Give Children Toy Robots to Educate and/or NeuroEducate: the exemple of PEKOPPA in Neurotypical and Atypical Children Aged 6 Years

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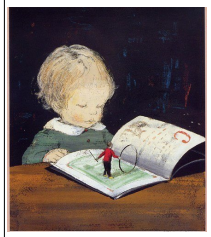
Nervous System
neural structures vs. neural activity
representations

Mind
representations

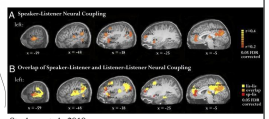
Environment
natural vs. artificial

Toys provide an interesting account of "how" physical objects are able to act as support for the symbolic play of children.



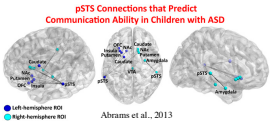
Symbolic play grows into language.
This is probably at the origin
of what is arguably one
of the trademarks of human cognition:
the capacity
to generate thoughts and concepts
for ourselves and
for the others which can be
verbally (and nonverbally) expressed
with the aim to communicate.

NeuroTypical

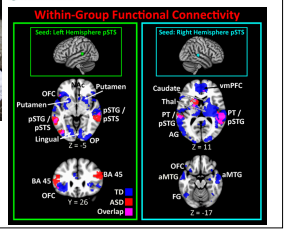


Stephens et al., 2010

Autistic



Abrams et al., 2013



Robota (interactions with a user by means of elementary conversation *Billard*, 2004)

Keepon (acquire and maintain visual contact, elementary conversation Kozima, 2007)

Tito (remote operated, upper limbs and head moving, camera in eye, vocal dictionary *Michaud*, 2002)

Roboto (animated face, mouth, eyebrows, eyes which can cause imitation *Gaussier & Nadel*, 2004)

Roball (ball shaped robot that moves automatically *Michaud & Caron* 2002)

Aurora Project (tools encouraging a child to communicate and to develop socially interactive abilities *Dautenhahn*, 2002)

Pleo (a dinosaur encouraging a child to develop socially interactive abilities *Scassellati*, 2012)

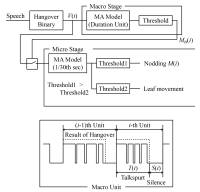
Method

neurotypical children

20 children (10 boys & 10 girls)
Mean chronological age:
6 years & 7 months
Mean developmental age:
6 years & 8 months
Without any neurological, cardiac and/or psychiatric disorders

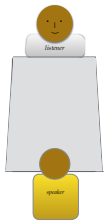
autistic children

20 children (14 boys & 6 girls)
Mean chronological age:
8 years & 10 months
Mean developmental age:
6 years & 8 months
First words at 2 years & 7 months (mean & sd);
All verbal
Diagnostic:
DSM IV, CARS-T

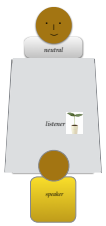


Watanabe (2011)

Robot InterActor

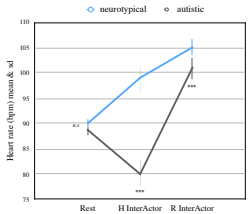


Human InterActor

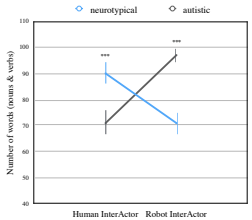


Robot InterActor

Results

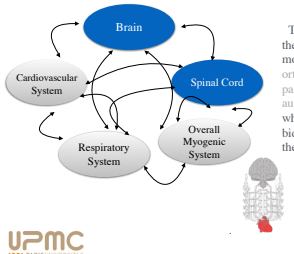


Mean heart rate activity



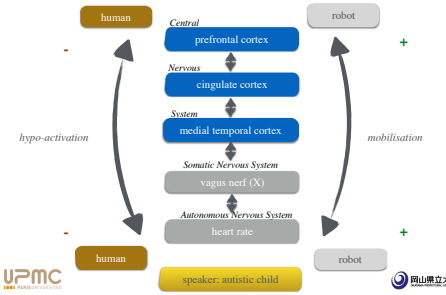
Mean number of words

Discussion



The physiological data of the study reflects the modifications of orthosympathetic and parasympathetic autonomous nervous system which is dynamically (and bidirectionally) connected to the central nervous system.

the hypothesis of mental mobilisation



Although both groups performed the task, everything happens as if the robot allowed autistic children to elaborate a multivariate equation encoding and conceptualizing within his/her brain,

and externalizing into unconscious emotion (heart rate) and conscious verbal speech (words).

Conclusion

An InterActor robot characterized by predictable behavior, better engages autistic children in multimodal verbal and emotional interaction than a human.

Toy robots, i.e., minimalist artificial environments could improve brain activity in order to support the embrainment of cognitive verbal and emotional information processing.