The Use of RoboParrot in the Therapy of Children with Autism: In Case of Teaching the Turn-Taking Skills

Pegah Soleiman[1], Hadi Moradi[1], Maryam Mahmoudi[2], Mohyedin Teymori[3], Hamid Reza Pouretemad[3,4]

[1]School of ECE, University of Tehran,

[2]School of Psychology, Allameh Tabatabei University

[3]Tehran Autism Center

[4]School of Psychology, Shahid Beheshti University

Introduction

- Robot-Assisted Therapy (RAT) is used for children with developmental disorders such as Autism Spectrum Disorder (ASD)

- Individuals with ASD are characterized by:

  - Deficits in communication and social skills

  - Restricted or repetitive behaviors

- Children with ASD are attracted to robots

Robots for Therapy

► Robots are used for therapies such as improving:

  ► turn-taking,

  ► concentration skills,

  ► imitative game playing, and

  ► social behavior

► Why a parrot-like robot

  ► Parrots' appearance

  ► Parrots' ability to speak

Turn Taking

- The reason for selecting turn-taking therapy
  - Its importance for success in different social situations
  - A time consuming and exhausting task for speech therapists and for children
- A turn-taking therapy scenario between a child and a partner
  - three category of things, i.e. fruits, animals, and body parts
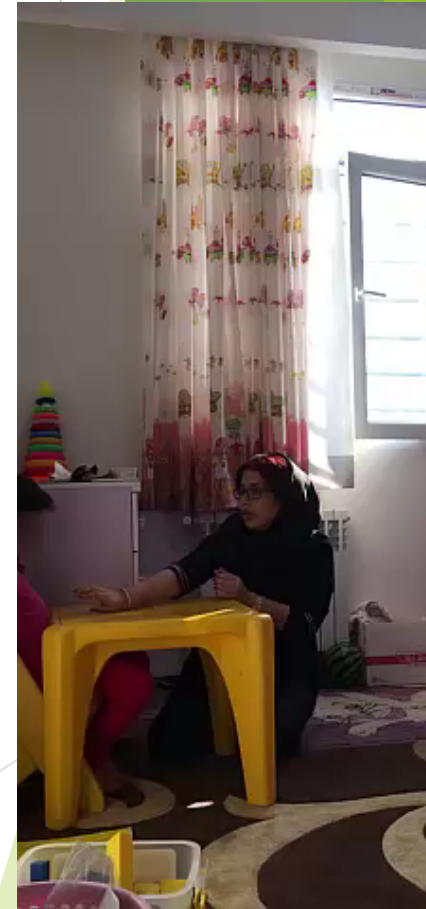
Therapy Setup
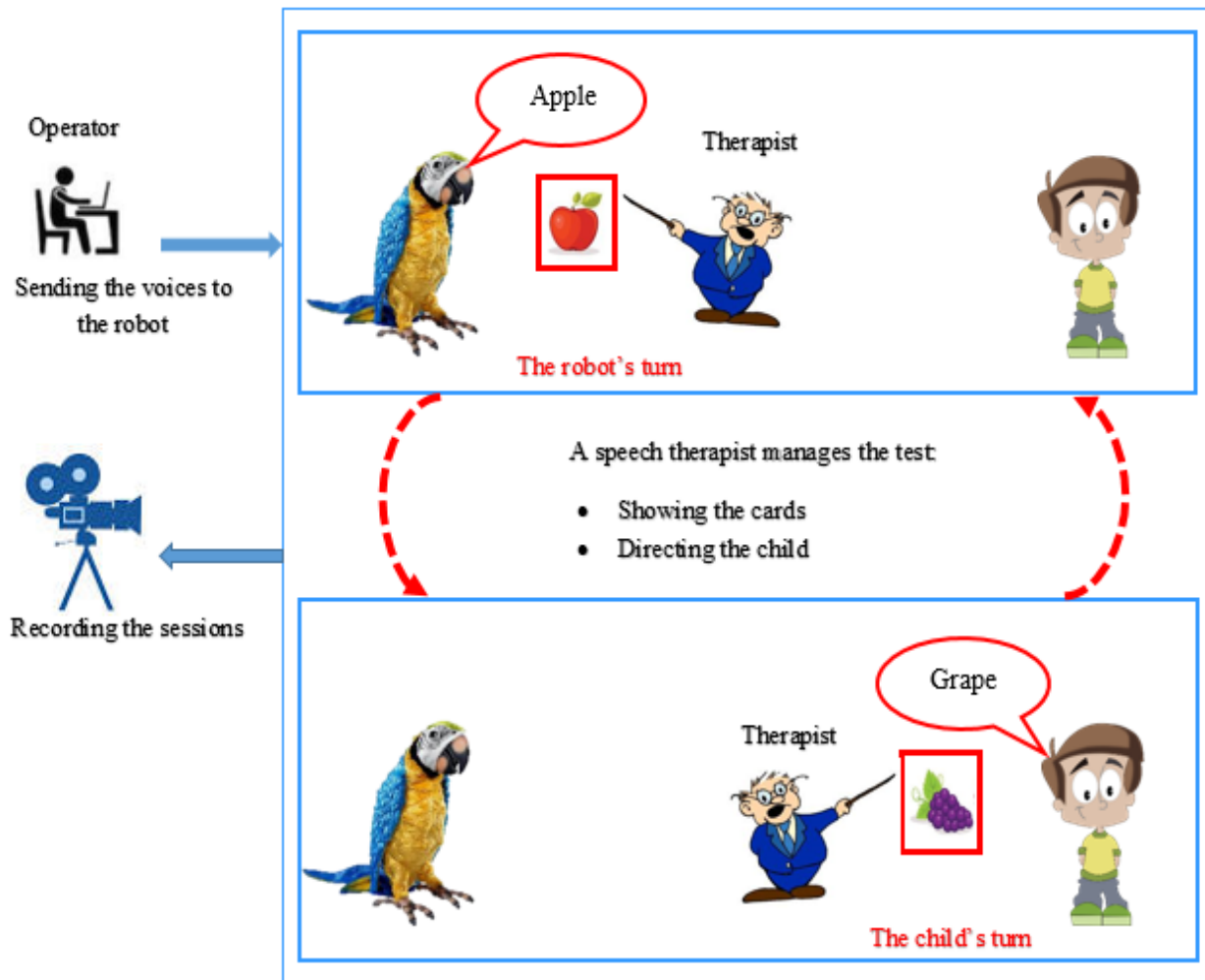
Turn Taking and Turn Telling Variables

