A comparison between a person and a robot in the attention, imitation, and repetitive and stereotypical behaviors of children with Autism Spectrum Disorder

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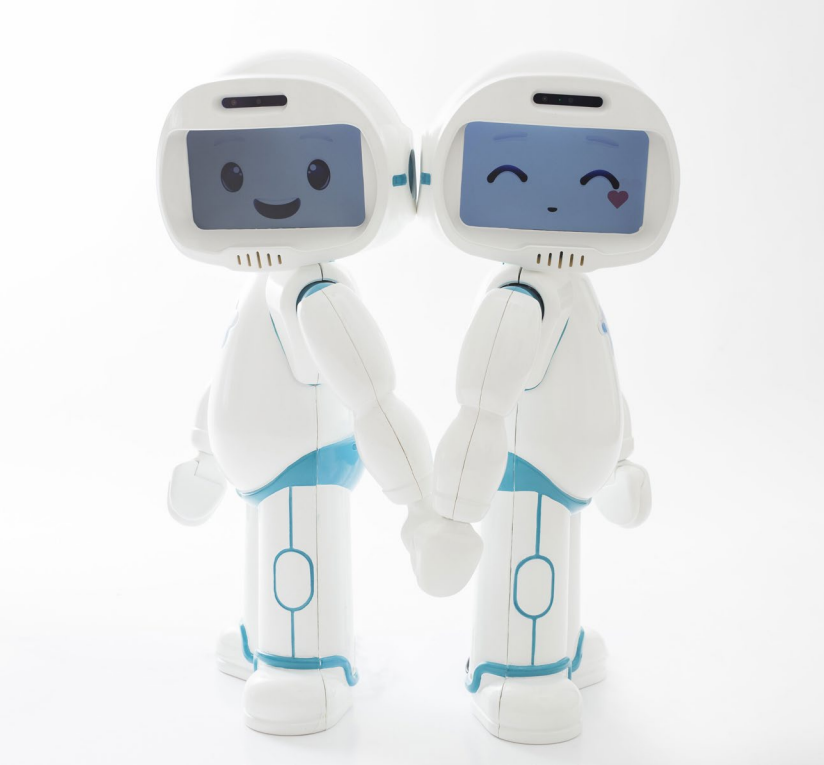

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Abstract

The aim of the present study was to assess the usefulness of QT, a socially assistive robot, in interventions with children with autism spectrum disorder (ASD) by assessing children's attention, imitation, and presence of repetitive and stereotyped behaviors. Fifteen children diagnosed with ASD, aged from 4 to 14 years participated in two short interactions, one with a person and one with QT robot. Statistical analyses revealed that children directed more attention towards the robot than to the person, imitated the robot as much as the person, and engaged in fewer repetitive or stereotyped behaviors with the robot than with the person. These results support previous research demonstrating the usefulness of robots in interventions with children with ASD and provide new evidence to the usefulness of robots in reducing repetitive and stereotyped behaviors in children with ASD, which can affect children's learning.

Research Questions and Hypotheses

Research Questions

1) Do children with ASD pay attention to and imitate QT robot as much as a person?

2) Can an interaction with a robot reduce children's repetitive or stereotyped behaviors?

Hypotheses

1) QT robot is at least as effective as a person in eliciting children's attention and imitation.

2) Children with ASD have less repetitive or stereotyped behaviors with QT robot than with a person.

Participants

- N=15 boys aged 4 to 14 years (M=9.73; SD=3.38)
- Diagnosed with ASD by an expert in the light of DSM-5 criteria.
- Participants were invited through a letter distributed by institutions for children with ASD.
- The study was approved by an ethics panel (ERP17-017-SAR-A) and parents signed informed consent forms.

#	Age	ASD Severity*	IQ*	Verbal (V) or non-verbal (NV)
1	13.67	Severe	80-120	V
2	8.19	Severe	<80	V
3	13.49	Severe	>120	V
4	4.14	Severe	<80	NV
5	4.54	Mild	<80	NV
6	11.46	Moderate	<80	NV
7	8.85	Severe	80-120	V
8	9.22	Moderate	80-120	V
9	8.21	Severe	<80	V
10	14.46	Severe	80-120	V
11	14.46	Moderate	<80	NV
12	8.22	Severe	80-120	V
13	9.58	Severe	80-120	V
14	6.04	Mild	<80	V
15	11.36	Severe	<80	V

Measures

Screening measures

- Social Responsiveness Scale [1]
- Wechsler Nonverbal Scale of Ability [2]

Comparison QT robot vs Person

Attention: number of children's gazes towards the interview partner and the duration of each gaze.

Imitation: number of imitations asked by the interview partner and done by the child: four gestures with the arms (e.g. left arm up, right arm up, left arm to the side, right arm to the side).

Repetitive and stereotyped behaviors: number of chains of repetitive and stereotyped behaviors (uninterrupted sequence of the same type of repetitive and stereotyped behavior) as well as the number of repetitions per chain.

QT robot characteristics

QT is a commercial social and humanoid robot from LuxAI (www.luxai.com; see Fig. 1). QT robot presents different facial expressions using animated characters and upper-body gestures.

Procedure

Children's interactions with QT robot and with a human were compared using two interviews similar in structure and length but with different items (interview A with person; interview B with QT robot).

Setting: During the interview, the child sat at a desk facing the interview partner and was frontally videotaped (QT robot or person; see Fig. 2).

Analysis

The videos of the interviews were coded by one observer. The non-parametric Wilcoxon signed-rank test was used to compare children's attention, imitation, and repetitive and stereotyped behaviors across conditions (person vs robot).

Results

Attention & Imitation

- Children had more gazes towards the person (M=11.02; SD=6.63) than towards the robot (M=8.79; SD=5.16) but this difference was not statistically significant, T=52, p=.454, r=.09.
- Children's average duration per gaze was significantly lower for the gazes directed at the person (M=2.73; SD=2.74) than at the robot (M=6.23; SD=6.88), T=17, p=.046, r=.39.
- Children spent a lower percentage of time looking at the person (M=41.28; SD=26.83) than at the robot (M=66.21; SD=19.78), T=10, p=.013, r=.49.
- Children imitated more often the person (M=3.85; SD=0.55) than the robot (M=2.93; SD=1.83) but this difference was not statistically significant, T=3, p=.180, r=.26.

Repetitive and stereotyped behaviors

- Significantly more chains of repetitive and stereotyped behaviors during the interaction with the person (M=3.31; SD=4.16) than with the robot (M=1.05; SD=1.91), T=48, p=.037, r=.38.
- Significantly more behaviors per chain in the interaction with the person (M=13.56; SD=17.66) than in the interaction with the robot (M=4.45; SD=8.40), T=40, p=.0.38, r=.39.

Conclusions

The present results demonstrate that QT is an engaging robot that can be beneficial to be used with children with ASD. The fact that children direct more attention towards the robot, imitate the robot as much as a person, and engage in fewer repetitive or stereotyped behaviors with the robot than with a person represent increased learning opportunities for children with ASD. However, the present results can also be due to a novelty effect that could disappear over time. Studies with an evaluation of longer periods of interaction are needed to ascertain the long-term benefits of using a robot with children with ASD.

References

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