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How STEAM applies to autistic children: the case for (social) robots

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Autism Spectrum Disorders

- Significant social, communication and behavioural challenges.
- People with ASD may communicate, interact, behave, and learn in ways that are different from most other people.
- In the US, 1 in 68 children has been identified with ASD.
- ASD is about 4.5 times more common among boys.



Therapy

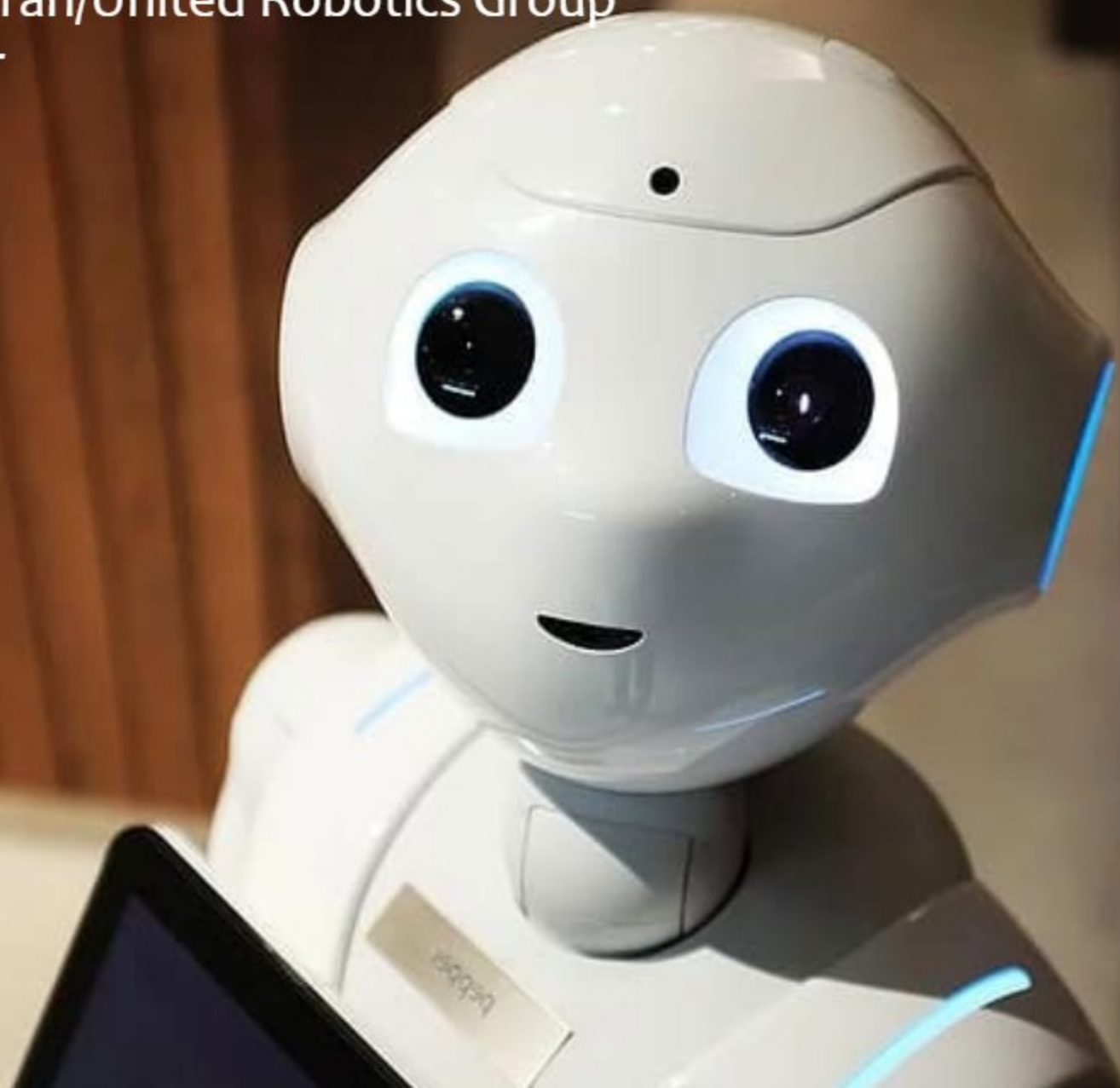
- Applied Behavioural Analysis (ABA)/Cognitive Behavioural Therapy are the most used and recognised ASD therapies
- Practising social skills, such as joint attention, imitation, turn taking
- Stimulus → behaviour → reward
- Increasingly, the use of technology, including **social robots**.



