Introduction

- In autism spectrum disorders, an atypical sensorimotor development has been reported (Piven et al., 2007), with dexterity and gait troubles (Wyatt et Craig, 2012; Bauman, 1992). However, since these troubles have been considered as a secondary consequence of the core social communication impairment, they have not been deeply investigated.
- An optimized motor control requires the use of both an efficient feedback mode of control to correct, and an effective feedforward one to anticipate, the latter one relying on the intact build up of internal representations.
- A previous study in children with ASD evidenced an impairment of the feedforward control in a postural task (Schmitz et al., 2003).
- We hypothesized that ASD children present a preserved feedback mode of control despite an impairment of the feedforward one.

Objective: to determine the nature and the specificity of motor deficits in ASD by exploring the kinematics translating feedback and feedforward control.

Participants & Tasks

- 30 TD children from 5 to 10 years old and 7 ASD children from 9-10 years old
- Typically developing children: 5-6 y/o, 7-9 y/o, 9-10 y/o
- ASD children: 5-6 y/o, 7-9 y/o, 9-10 y/o
- Description of ASD children: positive AD or ADOS; no diagnosed developmental coordination disorder; 1 Asperger syndrome, 1 PDD-NOS, 5 HFA
- Task: reach and grasp a bottle in order to displace it to a lateral location; two visually identical opaque bottles weighting 500g (200g for the 5-6 y/o), and 50g (or 25g) were presented.
- Known weight: 15 trials with the heavy object and 15 with the light one (a pseudo-random order).
- Feedforward assessment in the reaching phase:
  - Known object: 20 pseudo-random trials with the heavy or the light bottles
  - Feedback assessment in the displacing phase

1a/ A progressive building of feedforward in TD children

- Statistical analysis:
  - Weight effects for the three groups
  - Interactions between the 5-6 y/o and the two older groups (6 parameters out of 8 for the 7-8 y/o, and 4 for the 9-10 y/o, all p < .05)

5-6 y/o

- Known object: 10 children
- Unknown object: 20 children

1b/ A failure in feedforward control in ASD children

- Statistical analysis:
  - No weight effect for the ASD group
  - Interactions with the 9-10 y/o TD children for velocity peak (SE=29.6, t=2.0, p=.099) and a trend to significance for the deceleration peak (SE=292, t=1.9, p=.057)

9-10 y/o ASD

- Known object: 7 children
- Unknown object: 13 children

2/ A preserved feedback control in ASD children

- Statistical analysis: mixed model
  - Weight effects for each group (all p < .05): latency increase and peak amplitude reduction
  - No interaction between TD and ASD

9-10 y/o TD

- Known object: 15 children
- Unknown object: 15 children

3/ A preserved weight representation in ASD children?

- Statistical analysis:
  - Interactions between weight, knowledge and group in the reaching phase for acceleration peak (SE=461, t=3.8, p=.001) and velocity peak (SE=13, t=1.1, p=.092) and in the displacing phase for acceleration peak (SE=349, t=3.6, p=.001) and deceleration latency (SE=70, t=2.1, p=.052)

9-10 y/o ASD

- Known object: 7 children
- Unknown object: 13 children

Summary and Conclusion

- TD children use a steady feedforward mode of control as early as 5, yet this control becomes efficient and adequate only at the age of 7.
- ASD children exhibit a failure in feedforward control, but a preserved online control. They were nevertheless able to take weight information into account but needed somatosensory feedback to do so (bottle in hand).
- Motor impairments in ASD might originate from a deficit in the executive part of the feedforward control, rather than a failure to build up a sensori-motor representation. Feedback is preserved.

Acknowledgements

This work was supported by the ANR Saments 015 02.

References: