Inhibition task for functional MRI

The stop-signal anticipation task (B. Zandbelt & Vink, 2010) for functional MRI aims to measure performance and brain activation during actual stopping as well as during the anticipation of stopping.

The Task

In this task which is based on work by Zandbelt & Vink (B. Zandbelt & Vink, 2010), subjects are presented with three horizontal lines displayed one above the other. On each trial, a bar moves at a constant speed from the lower line towards the upper line, reaching the middle line in 800 ms. The main task is to stop the bar as close to the middle line as possible, by pressing a button with the right thumb (i.e. Go trial). Stop trials are identical to Go trials, except that the bar stops moving automatically before reaching the middle line, indicating that a response has to be suppressed (i.e. stop-signal). The probability that such a stop-signal will appear is manipulated across trials and can be anticipated based on a symbol at the beginning of each trial; '0' indicating 0% chance, '*' 22 percent and '**' 33 percent chance the bar will stop on its own.

The SSAT is used to measure three distinct processes, being [a] basic response execution, [b] reactive inhibition, and [c] proactive inhibitory control. Basic response execution can be examined by investigating reaction time variability of Go responses in baseline Go trials with a 0% stop-signal probability. As has been shown before, development is characterized by a decrease in reaction times variability. In the brain, activation in the primary motor cortex is taken as an indicator of basic response execution. Reactive inhibition can be examined by measuring the latency of inhibition ([stop-signal reaction time (SSRT)]. Accuracy of inhibition will not be taken into account, as task difficulty is manipulated during the task to ensure an 50% accuracy level on stop trials. In the brain, reactive inhibition measures are operationalized by contrasting brain activation during successful inhibition versus unsuccessful inhibition and successful inhibition versus baseline responding in the frontostriatal network and motor cortex. Proactive inhibitory control can be examined by measuring the effect of stop-signal probability on reaction times. We and others have repeatedly shown that subjects slow down responding as stop-signal probability increases (Vink, Kaldewaij, Zandbelt, Pas, & du Plessis, 2015; B. B. Zandbelt, Bloemendaal, Neggers, Kahn, & Vink, 2013). In the brain, proactive inhibition can be operationalized by an increase in both activation as well as connectivity in the frontostriatal network (Vink et al., 2014).

The scan sequence: SENSE coil; parallel imaging, sensefactor 1.8; T2* weighted scan; Timeseries 595 scans, single scan duration 1 sec; Scanorientation sagittal; 64x64 acquisition matrix; 51 slices; multiband factor 3; FOV = 220 mm; 2.5 mm isotropic voxels; TR/TE 1000/25.

References:

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