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Social Robots & Young Children

Parents' Judgments of the Acceptability and Importance of Socially Interactive Robots for Intervening with Young Children with Disabilities

Carl J. Dunst, Carol M. Trivette, Jeremy Prior, Deborah W. Hamby, Davon Embler

Orelena Hawks Puckett Institute, 128 South Sterling Street, Morganton, NC 28655 USA

KEY WORDS

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Humanoid-like robots
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Attention deficit disorder

ABSTRACT

A number of different types of socially interactive robots are being used as part of interventions with young children with disabilities to promote their joint attention and language skills. Parents' judgments of two dimensions (acceptance and importance) of the social validity of four different social robots were the focus of the study described in this research report. Results showed that toy-like robots were judged as more acceptable and important compared to humanoid-like robots but that the social validity judgments of all four robots were much lower than found in studies of other types of interventions. The need for additional studies of parents' judgments of socially interactive robots is described.

Any intervention or practice needs to be viewed as both acceptable and important if a practitioner or parent is likely to judge the intervention or practice as worth their time and effort. Similarly, the benefits or outcomes that are likely to occur by using an intervention or practice also need to be viewed as acceptable and important for the outcomes to be judged as worthwhile. The acceptability and importance of an intervention or practice and the outcomes of the intervention or practice are two dimensions of social validity (Foster & Mash, 1999). In a number of studies conducted by ourselves and our colleagues, we found that the more socially valid parents and practitioners judged different types of intervention practices for young children with disabilities, the more they used the intervention practices with fidelity (e.g., Dunst, Pace, & Hamby, 2007; Trivette, Dunst, Hamby, & Pace, 2007).

The purpose of the study described in this research report was to evaluate parents' ratings of the acceptability and importance of socially interactive robots with young children (e.g., Bernstein & Crowley, 2008; Demiris & Meltzoff, 2008; Tanaka, Cicourel, & Movellan, 2007). Socially interactive robots include either autonomous or remotely controlled devices that are used to engage children in interactions to enhance their social development, including joint attention and communicative competence (Kahn, Gary, & Shen, 2013). A number of robotics experts have investigated the use of socially interactive robots with young children with disabilities, and especially children who have difficulties establishing and maintaining social relationships with other children and adults (Besio, Caprino, & Laudanna, 2008; Cook, Howery, Gu, & Meng, 2000; Kronreif, 2009; Robins, Dickerson, Stribling, & Dautenhahn, 2004; Welch, Lahiri, Warren, & Sarkar, 2010). The study described in this paper was conducted as part of a line of research and practice investigating the utility of socially interactive robots with young children with autism spectrum disorders, Down syndrome, and other disabilities (Dunst, Prior, & Trivette, 2012).

An extensive review of the literature was used to identify the types of socially interactive robots being used as part of interventions with young children with dis-

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abilities (e.g., Diehl, Schmitt, Villano, & Crowell, 2012; Feil-Seifer et al., 2009; Feil-Seifer & Mataric, 2011; Giannopulu & Pradel, 2010). After carefully reviewing the types of social robots that appeared to hold promise as part of intervention studies we planned to conduct, we selected four socially interactive robots that were the focus of our initial research. The four robots are shown in Figure 1. They are Popchilla (Interbots, 2011), Keepon (Kozima, Michalowski, & Nakagawa, 2009), CosmoBot (Brisben, Safos, Lockerd, Vice, & Lathan, 2005; Lathan, Brisben, & Safos, 2005), and Kaspar (Dautenhahn et al., 2009). Popchilla and Keepon are both toy-like robots that are remotely controlled by an interventionist who uses different features of the robots to engage children in interactions or to respond to children's initiations. CosmoBot and Kaspar are more humanoid in their appearance and are operated in the same manner as Popchilla and Kaspar.

METHOD

Participants

The participants were 108 parents and other primary caregivers of children 1 to 12 years of age with autism spectrum disorders, chromosomal conditions, and other identified disabilities. A majority of the children (79%) were male. Participants were recruited through local, regional, and national parent and professional organizations. Nearly all the participants (98%) were between 30 and 50 years of age. Thirty percent had completed high school or some college, whereas 70% had undergraduate or graduate college degrees.

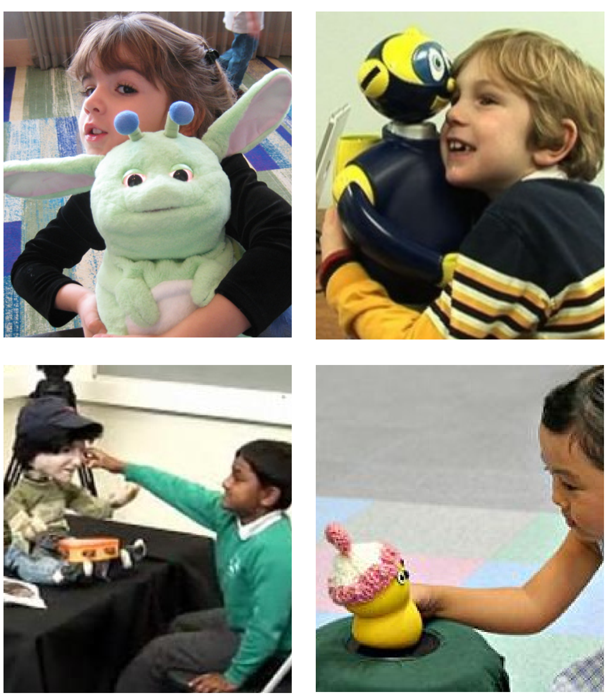

Figure 1. **The four socially interactive robots that were the focus of parents' social validity judgments.**

Survey

A 12-item survey was developed to obtain participants' social validity judgments using Foster and Mash's (1999) framework for differentiating between the acceptability and importance of interventions and their intended outcomes. The acceptability of the socially interactive robots was assessed in terms of participants' judgments of the likelihood of using a robot as part of interventions with young children with disabilities and of them having child benefits. The importance of the socially interactive robots was assessed in terms of participants' judgments of how advantageous the robot and its consequences would be to a participant and his or her child. Table 1 includes examples of the different types of social validity items on the survey. Each item was rated on a 5-point scale ranging from *do-not-agree-at-all* to *agree totally* with each statement.