▶ Sub-variables

   ▶ **Non-Directed turn-taking (ND):** The subject performed turn-taking without any help from others.

   ▶ **Directed turn-taking:** the subject performed turn-taking with help from others:

      ▶ Verbally Directed (VD)

      ▶ Physically Directed (PD)

   ▶ **False Answer (FA):** the subject could not correctly determine the turn

   ▶ **Correct Answer (CA):** the subject could correctly determine the turn

   ▶ **Correct Answer Directed (CAD):** the subject needed guidance to correctly determine the turn

Therapy Evaluation

- Assessing the child-robot and the child-trainer sessions
  - Changes in turn-taking and turn-telling
  - An interview form provided to the therapist
- The results were divided in two parts
  - Qualitative results: interview forms evaluation and overall observations
  - Quantitative results: effect sizes' comparisons
    - Standardized Mean Difference:
      - (new treatment improvement-placebo improvement)/Pooled Standard Deviation

Participants

- **Participants:** The subject was selected from a pool of 28 children

  - One of the 19 children, out of the 28 children, who did not show turn-taking ability in a card-based turn-taking test.

  - could interact verbally and

  - could be placed among children with medium autism severity, based on GARS scale

- **Experimental design**: A single subject study using cross treatments, cross variables, and AB design

Method: Baseline

- **Warm up session**: introducing the process to the child

- **Baseline (A):** Showing the pictorial cards to the child and asking him to name them in turn with the therapist

  - If the child could not name the cards in turn, then the trainer verbally (VD) or physically directed (PD) the subject to his turn.

  - The same approach used in the turn-telling sessions

Method: Intervention

- **Intervention (B):** At least 6 minutes (3-4 min child-trainer; 3-4 min child-robot).

  - turn-taking variables in 15 sessions

  - turn-telling variables in 11 sessions

  - Once or twice a week in which the order of child-robot and child-trainer was changed in each session

- If the child was not successful following the scenario, even with verbal direction, the therapist physically directed him using physically directed approach

Method: Analysis

- **Tools:** An open-ended questions interview

  - 6 questions regarding the efficacy of the child-robot turn-taking therapy.

