Cue Onset Asynchrony in Task Switching

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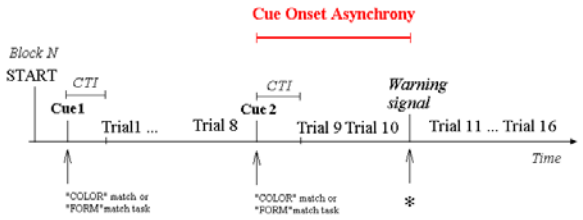
The Overlapping Cues Paradigm (OCP) and Cue Onset Asynchrony (COA) are introduced as an experimental tool to investigate the dynamics of control mechanisms involved in task switching in a situation with "competition" between two concurrent task goals. We report three experiments focusing on the questions (1) what are the consequences for task performance when two sequentially implemented and overlapping goals are in "conflict"? (2) In such overlapping goal situations, what are the consequences of differences in time pressure (externally paced Cue Target Interval)? (3) How are task switch costs affected by stimulus driven factors (Convergent vs. Divergent trials)?

Experimental paradigm

In the experiments there were two tasks, detection of a form-match or a color-match between a colored geometric figure functioning as a reference and an array of four figures. Which of the two tasks the participant had to perform was indicated by corresponding cues, either the word "Form" or the word "Color" (see figure). Two cues, separated by 8 trials, were presented within each block of 16 trials in two possible combinations: non-conflict (Cue1=Cue2) or conflict (Cue1≠Cue2). Two trials after Cue2, a star was presented as warning signal, which forced a task switch in the conflict condition, but not in the non-conflict condition. The Cue Onset Asynchrony refers to the distance between Cue2 and the Warning-signal.



Manipulated factors

Within the experiments we manipulated the following factors: 1. Task type with levels "Color" match and "Form" match; 2. Cue type with levels non-conflict (Cue1=Cue2) and conflict (Cue1≠Cue2); 3. Stimulus convergency with levels Convergent stimuli (the two different tasks require the same response) and Divergent stimuli (the two tasks require different responses); 4. Cue Target Interval duration (CTI): self-paced (Experiment1); 200ms (Experiment 2) and 900ms (Experiment 3).

Results and discussion

The results show (1) Slower performance for the conflict than for the non-conflict condition on trial 9 (after Cue2) and on trial 11(after warning signal) associated with **top-down control** during COA in order to suppress a conflict if Cue1≠Cue2; (2) For non-conflict condition and self-paced CTI, better performance on trial 9 than on trial 8, and on trial 11 than on trial 10: elimination of restart costs presumably based on **forward facilitation;** (3) On trial 9, faster and more accurate performance for convergent than for divergent condition, because of stimulus driven, **bottom-up control.** And a consequence: On trial 10 better performance if trial 9 was divergent rather than convergent, presumably associated with **backward inhibition;** (4) Different patterns of performance for self-paced and externally paced CTI, associated with different control strategies for the conflict and the non-conflict condition for different CTI.

Issues for further research

These findings reconcile some opposite previous views regarding control mechanisms in task switching and provide a perspective for new investigations on executive control. In the next step we intend to implement two main modifications: a spatiotemporal manipulation of COA, concerning the variation of the relative position at which Cue2 and Warning signal are presented, and second, a spatiotemporal manipulation of Convergency, concerning the variation of the relative position at which Convergent stimuli are presented.

References

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