

## **The Spiritual Brain: Neuropsychological and neurophysiologic investigations of Self-transcendence and Spirituality**

### **Results:**

The project aimed at characterizing the neurocognitive basis of religiousness/spirituality (RS) and its links with the bodily self. First, by using transcranial magnetic stimulation (TMS), we down-regulated neural activity of the inferior parietal (IPL) and prefrontal areas to test possible modifications of implicit RS in healthy subjects. We found that TMS of the IPL increased participants' implicit RS. Given the role of the parietal cortex in self-awareness and body schema representation, the results suggest that altered parietal activity is a neurophysiological substrate of self-transcendence. Preliminary results on 12 patients with lesion to either parietal or frontal brain regions confirmed the role of the parietal cortex in RS. The links between self-transcendence and bodily self were also investigated in 96 children. We explored how personality traits influence the development of the abilities to mentally rotate bodies and external objects. We found that mental body rotation is acquired later than mental object rotation (from 8-9 vs. 7 years of age) and that personality traits such as cooperativeness and self-transcendence importantly influence the development of these abilities. Finally, we assessed whether training in mindfulness meditation (MM) promotes congruency between implicit and explicit RS and their general increase in healthy subjects. Of note, for MM participants (vs. no MM controls), we found increased implicit RS after MM. Moreover, explicit and implicit RS were correlated, especially after MM. By using different approaches, the present project fostered our knowledge of the neurocognitive processes that allow humans to transcend the spatiotemporal constraints of the physical body increasing their RS.

### **Published works:**

#### **Full Papers:**

- Crescentini, C., Aglioti, S., Fabbro, F., & Urgesi, C. Virtual lesions of the inferior parietal cortex induce fast changes of implicit religiousness/spirituality (submitted for publication to The Journal of Neuroscience).
- Crescentini, C., Fabbro, F., & Urgesi, C. Mental transformation of objects and bodies. Different developmental trajectories in children from 7 to 11 years old (under review after minor revision by Developmental Psychology).
- Campanella, F., Crescentini, C., Urgesi, C., & Fabbro, F. Mindfulness-oriented meditation improves self-related character scales in healthy individuals (manuscript ready for submission)
- Crescentini, C., Urgesi, C., Campanella, F., & Fabbro, F. Mindfulness meditation promotes congruence between implicit and explicit spiritual self-representations (manuscript in preparation).

### **Area(s) of interest:**

Cognitive Neuroscience, Neuropsychology

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