Humans are able to learn and select responses to sensory inputs according to arbitrary rules.

This study investigates the changes in BOLD response occurring with practice of a stimulus-response mapping.

Our specific interest is in investigating learning-related changes in the motor cortex, SMA, basal ganglia and parietal cortex.

We used a simple stimulus response selection task a group of volunteers practised over eight days. BOLD signal was measured at the beginning and end of this practice period.

EXPERIMENT

13 subjects (7 female), right-handed, aged 18-18 years

Stimulus response selection task
4 stimuli, 4 responses, each shape mapped onto a button press with one finger

Practice
6 days, 25 min. session, total trials: 3480 (4 x 870)

Design
M1 - highly practised mapping, M2 - less practised mapping

WHOLE BRAIN ANALYSIS

BOLD response to button presses

Right hand

We observe reliable activation in the contra-lateral motor cortex and basal ganglia, as well as ipsilateral cerebellum.

Day 1 (reversed - practised) - day 1 (reversed - practised)

right pre-motor cortex

x=62  
y=2  
z=30

bilateral parietal cortex

Greater activation can be seen in the pre-motor and parietal cortex on day 8 (compared to day 1) for the unpractised mapping (compared to the practised mapping).

ROI DEFINITION

Region of Interest Analysis
Using SPM Marsbar toolbox

SMA-proper, pre-SMA based on Picard and Strick

Basal ganglia putamen, globus pallidus

Traced on MNI template

Motor cortex - hand knob area

Based on Young et al.: Joda 32, 32, 32, 5 mm sphere

REFERENCES


2. Young, P. et al. (2001). Joda 32. 32, 32, 5 mm sphere


CONCLUSIONS

There was a general reduction of activation in the motor system with practice.

After practice, the basal ganglia and SMA deactivate for the reversed mapping, but the parietal cortexreactives.

We suggest that the basal ganglia and SMA may be encoding the learned stimulus response mapping, so that they must be deactivated in order to perform the reversal.

The parietal cortex may be responsible for performance when the S-R mapping is novel or a strong prepotent S-R mapping is competing with the current task.

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