

I. Introduction

The field of educational robotics is rapidly developing and researchers are showing interesting results in the support of teachers and young learners [1], such as storytelling in kindergarten [2]. However, children attitude toward robots is still not clear. For instance, the youngest children are scared of relatively larger humanoid robots [3]. In the smaller children, size defines who the boss is, thus, larger and taller robots may induce a sense of control or even threat. An alternative reason may be that young children are more likely to accept small robots as toys because of their similarity to action figures.

In this abstract, we focus on pre-schoolers of 5 years old, who haven't seen a robot in person before and are still forming their ideas and opinions on robots through their peers and popular culture. The study of these children is an important opportunity to observe their first interaction with a real, physical humanoid robot, and to explore the effects on their attitude towards robots. In this abstract, we have conducted an exploratory study in which we interviewed 52 children before and after interaction with a Nao humanoid robot. We had two hypotheses:

(H1) the interaction with a humanoid robot can change the child's attitude compared to the previous idea he/she had;

(H2) the experience can decrease the distress when encountering a robot in person.

II. Materials and Method

A. Participants

A total of 52 children, attended all sessions of our study (n=52, Males=28, Females=24, M-age=5 years, range= 5-6, *SD*=0.33), all enrolled from four classes of the same kindergarten school in Catania, Italy. We chose participants of 5-6 years because they are on the preoperational stage, and this is the age in which children develop intuitive thought, characterized by realism, animism, and artificialism [3]. In this phase, the child creates mental schemes in order to represent mentally objects and events, with the development of fiction, language, and drawing. Indeed, in this development stage, when drawing, the child does not copy the reality as it is, but represents it, reporting only what for him/her has more importance and meaning. Also, at this stage cultural and social stereotypes are not yet fully structured.

A condition for inclusion was that participants did not previously meet a robot in person. Ethical approval had been obtained prior to any data collection, all the parents signed consent forms before their children were included in the study.

B. The humanoid robot and its position

The robot used in the experiment was the Softbank Robotics Nao which is a small toy-like humanoid robot, very popular for child-robot interaction studies. The Nao robot was deployed in the centre of the room on a table, in order to have approximately the same height as the children, who were initially at a distance of at least one meter. We chose this distance, known as "Personal distance zone" [4], because it has the right balance for children: friendly not too intimate.

C. Experimental procedure

The experimental procedure includes three sessions over three weeks, i.e. one per week. The experiments were carried out in the same classroom where children usually do their activities and two curricular teachers were always available to represent a "secure base" for the children [5]. The time slot chosen was between 10 and 12 am, a period typically used in the kindergarten for drawing activities. The study consisted of three different sessions: (1) a pre-interview (Ex-Ante), where we invited the children to draw a robot, after that, we interviewed them to reveal their interpretation of the drawings, (2) the interaction with humanoid robot Nao. The robot introduced itself to the children and played a popular music while dancing. Next, with a clear and simple language, told a tale to a group of children (Figure 1a). (3) Finally, a post-interview (Ex-Post), structured as the first session (1), was held to detect changes in children's perception.

Considering they are preschool age, the participants could have difficulties in answering questions using the scaled questionnaires. Therefore, we have chosen to administer a qualitative structured interview ispired by the Machover Draw -a-Person Test [6] but used only for cognitive purposes and not for projective purposes. Moreover, we allowed the use of coloured pencils. Before both interviews (Ex-ante, Ex-post), children were requested to draw an image of a robot on a white A4 sheet (Figure 1b).

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The experimental procedure had been previously co-designed and approved by the teachers.


(a)

(b)

Fig. 1. a) Interaction between children and Nao robot, b) example of drawing

Drawing what they imagine about the robot is a method to see the differences before and after the meeting with the robot, but also to stimulate children to talk about robots. Indeed, after drawing each child was interviewed by a psychologist, who administered six questions with open answers (see Table I). Children were free to answer, they were told that there was no right or wrong answer, and without time limits.

III. Results and Discussion

All the interviews were audio recorded and responses analysed. The results of the structured interview are summarised in Table I, which compares the answers obtained Ex-Ante and Ex-Post the interaction with the Nao robot.

TABLE I. Structured Interview Summary

(important differences are in bold)	***Ex-Ante***	***Ex-Post***
Who do you associate to the robot that you drew?		
Imaginary world character (toys, TV)	36.5%	38.5%
Family (parents, relatives)	23.1%	25.0%
Other humans (e.g. friends)	13.4%	19.2%
Don't know	**26.9%**	**17.3%**
What material is the robot made of?		
Metals (e.g. iron, steel)	63.5%	65.4%
Other (e.g. plastic, wood, bricks)	26.9%	34.6%
Don't know	**9.6%**	**0.0%**
What is the robot doing?		
Positive actions in motion (e.g. dance, jump)	40.4%	47.3%
Static actions (e.g. watching, eating)	21.1%	25.0%
Aggressive actions	**21.1%**	**11.5%**
Other	9.61%	5.8%
Don't know	3.8%	0.0%
What is the name of the robot?		
Familiar name (self, relative)	42.3%	42.3%
Imaginary name	50.0%	46.1%
NAO	0.0%	3.8%
Don't know	**3.8%**	**1.9%**
Is the robot male or female?		
Male	67.3%	67.3%
Female	32.7%	32.7%
Would you like to meet a robot in person? / Was it nice to meet the robot?		
Yes	**82.7%**	**96.2%**
No	15.4%	3.8%

The meeting with the robot definitely reduced the uncertainty in the children answers; indeed, we see a reduction of "don't know" in all the questions. Moreover, almost all children (96.2%) liked the interaction with the robot in person, despite 15% of them was not interested/scared before. After meeting significantly decrease (-10%) the number of children that imagined an aggressive robot. Regarding the gender, children didn't change their ideas and the majority considered it a male, confirming what observed with other robots, e.g. [7]. Minor changes are in the humanisation of the robot, which was associated more to family members (+2%), and friends (+6%) after the meeting.

Drawings (n=104), e.g. Fig.1b, were separately and coded by two researchers. Inter-coder agreement score was 0.97, producing a reliability (measured by Cohen's kappa) of 0.89. Discrepancies were resolved via discussion. One of the observations was that the children increased the number of colours used to draw a robot after meeting Nao. Psychoanalysis studies show how the child's mood can be interpreted according to the presence, the combination or the absence of colour, where a higher number of used colours corresponds to a higher perception of stimulating environment [8]. Furthermore, children rarely drew more than requested (i.e. to design a robot), and only in a few cases, the child inserted one or more humans into the drawing. This condition occurs after the physical encounter with the robot where the child draws the robot near himself. This to support that after the meeting the possibility of "feel close" increases.

IV. Conclusions

The children responses and our observations gathered during the experiments in the kindergarten suggest that exposing children to physical robots at a young age can positively affect their attitudes towards small humanoid robots. After the real experience, we saw a decrease of distress in meeting a robot and a positive improvement of the attitude. This suggests that early exposure of such technologies may facilitate future acceptance of the men and women of tomorrow.

As final remark, it is important to emphasize that educational technologies, such as robots, are not designed to replace parents or teachers, but to support the teacher's educational program. Therefore, for this reason, it is essential that the child is interested and shows a positive attitude towards the robot.

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