Individual differences in memory inhibition

Dopamine plays a major role for working memory and cognitive control in humans. Dopamine (DA) levels in the prefrontal cortex have been argued to explain about 4-11% of the behavioral variance in working memory (WM) capacity in healthy young subjects (for a review, see Savitz et al., 2006; Heinz & Smolka, 2006). In particular, the Val158Met polymorphism of the COMT gene appears to determine, at least to some degree, individual WM capacity, and carriers of the Met allele show more focal prefrontal BOLD responses during WM tasks (Egan et al., 2001). Those findings have been interpreted in terms of increased processing efficiency in high WM performers.

Retrieval-induced forgetting has been used successfully as a measure of inhibition in episodic memory (for a review, see Anderson, 2003; Bäuml, 2008), and prior fMRI investigations have demonstrated that it depends primarily on prefrontal processing resources (Wimber et al., 2008, 2009; Kuhl et al., 2007, 2008). Moreover, the degree of prefrontal activation has been shown to be closely related to individual inhibitory performance, with „low inhibitors“ recruiting more prefrontal resources than „high inhibitors“ (Wimber et al., 2009).

The present study aims at expanding the findings from the WM literature to inhibitory processing in long-term memory. The experiment involves scanning 60 subjects genotyped for the COMT Val 158 Met polymorphism (20 Val/Val, 20 Val/Met, 20 Met/Met), comparing an active retrieval practice condition (involving inhibition) with a more passive rehearsal condition (not involving inhibition). We hypothesize that, paralleling prior findings in the WM domain, Met carriers are more efficient at inhibiting irrelevant memories. Moreover, we expect this higher performance to be associated with a more focal, „efficient“ prefrontal pattern of BOLD activity. The study would thus be the first to directly relate individual differences in memory inhibition to prefrontal dopaminergic functioning.