How does preparation in task switching affect subsequent memory performance?

Cognitive control refers to a wide range of cognitive processes which bias information processing and behaviours in an adaptive, goal oriented manner. A typical method to investigate cognitive control is the **task switching** paradigm, where task switches can be either **predictable or random**.

Richter and Yeung (2012; 2015) used the cued task switching paradigm to show that switching between two tasks reduces memory selectivity. They investigated the influence of top down cognitive control on memory by manipulating the duration of the cue-stimulus-interval.

The goal of the present study was to further investigate the consequences of top down cognitive control on memory by varying the degree to which task switches were predictable. Preparation was operationalized by long vs. short inter trial intervals and by using either a predicable AABB task sequence or a cued task switching procedure. We expected that a predictable task switch will reduce cognitive conflict if enough preparation time is given and that this reduced conflict will enhance memory selectivity. Thus, this study contributes to revealing the gradual nature of top-down control on subsequent memory performance.

Method

Design

2x2x2x2 mixed design with the within-subjects variable **Task Switching** (*repeat* vs. *switch*) and three between-subjects variables:
Predictability (*predictable* vs. *unpredictable*),
Preparation Time (*long* vs. *short*) and
Stimulus Presentation (*until response* vs. *limited*)

N **=** 320 (100 men; *age* = 23, *SD* = 5)

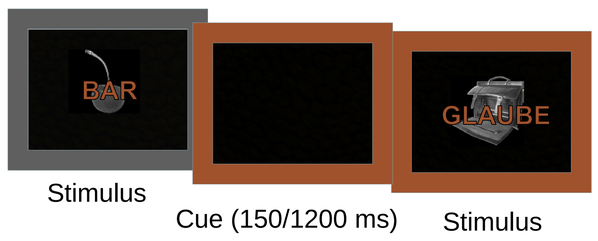
Material and Task

192 picture-word pairs appeared in a predictable AABB task order or task switches were cued with a colored frame. Participants switched between two classification tasks.
Object classification: The picture had to be classified as natural (key ‘n’) or man-made (key ‘m’).
Word classification: The word had to be classified as abstract (key ‘x’) or concrete (key ‘c’).

Procedure

Study phase

Unpredictable task switches in the Cued Task Switching paradigm

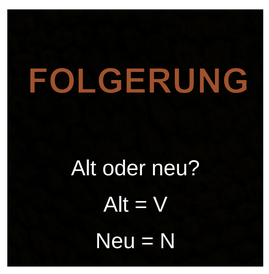


Predictable task switches in the Alternating Runs Paradigm

Trial examples represent task switches for the condition *Stimulus presentation until response.*

Test phase

1. Testblock: Words



2. Testblock: Pictures

After the study phase a surprise **recognition memory test** was administered.

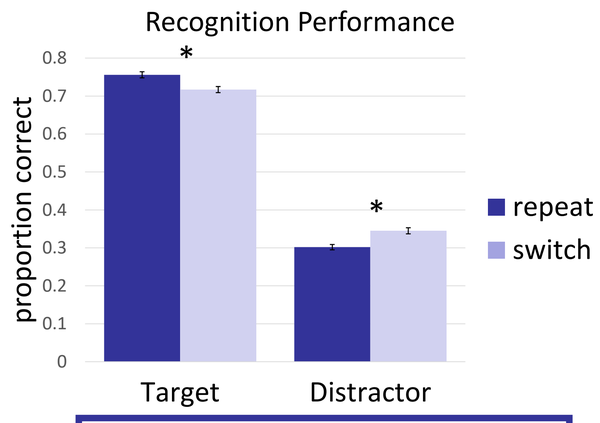
96 previously seen pictures and words were intermixed with **48 new stimuli**. Participants had to classify the items as old (key ‘v’) or new (key ‘n’).