Introduction to Social Robots

- Social robots are autonomous or semi-autonomous robots designed to interact with humans in a social manner.
- Capabilities: engage in conversations, recognise emotions, play games, and assist with learning tasks, ...
- Examples...

Aldebaran/United Robotics Group
Pepper



Anki
Vector



WooWee
KeepOn



Furhat
Furhat Robotics



Hanson Robotics
Sophia

Credit: Flickr, AI for GOOD Global Summit, CC BY

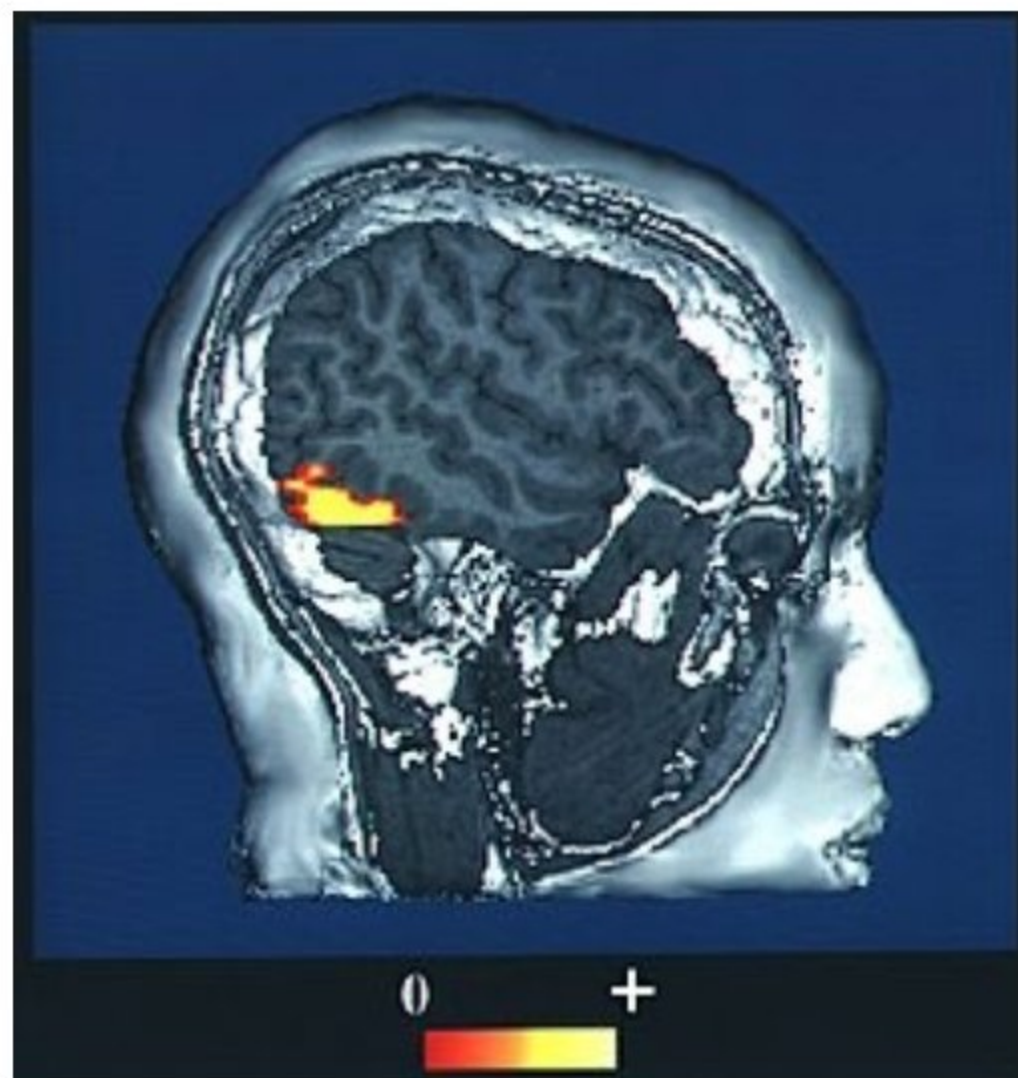
Robots tap into our social brain

We attribute human-like characteristics to artefacts, this effect is enhanced when the artefact is animated and responsive



Pareidolia

- Perceiving human-like features in non-human stimuli.
- Evolutionary psychology explains pareidolia as a hyper response to face-like and human-like features.
- Better to respond to false positives than to not respond.



Fusiform Face Area responds to seeing faces *and* to pareidolia experiences





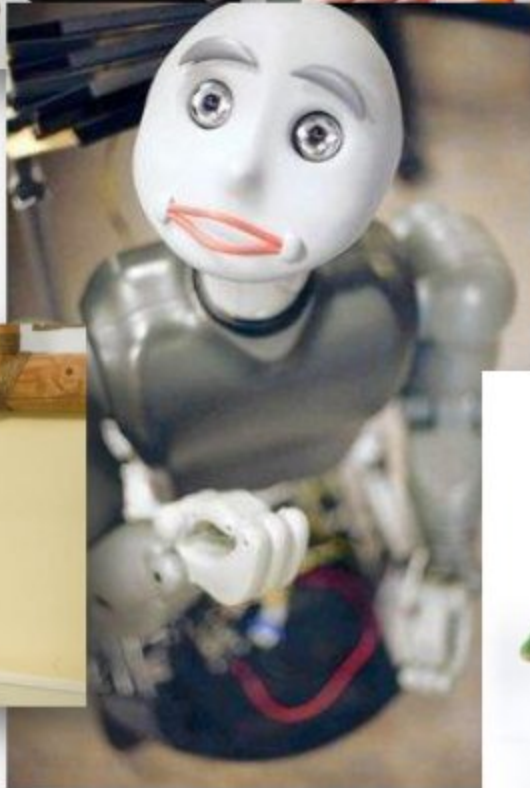




Robots for therapy

Benefits of Social Robots in Autism Therapy

- **Engagement:** Robots can capture the attention of children with ASD better than traditional methods.
- **Consistency:** Robots provide a consistent response, reducing anxiety related to unpredictable human interactions.
- **Patience:** Social robots can repeat tasks or exercises without frustration.
- **Customisability:** Therapy sessions can be tailored to the individual needs of the child.

