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Discipline: Social and Behavioural Sciences

Title: Clinical testing of mentalizing functions of cerebellar patients (Note: language knowledge NL and FR for some patients)

Abstract: Although enormous progress has recently been made in understanding the importance of the cerebellum in cognition and affect, its role in social cognition remains unclear and unexplored. To elucidate its functional role in social understanding, one theoretical perspective on the general function of the cerebellum is of particular relevance. This perspective implies that the cerebellum constructs internal models of motor and cognitive processes that involve sequencing and planning of actions in order to automate and fine-tune voluntary motor processes. The predictions of these internal models are continuously checked to see whether the anticipated predictions fit with current behavior and its external and somatosensory consequences. In this sense, the cerebellum is a “forward controller”. This has enormous advantages, because this allows on-line behavior adjustments during execution (rather than adjustments after failure). During evolution, a more advanced function developed which allowed the cerebellum to construct internal models of pure mental processes in the form of event sequences, without involvement of overt movements and somatosensory responses (Ito, 2008; Leggio, et al., 2011; Pisotta & Molinari, 2014). Thus, the cerebellum regulates non-motor mental operations in much the same way as it regulates movements (Andreasen & Pierson, 2008; Bower, 1997; Schmahmann, 1998). To illustrate the role of sequences in social understanding: it makes a difference if someone invites another person to enter a room first (he is courteous) rather than cut in front of her (he is impolite); to see a leader making a decision after the group convened and reached consensus (she is democratic) rather than before (she is autocratic). At a more general level, the ability to build action sequences in a coherent story is a critical cornerstone in the evolution of humankind, involving a cultural shift that unite people into larger civilizations rooted by shared social and religious stories and myths. In this manner, stories glue together people in a united past history that forms a common faith, value and identity (Harari, 2014). With respect to social mentalizing, the main focus of this research, we put forward the novel hypothesis that the (posterior) cerebellum develops and adjusts internal models of social action sequences so that these sequences can be used to make internal predictions that allow quick and accurate understanding of non-observable mental states of other persons, including their goals, beliefs and traits.

The repercussions of cerebellar lesions on social mentalizing are investigated by comparing patients with neurodegenerative cerebellar disorders and/or with acute vascular damage to the cerebellum against healthy controls (n = ±10-15 for each group). Patients and controls will be matched on age, and other important cognitive capacities (general cognition, memory, executive function, attention, praxis, gnosis, and spatial cognition) as assessed by means of standardized neuropsychological test batteries. If possible, an fMRI study will also be conducted on this population. The activation in the distinct groups will be compared to explore their differences in terms of functional activation and connectivity.

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