Preserved functional selectivity within the parieto-frontal motor networks in congenitally blind individuals

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The dorsal stream has been classically associated with the neural computations necessary for "vision for action". Nevertheless, a recruitment of the dorsal stream has been also described in congenitally blind individuals while performing motor tasks. This finding suggests that parieto-frontal networks underling motor control might follow a similar development even in the absence of visual experience. Still, it is not clear whether the lack of visual input affects the functional selectivity of the regions within these networks. The aim of our study was to investigate similarities and differences in functional selectivity within the motor networks of congenitally blind and sighted individuals by means of fMRI.

To tackle this issue, sighted (N=15) and blind (N=8) individuals performed the same motor paradigm within the MR scanner. The task involved performing different movements with the right dominant hand. Participants were instructed to perform two specific movements, either reaching or grasping, towards one of two objects positioned in different spatial positions (left vs. right with respect to the midline). Adopting MVPA of fMRI data, we could test for the selectivity of two specific motor features, i.e. action and direction. We performed a region of interest (ROI) analysis comparing the spatial distribution of the encoding of these two motor features within the parieto-frontal motor networks of the two groups.

Our results showed a similar representation of direction and action information in the brain of sighted and congenitally blind individuals. Indeed, the type and distribution of encoding within our ROIs was similar across the two groups, supporting the idea that parieto-frontal motor networks develop similar functional properties even in the absence of vision. In addition, we showed direction encoding within V1 of blind individuals during the execution of our motor task. This finding confirms the recent proposal - stemming from fMRI investigations in sighted individuals -of a supportive role of V1 in motor control.

Overall, our data provide support for the preservation of the functional role of the neural substrates underlying motor control regardless of the sensory inputs driving their development.