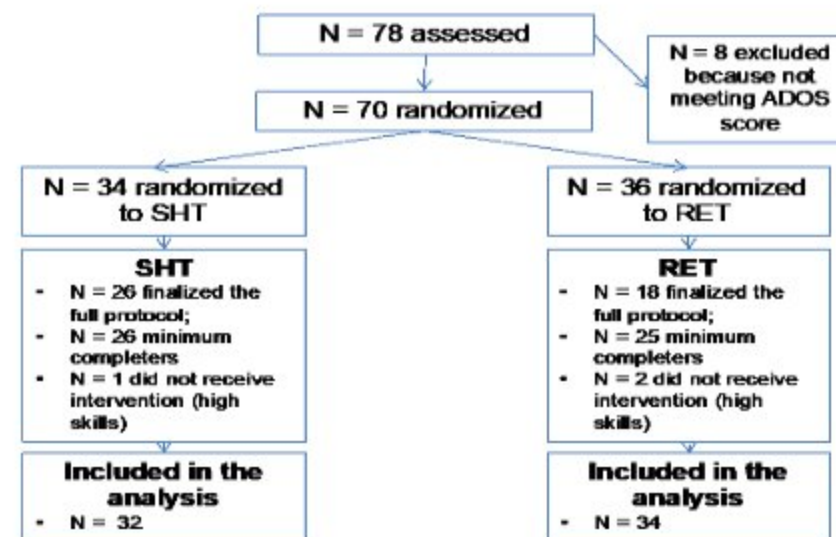


Robot assisted therapy

- Interest in robots, based on observation that children with ASD find robots appealing.
- Use robot for **Cognitive Behavioural Therapy** as a mediating device for social skills
- **Weak evidence for efficacy**, with all studies being qualitative reports or use cases on a small number of children.

Randomised Clinical Trial

- 70 children (11 female; mean age 4.7 years), 12 sessions per child.
- Diagnosed using the Autism Diagnostic Observation Schedule (ADOS) assessment and Social Communication Questionnaire (SCQ).
- Compared Robot Enhanced Therapy (RET) against standard human therapy (SHT)