Procedure

The surveys were completed online where one of the four robots was selected randomly for a participant to make his or her social validity ratings. The introductory remarks on the survey included the same background information with a robot's name inserted into the text to particularize the survey for each participant. The introduction also included a description of the purpose of the survey and information about how a robot is used as part of interventions to promote social interactions between a child and a robot, and between a child and other persons.

Following the introduction, each participant viewed a video tape of the randomly selected robot which lasted about two minutes. The video footage included examples of child-robot interactions that the robot developers use to illustrate the different capabilities of the robots. The video footage was obtained from either Google videos or from the robot developers.

Data Aggregation

Each of the four types of social validity described above was assessed by three items. The number of items rated *mostly agree* or *totally agree* for each robot was used to determine participants' judgments of the importance and acceptability of the socially interactive robots. We performed different types of between robot comparisons and also evaluated the effects of child age (1 to 4, 5

Table 1
Examples of the Social Validity Items Used to Measure the Acceptability and Importance of the Socially Interactive Robots

Social validity	Items
Acceptability	
Intervention practices	I would find (robot's name) easy to use with my child
Child outcomes	I think my child would find (robot's name) interesting and fun to play with
Importance	
Intervention practices	Using (robot's name) with my child would be worth my time and effort
Child outcomes	Using (robot's name) with my child would give him/her an added opportunity to learn to interact with other persons

to 8, and 9 to 12 years) and child condition (autism spectrum disorders, chromosomal conditions, other disabilities) to determine if the social validity ratings of the four different robots differed for those particular variables. *Post hoc* follow-up tests for between robot differences were used to test for the sizes of effects of the differences using Cohen's *d* effect sizes (Dunst & Hamby, 2012).

RESULTS

Between group analyses found no differences for either child age or child condition but did yield between group differences for the social robots. The percent of items rated either *mostly agree* or *totally agree* for the four robots are shown in Table 2. Keepon and Popchilla were rated as more socially valid compared to CosmoBot and Kaspar. There were no differences in the participants' ratings of Keepon and Popchilla and no differences in the participants' ratings of CosmoBot and Kaspar. We therefore combined the data for the two toy-like robots and combined the data for the two humanoid-like robots for further analysis. The findings are shown in Table 3 in terms of the average effect sizes for the differences between the two types of robots for the three items for each type of social validity. In all cases, the toy-like robots were judged as more socially valid compared to the humanoid-like robots as evidenced by the average effect sizes for the differences in the participants ratings for the two types of robots which ranged between $d = .42$ and $d = .50$.

DISCUSSION

It was not surprising or unexpected that the two toy-like robots-Keepon and Popchilla- were rated as more socially valid compared to CosmoBot and Kaspar. This was the case because a majority of the participants' children were less than eight years of age, where playing with toys is an age-appropriate activity. What was surprising was the fact that the percent of items rated *mostly agree* or *totally agree* was considerably lower than what we have found in studies of other kinds of interventions (Dunst et al., 2007; Dunst, Trivette, Gorman, & Hamby, 2010; Trivette et al., 2007) . In these other studies, the percentages of items rated a 4 or 5 on 5-point scales typically ranged between 85% and 95% for the intervention prac-

Table 2
Percentage of Social Validity Items Rated Mostly Agree or Totally Agree for the Socially Interactive Robots

	Social robots			
Social validity	CosmoBot	Kaspar	Popchilla	Keepon
Acceptability				
Intervention practices	52	61	75	80
Child outcomes	45	54	69	70
Importance				
Intervention practices	59	59	72	85
Child outcomes	61	61	75	83

Table 3
Cohen's d Effect Sizes for the Differences in the Percentages of Social Validity Ratings for the Toy-Like and Humanoid Social Robots

	Types of robot[a]		Effect sizes		
Social validity	Humanoid	Toy-like	Number	Average	Range
Acceptability					
Intervention practices	56	78	3	.50	.23-.66
Child outcomes	50	69	3	.44	.07-.71
Importance					
Intervention practices	60	79	3	.44	.37-.53
Child outcomes	61	79	3	.42	.18-.76

[a] Percent of items rated *mostly agree* or *totally agree.*

tices and outcomes that were the focus of participants' social validity judgments. The percentages of items rated a 4 or 5 in the study described in this research report were considerably lower for 3 of the 4 social robots.

As we briefly described in the introduction, there is a relationship between parents' and practitioners' social validity ratings of different types of interventions and their actual use of an intervention with fidelity (e.g., Dunst et al., 2007; Trivette et al., 2007). In these as well as other studies, participants' who judged intervention practices and outcomes as socially valid on 90% or more of the items they rated were more likely to use the intervention practices as intended. In contrast, participants who judged intervention practices and outcomes as less socially valid (70% to 80%) were less likely to adopt and use the practices with fidelity. The findings from the study described in this research report suggest that parents may not see the value of socially interactive robots for children with disabilities and may therefore not afford their children interventions involving social robots.

The fact that the social validity ratings in the present study were so low raises questions about the likelihood of parents of young children with disabilities seeing the value of socially interactive robots as a means to improve their children's social-communicative development. The results indicate a need for further investigation to learn about parents' beliefs about the value of socially interactive robots. The results from these studies could inform the conditions under which parents might avail their children of interventions involving the use of social robots.

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