- **Analysis method:** A mixed method approach

- **Quantitative analysis:**

  - Frequency ratios for all sessions' data and mean and standard deviation

  - Inferential results

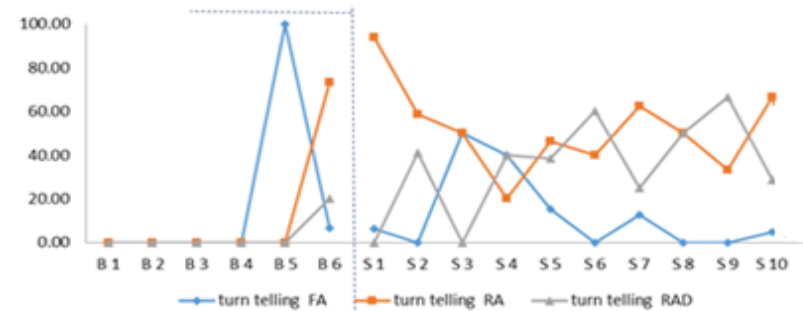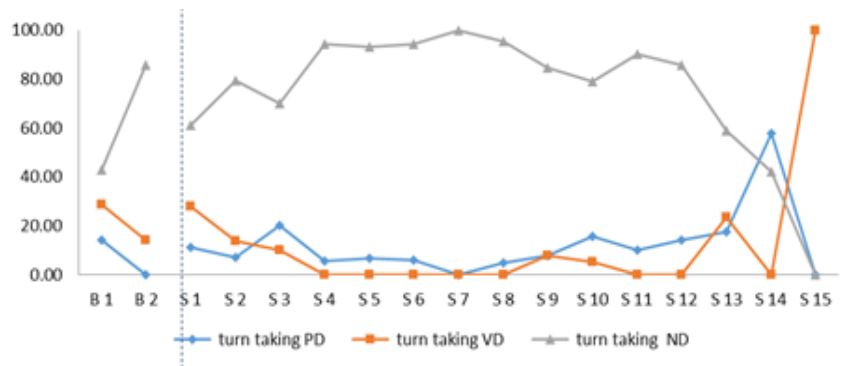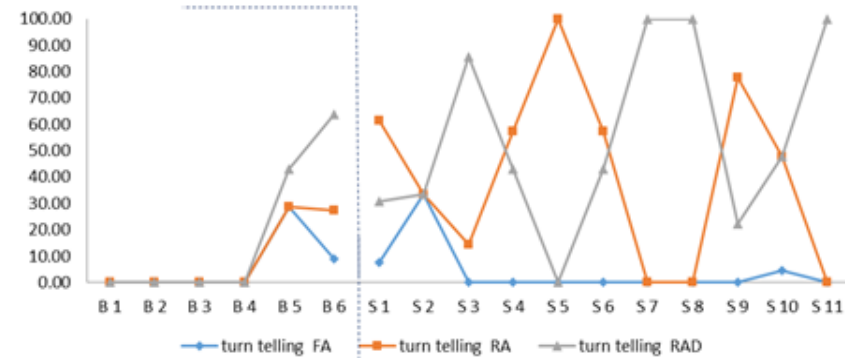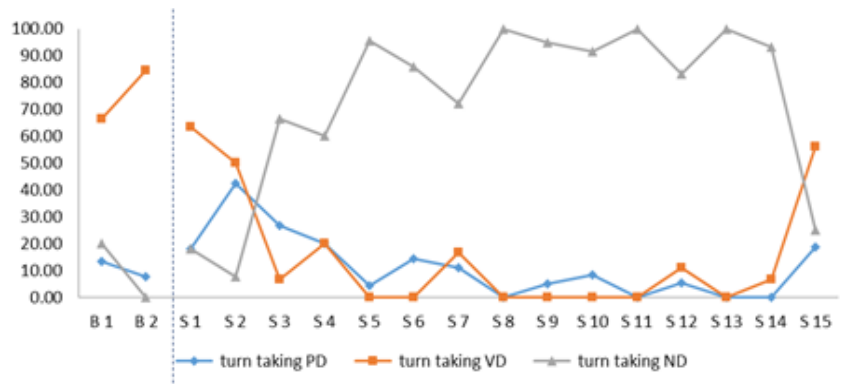- **Qualitative analysis:** Extracted from the interview form and session video recordings

Quantitative results

Child-trainer sessions

Child-robot sessions

Qualitative results

SMD values

		Child-robot sessions					Child-trainer sessions		
Turn taking		PD	VD	ND	Turn taking		PD	VD	ND
		0.28	4.74	4.45			0.5	0.88	0.35
Turn telling		FA	RA	RAD	Turn telling		FA	RA	RAD
		0.18	1.71	0.37			0.33	0.73	3.05

en's proposed effect interpretations: small, SMD = 0.2; medium, SMD = 0.5; and large, SMD = 0.8.

Quantitative results

▶ The feedback from the therapist:

  ▶ The robot is a good therapy support system

  ▶ It may also be used at home by parents

▶ The session videos were evaluated by an expert

  ▶ The robot is a very good motivating media

  ▶ The child was more encouraged and involved in the therapy sessions when the robot is involved.

Conclusion

▶ A simple turn-taking game is designed based on RoboParrot

▶ The results show

  ▶ The effectiveness of the robot as a support system

    ▶ SMD effect sizes were larger in most of the sub-variables in the child-robot therapy than the child-trainer therapy

    ▶ The therapist suggests the usefulness of using the robot

  ▶ The child was more open to the robot compared to the therapist

    ▶ there were times that the child was distracted and non-cooperative with the therapists

Future Work

▶ Further tests are needed

▶ To check the effect of the therapy in real world situation

    ▶ answering phone calls

    ▶ participating in real world conversations

▶ Add variety of games and activities

    ▶ To increase children's ability to generalize turn-taking skill

▶ Add extra functionalities to the robot

    ▶ Extending the attractiveness of the robot.

▶ Further study to evaluate the habituation effect.