RET

SHT

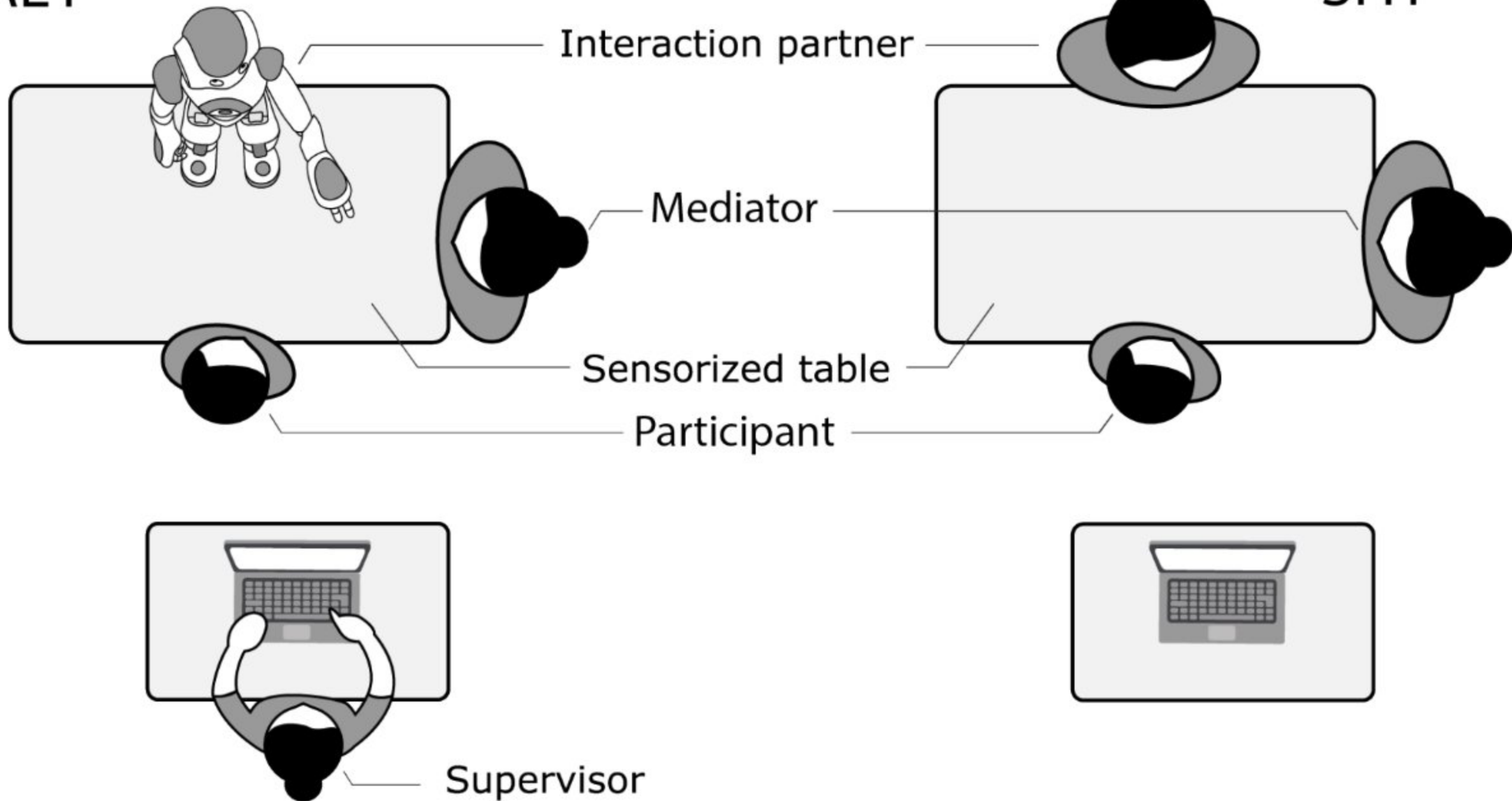
Interaction partner

Mediator

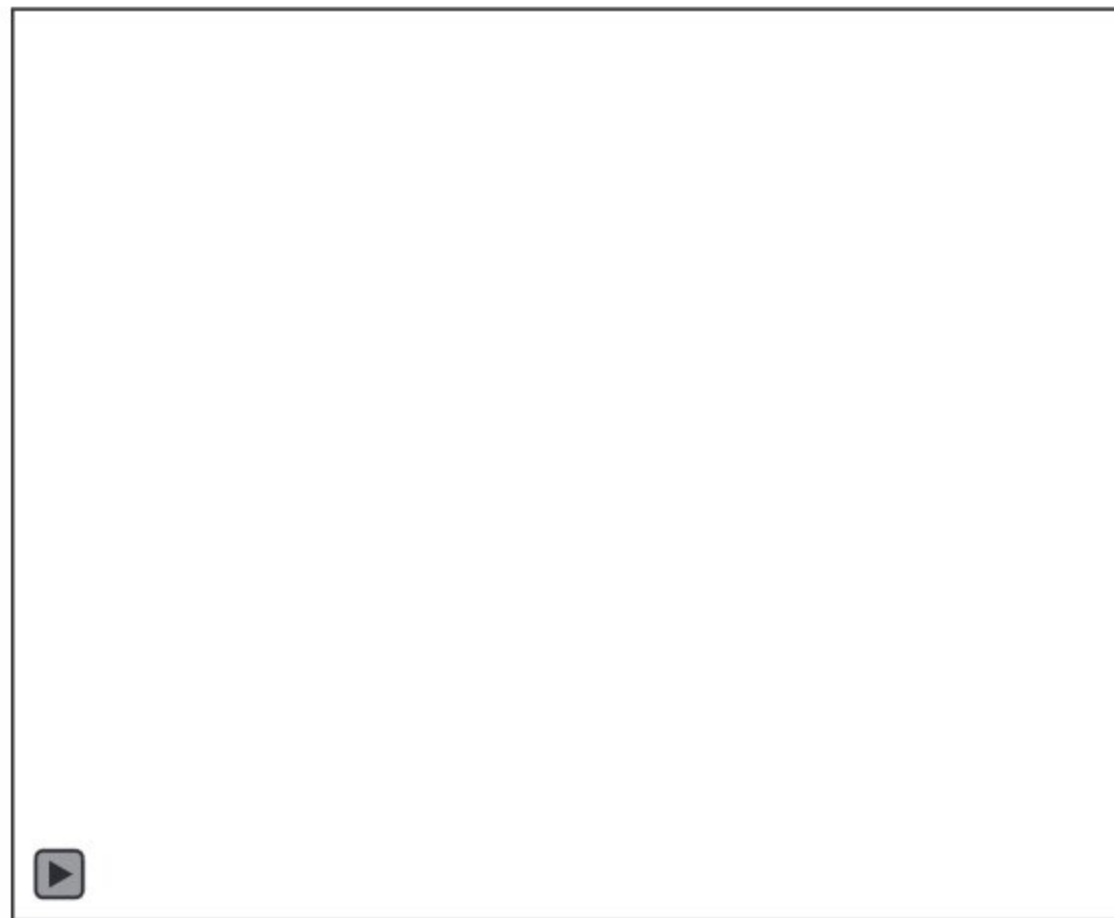
Sensorized table

Participant

Supervisor

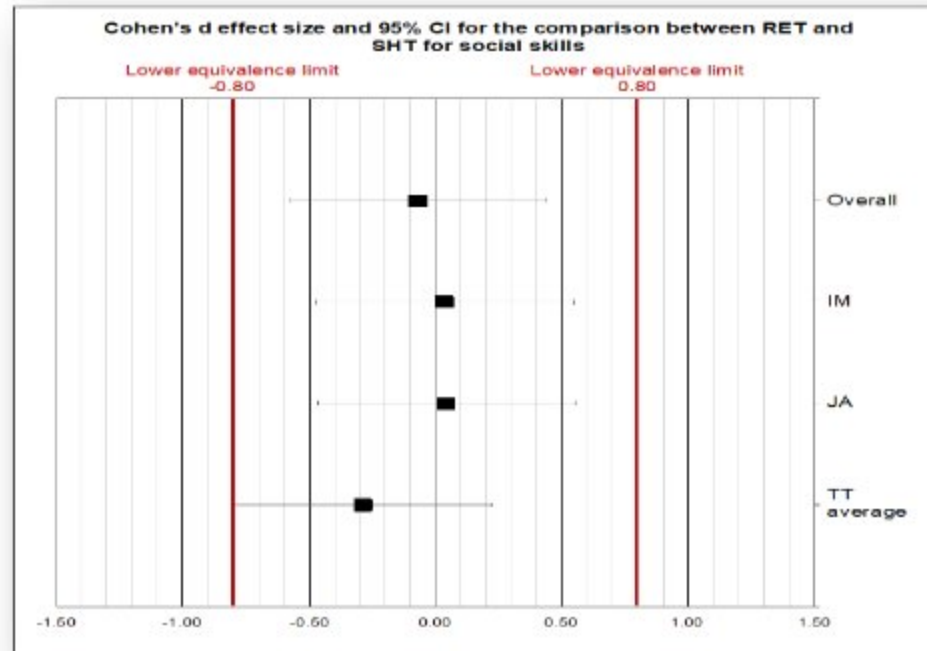


Joint attention

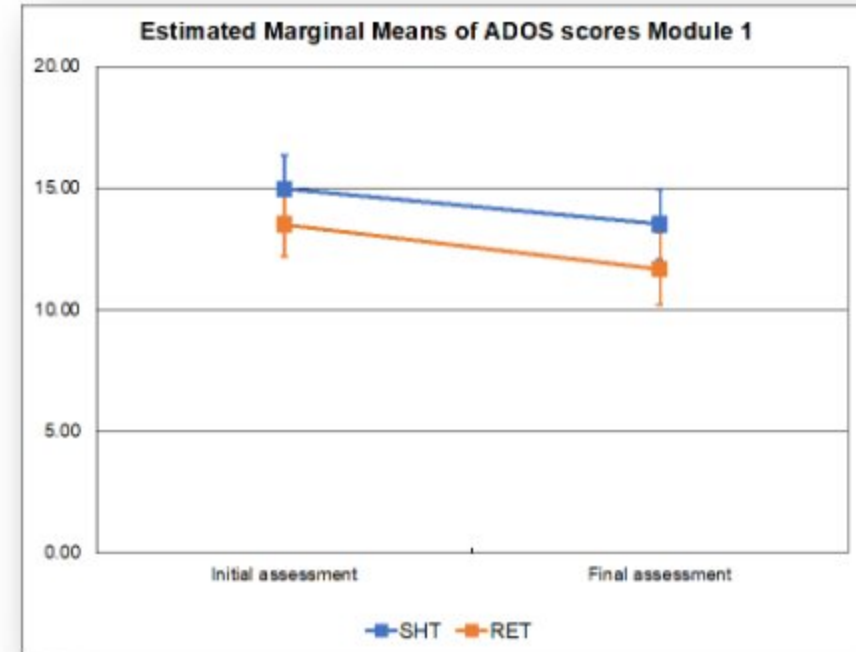


Results

Results indicate that robot therapy is equivalent to standard therapy



