Sacheli – Report on the project:

"Social grasps along development: a study on joint action in toddlers"

My visit at the Donders Institute for Brain, Cognition and Behaviour (Radboud University Nijmegen, The Netherlands), supported by a NENS Stipend for Training Stay provided by the Federation of European Neuroscience Society (FENS), was aimed to set up a joint project on the development of the ability to coordinate with others in a non-imitative fashion during social interactions.

The main purpose of this project was to extend previous findings from the host laboratory (Action and NeuroCognition group, ANC, held by Prof Harold Bekkering) on children's competence during joint actions (see for instance Meyer et al. 2010), and investigate the different contribution of action planning vs. simulation of others' movements in toddlers' ability to engage in non-imitative motor interactions with a partner (Project title: "Social grasps along development: a study on joint action in toddlers"). Working together with researchers from both the ANC and the BabyBRAIN group (held by Sabine Hunnius), I built up a new experimental set-up to study toddlers' ability not only to imitate but also to complement a partner's action. More precisely, we compared 42-month-old children's performance during two dyadic tasks, one requiring motor coordination at the movement level (Task 1, "Executive functions task") and the other requiring motor coordination in order to cooperatively achieve a complementary common goal (Task 2, "Common goal task"). Both tasks required children to perform button presses choosing between two possible options, adapting their own movements to the experimenter's ones according to different instructions which led them to perform either congruent or incongruent movements with respect to the experimenter's ones. Each button-press was associated with an outcome on the screen: a sequence of images was displayed, showing a bear "being dressed" as a consequence of the child's and experimenter's joint action (see Figure 1).

Results showed that children are equally able to perform congruent and incongruent movements during the Executive Function task as a result of fast associative learning; on the contrary, they performed better during incongruent than congruent movements in the Common goal task, when the focus is on "dressing the bear together", i.e. on a complementary goal: instructions "if I put the trousers, you put the t-shirt, and vice-versa". These results suggest that when children have to achieve a collaborative "complementary" goal with a partner, performing non-imitative actions is the most natural condition for them. Thus, results challenge the idea of a direct matching between action observation and execution during joint action (i.e. pure action-perception coupling, as during the Executive Function task), and rather suggest a hierarchical action planning during joint action, where "complementary" (i.e. incongruent) goals call for incongruent movements at the motor level.

Thanks to the NENS Stipend, I had the opportunity to stay at the Donders Institute for three months and thus have time to interact and exchange ideas with seminal experts both in the field of the development of motor cognition and research on joint-action, in the ANC and the BabyBRAIN research groups. This enabled me to acquire new perspectives on the study of social interactions. In particular, the new experimental paradigm that we developed together is apt to bring my research questions (i.e. the impact of action simulation on the ability to interact with others) to the study of development. Humans are social beings from the first days of their life, and from 18 months of age on infants' interactions with peers become more frequent and coordinated, until they achieve adult-like level of performance during late childhood. Acquiring a developmental approach to the study of joint action will allow me to characterize which processes support this development and consequently which processes might be lost in pathological conditions when motor interactions are impaired, e.g. in brain injury.

In Rome, in Prof Aglioti's lab and under the supervision of Dr Matteo Candidi, we plan to extend our findings on the neural bases of social interactions to neuropsychology in the near future (2014), focusing on how brain lesions impair the ability to interact from childhood to elderly, and on how to use social interactions to foster rehabilitation. Thus, thanks to the NENS Stipend, my training at the Donders Institute will enable me to develop new experimental paradigms adapt to children and patients. This will bring forward the findings achieved so far with my PhD project, providing my lab with new theoretical approaches and practical skills.

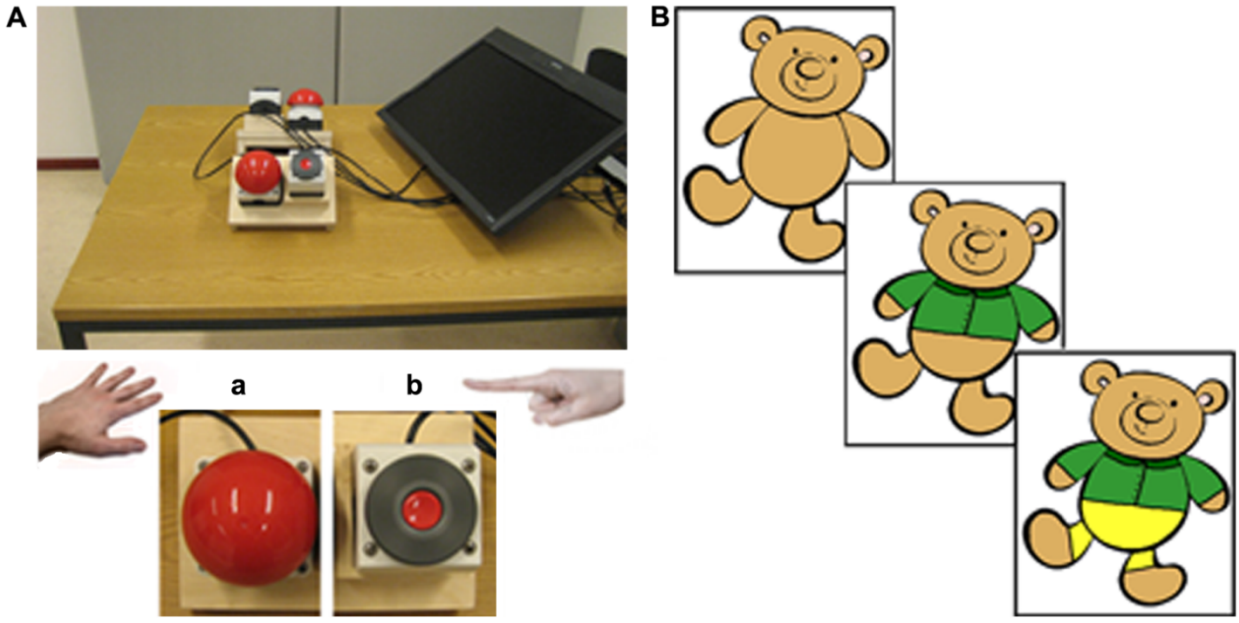

Figure 1. PANEL A. The experimental set-up. The child sits on the parent's lap in front of the experimenter who plays as interactive partner. Both the child and the experimenter have two buttons in front of them: (a) a large button requiring a whole-hand press, and (b) a small button requiring a finger press (b). The experimenter always starts the interaction and the child responds

performing congruent/incongruent movements according to task instructions. PANEL B. At each experimenter's button-press, the screen shows the bear "receiving" an article of clothing, e.g. a shirt; if the child correctly performs the response, the dressing action is complemented, e.g. the bear also receives the trousers.

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