

Topic: Adaptive Assisted Robotics and Interfaces to Support Cognitive Development of Children with Special Learning Needs

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Definition of assistive robot – adapted from David Jaffe (2012)

- Assistive robot is a device that can perceive and process perceptual information and perform activities that are beneficial to children or adults with disabilities

Socially Assistive Robot

David Feil-Seifer and Maja Mataric (2006)

Humanoid - preferred



Android - disliked



METEMSS Methodologies and technologies for enhancing the motor and social skills of children with developmental problems,

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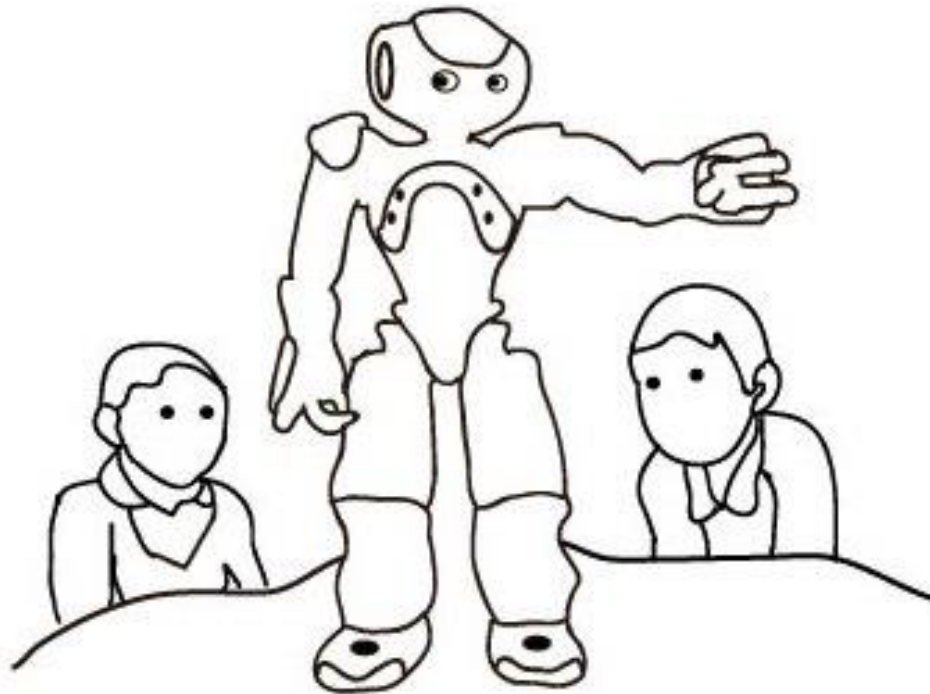


Fig. 1. Experimental setup with a walking robot for learning abstract concepts (cognitive motivation boost)



- Dimitrova, M., Lekova, A., Chavdarov, I., Kostova, S., Krastev, A., Roumenin, C., Stancheva, V., Andreeva, A., Kaburlasos, V.G., & Pachidis, T. A Multidisciplinary Framework for Blending Robotics in Education of Children with Special Learning Needs (submitted to IABL, 2016)
- Social motivation boost via a humanoid robot

A Scenario with NAO - tutor



Dimitrova, M., Wagatsuma, H., Tripathi, G. N., & Ai, G. (2015, June). Adaptive and intuitive interactions with socially-competent pedagogical assistant robots. In *IEEE International Conference on Information Technology Based Higher Education and Training (ITHET)*, 2015 (pp. 1-6)

A new method was proposed to study the perception of a robot as a teacher by registration of saccadic eye movements in the learning process when the teacher is a humanoid robot (lesson in zoology)



Main Features of a Social Robot

- K. Dautenhahn outlined five functional roles of social robots, being:
 - “socially evocative”,
 - “socially situated”,
 - “sociable”,
 - “socially intelligent” and
 - “socially interactive”.
- K. Dautenhahn, “Socially intelligent robots: dimensions of human–robot interaction,” *Phil. Trans. R. Soc. B*, 362, 2007, pp. 679-704.

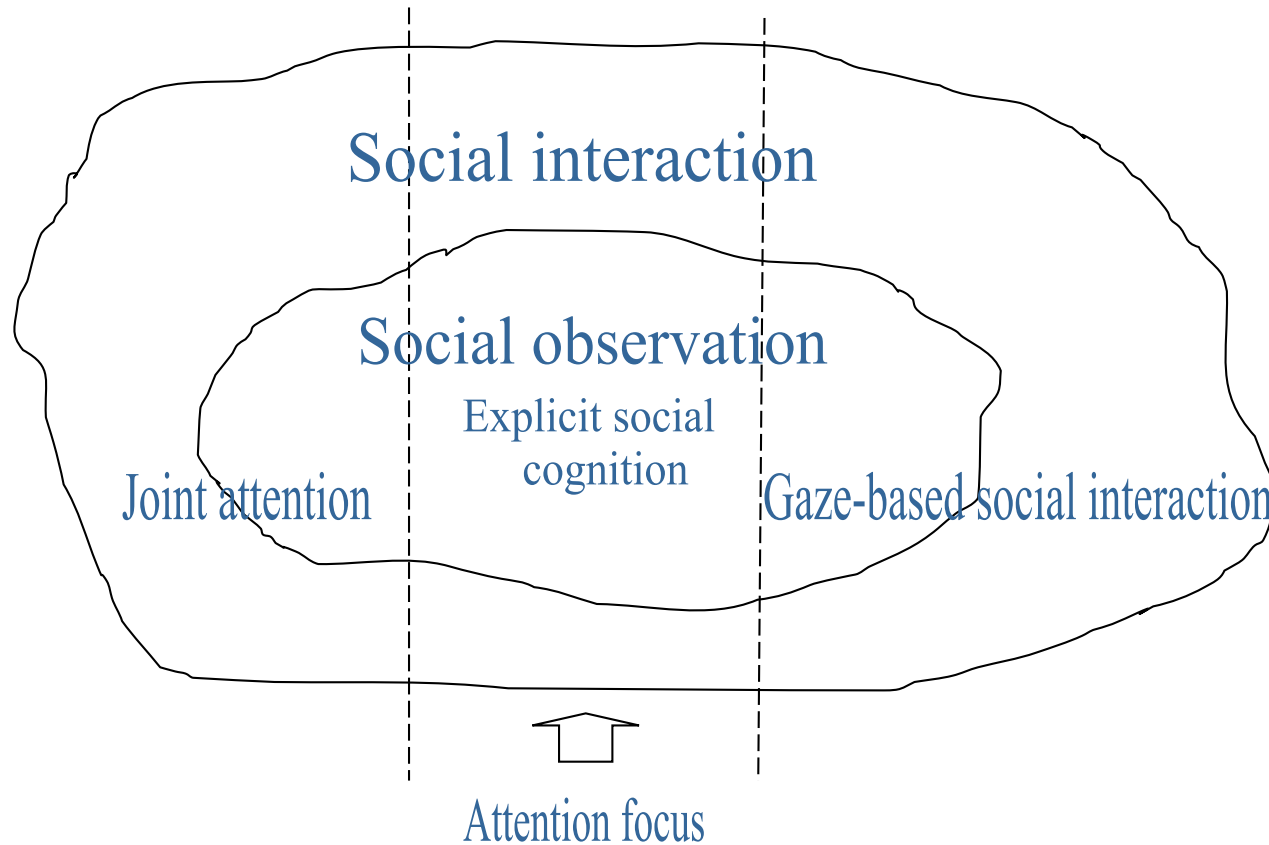
Main Behaviours of a Social Robot

- According to K. Dautenhahn, the *socially - interactive robots* can perform the following behaviors:
- “express and/or perceive emotions;
- communicate with high level dialogue;
- learn models of, or recognize other agents;
- establish and/or maintain social relationships;
- use natural cues (gaze, gestures, etc.);
- exhibit distinctive personality and character;
- and may learn and/or develop social competencies” (2007, p. 584).

Implementation of Social Communication Competence in Pedagogical Assistant Robots

- In the present paper we focus on using ‘natural cues’ to ‘develop social competencies’ in the social situation of introducing a robot as a pedagogical assistant in the classroom
- The proposed framework is intended for both typical children and children with specific difficulties that are being revealed in learning via socializing and in using the social reward mechanisms, like with ASC

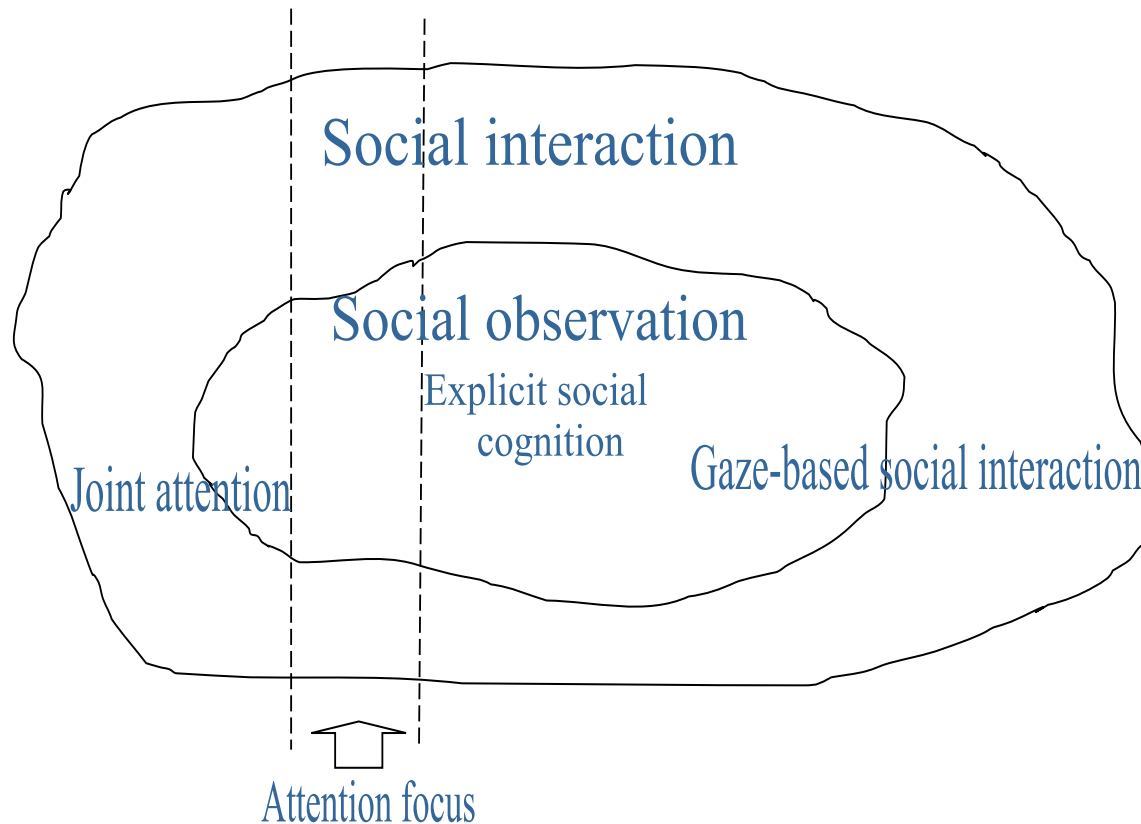
Interplay of Social Interaction and Observation in Shaping Human Learning Abilities



Effect of the Awareness of One's Own Communication Signaling

- In children with ASC *gaze-based social interaction* is being avoided
- The area of awareness of the *own social signaling* is shifted towards the automatic range
- Being mainly aware of *own automatic social signaling* makes them shy or thinking it difficult to modulate behavior by conscious control

