SUPPLEMENTARY INFORMATION

SUPPLEMENTARY RESULTS

META-ANALYSES

1.Visuo-spatial functions

Meta-analytic maps (Figure 1) showed that voluntary oriented attention mainly recruited dorsal areas, such as the intraparietal sulcus/superior parietal lobule and the frontal eye field (FEF), whereas automatic captured attention extended to more ventral regions such as the middle frontal and the angular gyri. In other words, they supported that voluntary oriented and automatically captured visuo-spatial attention are partially segregated functions (Corbetta and Shulman, 2002; Thiebaut de Schotten et al., 2011), in agreement with convergent results coming from PET studies (Corbetta et al., 1993; Nobre et al., 1997), *f*MRI data (Corbetta et al., 2000; Hopfinger et al., 2000) and functional connectivity analyses (Fox et al., 2006; He et al., 2007). Notably, the nodes of the dorsal attentive network were consistently recruited during voluntary saccadic movements, as in previous simian and human reports. For instance, the microstimulation of the FEF in the simian brain affects both saccadic movements and the performance in attention-demanding tasks (Moore and Fallah, 2001), whilst functional imaging studies report a strong overlap between covert spatial attention and overt oculomotor shifts in the nodes of the dorsal network (Corbetta, 1998; Nobre et al., 2000). Mental imagery, regrouping motor imagery and mental rotation tasks, consistently activated the FEF, the mid portion of the middle frontal gyrus, the intraparietal sulcus and the superior parietal lobule, suggesting that both these tasks rely on the same fronto-parietal regions (Hanakawa et al., 2003; Lotze and Halsband, 2006; Mourao-Miranda et al., 2009; Vry et al., 2012). Specifically, it has been reported that the prefrontal cortex modulates the activation of primary areas in a content-selective manner, whereas the parietal

cortex may contribute to the generation of mental images regardless of their content, probably through the engagement of attentive resources (Mechelli et al., 2004). Ventral fronto-parietal areas appear to contribute with less consistency, contrasting with a previous report (Vry et al., 2012), probably in relation to the different tasks included.

2.Working Memory

The segregated localisation and the hemispheric lateralisation of verbal and spatial working memory is the matter of debate (Smith and Jonides, 1998; Walter et al., 2003; Owen et al., 2005). Our meta-analyses revealed that verbal and spatial working memory shared bilateral activations in the posterior middle and inferior frontal gyri, the supplementary motor area, the supramarginal and angular gyri. However, spatial working memory tasks specifically recruited more dorsal areas, such as the FEF, the anterior portion of the middle frontal gyrus and the superior parietal lobule, whereas verbal working memory engaged more ventral regions, such as Broca's territory and the inferior parietal lobule. Taken together, these findings support the existence of a "core" bilateral network engaged by working memory independently of the type of stimuli, task or contrast (Baddeley, 1986; Rottschy et al., 2012), and of a dorso-ventral gradient between areas respectively devoted to spatial or verbal working memory contents.

3.Language

Linguistic functions were clearly left-lateralised and showed a partial segregation among the areas dedicated to either phonological or semantic processing. Both functions co-activated Broca's and supplementary motor areas. Phonological processing also activated the supramarginal gyrus, whereas semantic processing specifically recruited the posterior middle frontal and the angular gyri. This is in accordance with previous reports (Vigneau et al., 2006; Price, 2012).

4.Motor functions

Motor coordination activated motor and somatosensory areas but also the supramarginal gyrus and the anterior portion of the superior parietal lobule, in agreement with a previous meta-analysis (Witt et al., 2008). The inclusion of several tasks employing the right dominant hand explains the greater consistency in the left hemisphere, whereas the use of complex finger sequences may induce the observed consistent recruitment of the posterior parietal cortex, which retrieves memorised sequences to translate them into plans of execution (Sakai et al., 1998; Shannon and Buckner, 2004). Conversely, motor inhibition tasks elicited a more extended activation of fronto-parietal regions, including the anterior and posterior portion of the middle frontal gyrus, posterior portion of the superior frontal gyrus, medial precentral gyrus and the whole parietal lobe. The general pattern of activation is in agreement with previous meta-analyses (Swick et al., 2011; Criaud and Boulinguez, 2013), whereas the global low level of consistency may be explained by the inclusion of different response inhibition tasks. Swick and colleagues (2011) have in fact reported that the widely used Go/No Go Task and the Stop Signal Task actually produce overlapping as well as different regions of activation (Swick et al., 2011). The former engages the fronto-parietal network to a greater extent than the latter, which is mainly supported by a cingulo-opercular network. The extensive activation, as well as the differences reported for these two tasks, suggests that response inhibition is a multifaceted process, whose different components are supported by dissociable neural systems (Burnett Heyes et al., 2012). Moreover, fronto-parietal activations have been associated with task complexity and argued to reflect the employment of attentive and working memory resources, instead of motor inhibition *per se* (Simmonds et al., 2008; Hampshire et al., 2010; Criaud and Boulinguez, 2013).

5.Other functions

Number manipulation more specifically activated the angular gyrus and the superior parietal lobule, extending to the supramarginal gyrus and the posterior portions of the superior,

middle and inferior frontal gyri. This fronto-parietal activation is consistent with a recent meta-analysis including 53 studies of number and calculation tasks (Arsalidou and Taylor, 2011), which found that the recruitment of the frontal lobe and the pattern of lateralisation are related to calculation complexity. Both this study and our findings support the need of adding a frontal component to the classical tripartite model proposed by Dehaene and co-workers (Dehaene et al., 2003). The level of concordance in the areas activated by decision-making tasks is low, indicating a low reproducibility across studies. However, we identified bilateral frontal areas, such as the most anterior portion of the middle frontal gyrus and the inferior frontal gyrus (extending towards the frontal pole and the orbitofrontal cortex) and the supplementary motor area, as the regions possibly hosting the core of the decision making process, in agreement with previous literature reports (Brand et al., 2006; Koechlin and Hyafil, 2007; Heekeren et al., 2008; Kouneiher et al., 2009; Summerfield and Koechlin, 2010; Rushworth et al., 2011). The supramarginal, angular and superior parietal lobule are also involved. The inferior frontal/orbitofrontal cortex, medial SFG and the supramarginal gyrus were significantly activated during emotion processing, as previously reported by studies investigating emotional face processing and affective prosody (Phan et al., 2002; Wildgruber et al., 2005; Fusar-Poli et al., 2009; Bruck et al., 2011). Bruck et al. (2011) suggested that fronto-parietal areas are recruited for the cognitive evaluation of emotional percepts occurring after the extraction and integration of acoustic and visual features (Bruck et al., 2011). Mirror neurons are considered to be very responsive to the representation of other's motor action, thoughts and emotions by the corresponding processes in oneself, and thus to be the core mechanism underlying imitation, theory of mind and empathy (Gallese and Goldman, 1998; Rizzolatti et al., 2001; Preston and de Waal, 2002). In agreement with previous studies (Rizzolatti and Arbib, 1998; Buccino et al., 2001; Buccino et al., 2004), we found that mirror neurons tasks recruited the precentral gyrus, extending in the frontal lobe to the posterior portion of the middle

and inferior frontal gyri and, in the parietal lobe, to the supplementary motor area, supramarginal and angular gyri and superior parietal lobule.

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