Task-Set Specific Preparation Prohibits the Expression of Repetition Benefits in Task Switching

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Task Switching: Top-Down or Bottom-Up?

The research on task switching has gained a lot of attention in cognitive psychology in the last decade. The phenomenon observed is the so-called switch cost, which is the decline in performance after a task switch, with the base-line performance being measured on task repetition trials.

Generally speaking, the theoretical interpretations for switch costs can be divided in two groups: top-down and bottom-up interpretations. One of the most prominent top-down interpretations is the reconfiguration theory proposed by Rogers and Monsell (1995), and one of the most recent bottom-up interpretations is the activation theory proposed by Altmann (2004). The reconfiguration approach assumes a functional switching process, with switch costs as an index of this process, while the activation approach assumes a more distributed, general activation of a task representation in memory, with switch cost as a side effect.

The aim of this study was to test the validity of predictions the reconfiguration and the activation theory make about task switching.

Methods and Results

In 2 experiments, the preparation interval duration and the preparation interval type (self-paced vs. externally paced) were manipulated. These manipulations occurred within subjects in Experiment 1 (900 and 200 ms) and between subjects in Experiment 2 (self-paced, 900, 600, 300 and 200 ms). Color and form matching tasks were presented repeatedly in switch and no-switch blocks of 8 trials each. A written cue specified the nature of the upcoming task. The cue appeared at the beginning of a task block and disappeared as soon as a preparation interval was over. No switching between the two tasks occurred within the blocks.

The results showed switch costs, restart costs, and generic performance improvement for longer preparation intervals. A task-switch specific preparation effect (reduction of switch costs with longer preparation intervals) was only observed in Experiment 1.

Conclusions

The data of this study can just partially be explained by the two approaches. On the one hand, our results showed that task-switch specific preparation effect is design dependent. This contradicts the assumption of reconfiguration theory for this effect being robust. On the other hand, the self-paced condition showed switch costs but no restart costs. This observation is at odds with the activation theory, which assumes that the basic processes involved in switch and repeat trials are qualitatively the same.

Therefore, we propose an alternative model of task switching (see Figure 1). The model focuses on processes taking place around the preparation interval, which starts with a cue and lasts until the first imperative stimulus. Generic preparation is the main part of this model, which activates the system if no task switch is required and inhibits this generic activation if a task switch is required. The generic activation compensates for costs accompanied with rule reactivation if the preparation period is sufficiently long. The generic inhibition reduces the chance of making errors but cannot compensate for rule activation costs. Therefore, irrespective of the preparation interval duration, the costs of rule activation become apparent if a task switches.

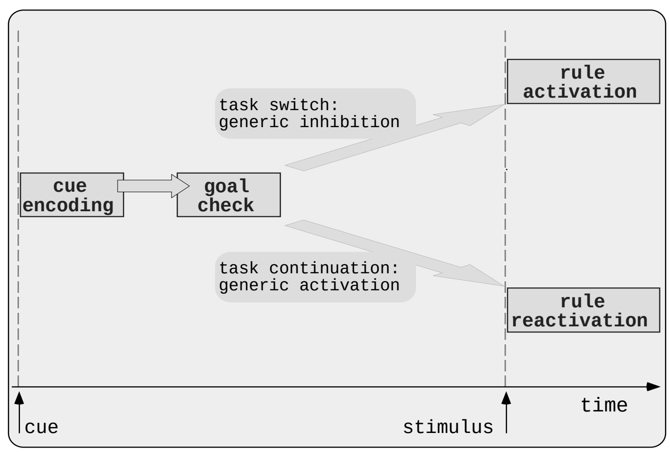

Figure 1: An alternative model of task switching, with generic preparation (activation for task continuation or inhibition for task switch) as its main part.

References

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