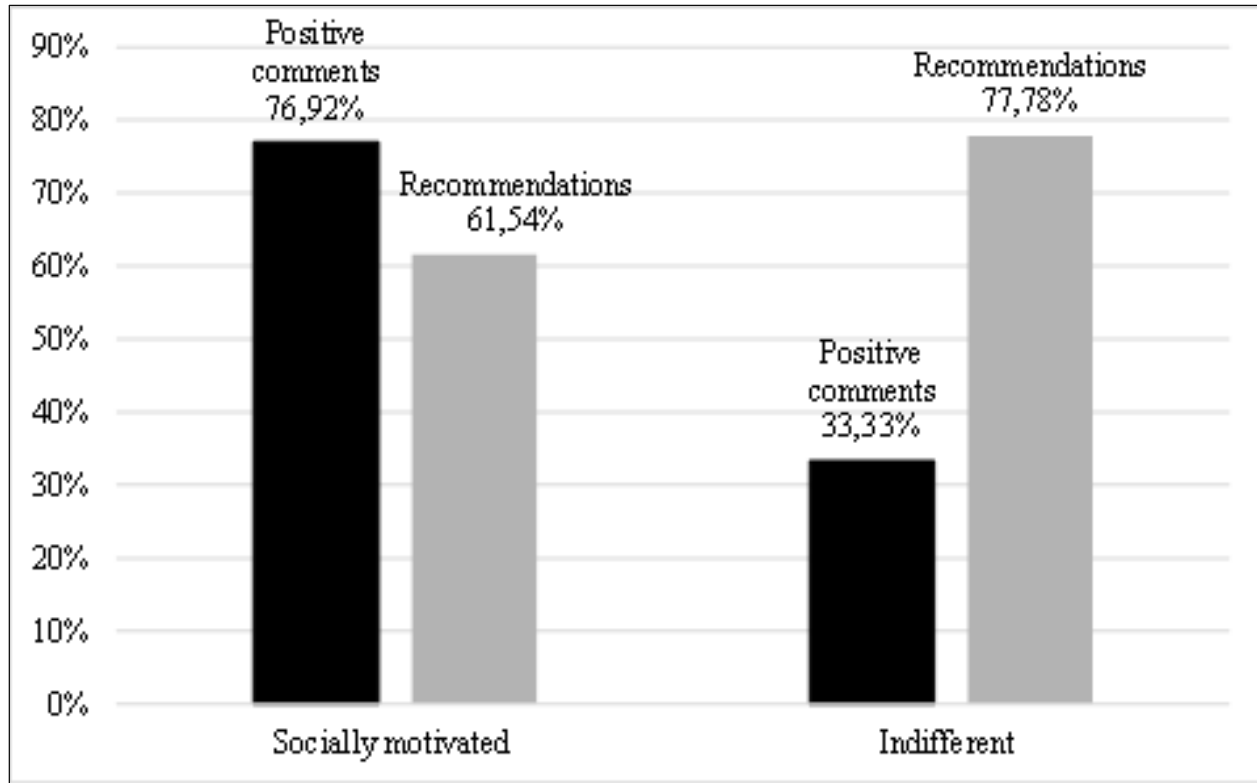
Interplay of Social Interaction and Observation in Shaping Human Learning Abilities with ASC



The Human-robot Pedagogical Strategy Will Focus on:

- Extending the attentional area towards demonstrating the *easiness of one's own conscious modulation* of eye signaling
- Shifting attention from focusing on the own automatic response to the *social signaling* of the others
- This will lead to better *adaptation* of the robot tutor to the individual needs of the child

The Socially-motivated Participants Gave a Higher Number of Positive Comments and Fewer Recommendations to The Robot Teacher



Percent positive comments (dark bar) and percent recommendations (light bar) made by the socially motivated participants vs. the indifferent , $p < 0,05$

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