Results

Task switching performance

As expected, robust **switch costs** emerged in **all conditions.**

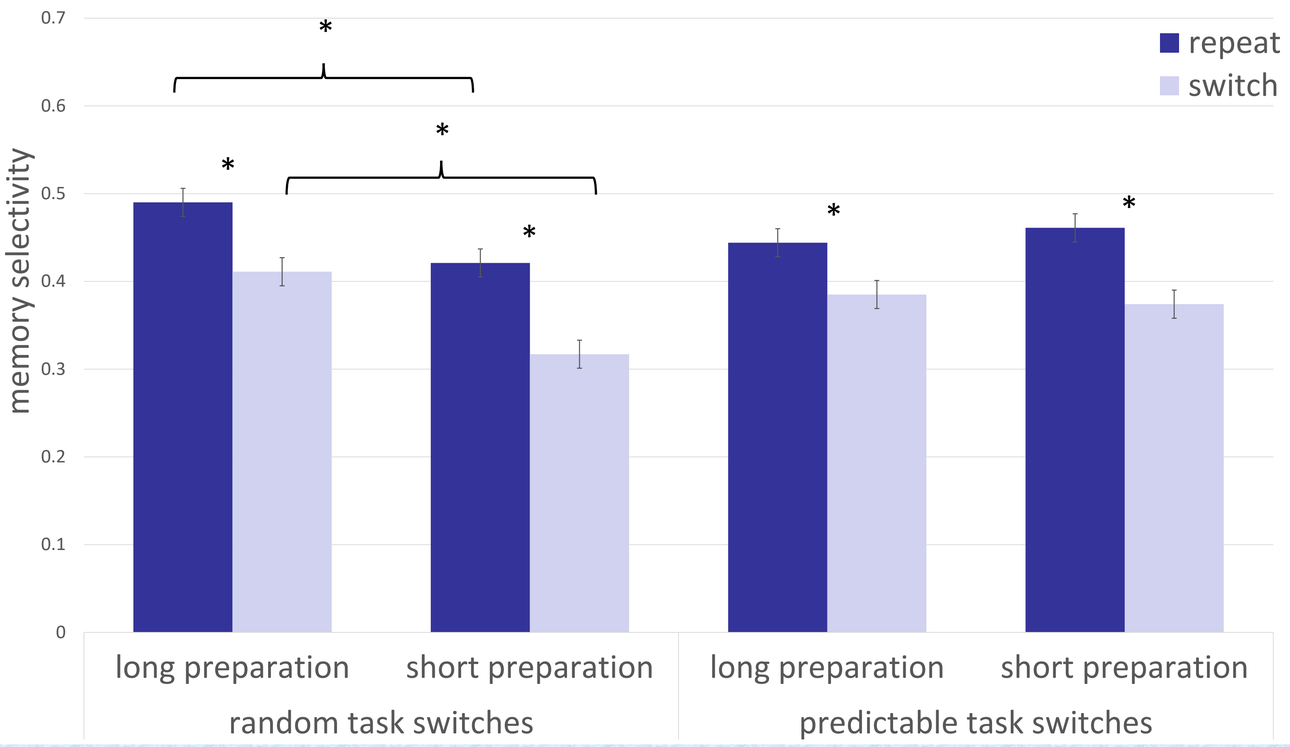
Recognition performance



Targets (stimuli that were classified during task switching) were reliably better recognized than distractors, $p < .001$. This effect interacted with task switching, $p < .001$. Targets were better recognized if they appeared in a repeat trial, $p < .001$, whereas distractors were better recognized if they appeared in a switch trial, $p < .001$.
The difference between targets and distractors represents **memory selectivity**. The higher the memory selectivity score, the more targets over distractors were recognized.

Main effects:
Task switching, $p < .001$
Predictability n.s., $p = .64$
Preparation Time, $p = .004$
Stimulus Presentation, $p < .001$

Interactions:
Task Switching x Stimulus presentation, $p = .003$
Predictability x Preparation Time, $p = .004$
Other interactions were n.s.



Summary and Conclusion

(1) The finding of higher memory selectivity for repeat trials replicates previous studies (Richter & Yeung, 2012; 2015).
(2) Longer preparation increased memory selectivity after cued task switching (i.e., random order). In contrast, preparation time had no effect on memory selectivity after predictable task switching (i.e., AABB order).
(3) Thus, the degree of top-down control at encoding affects long-term memory selectivity.
(4) The study highlights the importance of establishing an appropriate cognitive set for effective learning.

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Richter, F. R. & Yeung, N. (2012). Memory and cognitive control in task switching. *Psychological Science*, *23*(19).
Richter, F. R. & Yeung, N. (2015). Corresponding influences of top-down control on task switching and long-term memory. *The Quarterly Journal of Experimental Psychology, 68, 1124-1147.*