Robotics and neurodevelopmental disorders: a focus on motricity

Social Robotics for Neurodevelopmental Disorders
Workshop in conjunction with
the 2020 IEEE International Conference on Robotics and Automation

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Abstract

Neurodevelopmental disorders are a group of conditions characterized by the following: they are caused by an early dysfunction of the brain or/and their early occurrence impact neurodevelopment. They include autism spectrum disorder (ASD) which core symptoms are impairments in socio-communication and repetitive symptoms and stereotypies. Although not cardinal symptoms per se, motor impairments are fundamental aspects of ASD. These impairments are associated with postural and motor control disabilities and learning disability (e.g. writing). The increasing use of robots with children with ASD has increased mediatic exposure and public expectation.

In the current conference, after a brief overview of the field, I will focus on the assessment of motor activity in children with ASD through human-robot interaction. We will distinguish 3 possible applications based on collaborative research I participated. (1) Developmental robotics: from several human robot experiments and using a robot centered approach, we evidenced that motor signature at both groups’ and individuals’ levels had a key influence on robot’s imitation learning, posture recognition and identity recognition with children with ASD (Boucena et al, 2014; Boucena et al. 2016; Guedjou et al., 2017). (2) Assessment robotics: From two experiments – the first on joint attention induction by a robot, the second a dynamic motor imitation paradigm with a tightrope walker avatar (Xavier et al., 2018; Anzalone et al, 2018) – we measured that intensity of movements in children with ASD was increased at all frequencies explored (1 to 5 Hz) compared to both children with typical development and children with developmental coordination disorder. Taken together these results tend to show motor peculiarities of children with ASD. The nature of these motor peculiarities needs to be further explored. (3) Rehabilitation robotics: I will present a longitudinal single case study showing the feasibility and acceptability of implementing a robot combined with a serious game during occupational therapy sessions of a child with severe dysgraphia. After 30 sessions, the child’s motivation was completely restored; avoidance behaviors disappeared; handwriting quality, handwriting speed and posture improved dramatically.

In conclusion, robotics offers clinicians new ways to interact and work with people with NDD. Robots are promising in terms of research, although robotics is a technological domain that has reached the clinical achievement of serious games. However, given the lack of robust studies with a strong methodology do not allow evaluating the evidence based benefice of robotics in individuals with NDD. It remains mainly a research field.
References