Social skills

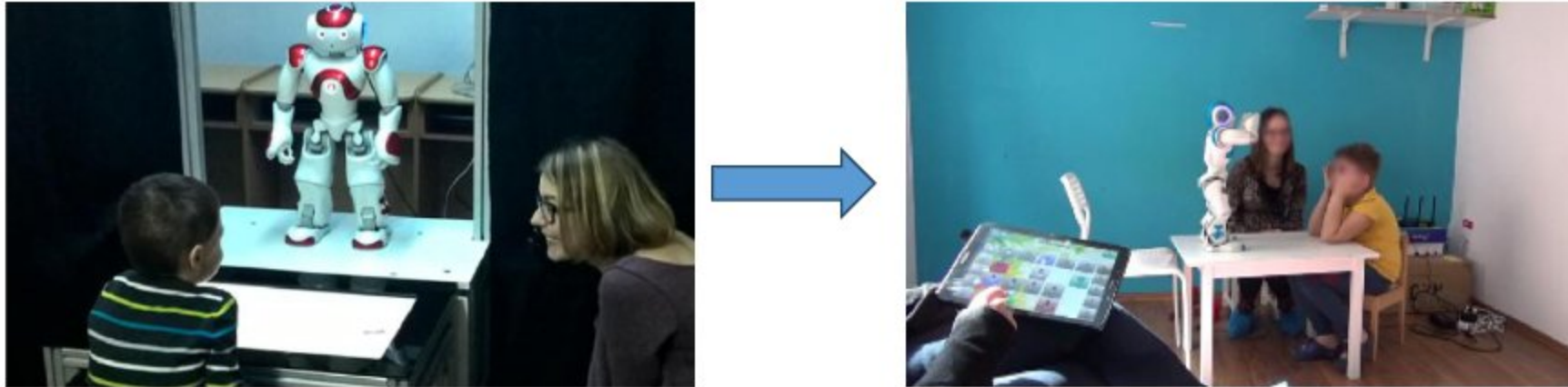


ADOS score

David, D. et al. (2024) Efficacy and Effectiveness of Robot-Assisted Therapy for Autism Spectrum Disorder: From Myth to Reality and from Lab to Life. *Under review*.

From efficacy to efficiency

- From expensive and fixed, to relatively cheap and mobile.



- N = 63 (7 female, split 31 TAU -32 RAT); mean age = 5.9 y.
- 10 special education institutions and therapy centers in Cluj-Napoca, Romania.
- Outcomes and assessments of robot equivalent to that by therapist.

Summary and final thoughts

- **Recap:** Social robots are emerging as valuable tools in autism therapy, offering unique benefits and challenges.
- **Future Outlook:** The integration of social robots holds promise for enhancing therapy outcomes for children with ASD.
- But further research, investment, and exploration in this innovative field is needed – this is **long-term research!**