Binding of task-irrelevant contextual features in task switching: Results and perspectives

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Binding Effects in Task Switching: Is Context Bound?

Task switching (i.e., multitasking) performance is affected by features binding and episodic retrieval (Allport and Wylie, 2000; Waszak et al., 2003; Koch & Allport 2006).

The response repetition effect. In task switching, response repetition benefits emerge in task repetitions but *costs* in task switches → Evidence for response inhibition. However, also binding & retrieval processes could account for it, if task-response binding is assumed.

N-2 task repetition costs. Repeating the n-2 task is slower than switching it → Taken as evidence for task-set inhibition (Backward Inhibition).

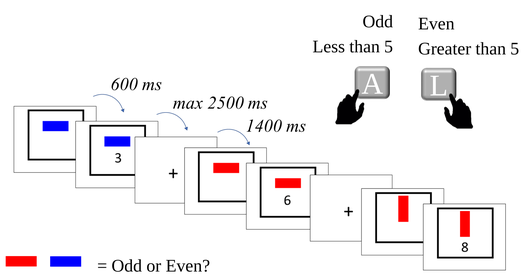
Binding & retrieval could account for it, since if response repeats from n-2 to n, smaller Backward Inhibition (Grange et al., 2017).

Do binding & retrieval processes involve also task-irrelevant (i.e., context) features? Investigating context binding (i) provides indirect evidence for binding of task-relevant features too, and (ii) sheds light on binding processes: does task-relevance affect binding likelihood?

Context Binding Effects From Trial N-1 to N

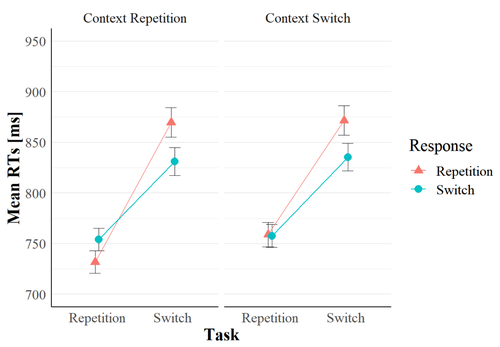
In previous studies (Benini et al., 2022, *QJEP*), we showed that repeating the context increased response repetition benefits in task repetitions (full repetition benefits) → Context is bound and can retrieve the n-1 episode when it repeats.

- Context was the irrelevant cue colour
- Context modulated the task-response interaction



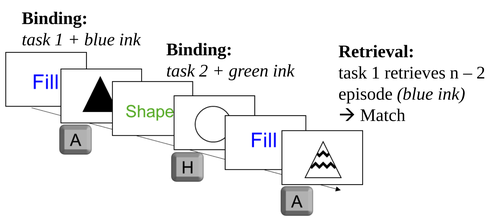
= Odd or Even?

= Greater or Less than 5?

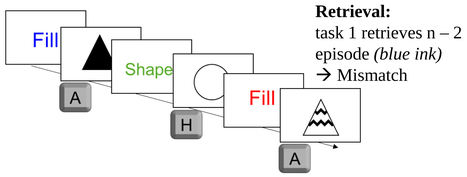


Context Binding Effects From Trial N-2 to N

If context is bound with the task and the response, repeating the context from n-2 to n retrieves the n-2 task. If the task also repeats, the match of trial n with trial n-2 compensates the Backward Inhibition.



If the context switches from n-2 to n, the repeating task retrieves a different context. This mismatch exacerbates the Backward Inhibition.



Objectives and Open Issues

Examine n-2 task repetition costs as a function of response repetition from n-2 to n & context repetition from n-2 to n.

- Is the context retrieving the task or vice versa?
- When the task switches from n-2 to n, will repeating the context create costs compared to switching the context?
- Does finding effects from trial n-2 to n suggests retrieval as opposed to priming?

Take Home Message

- Collected evidence that the context is bound with the task and the response. This is shown by the presence of full repetition benefits = partial repetition costs (but not full switch costs).

→ Future experiments will explore partial repetition costs, but from n-2 to n.

- Full repetition benefits only found with an early context onset (either with the cue or before the target when there is no cue). Is context-triggered retrieval a slow process that needs time to unfold?

→ In future experiments, we will manipulate context onset keeping constant context presentation duration. No effect of a late versus early onset are expected if retrieval is slow; they are expected if context acts as a segmentation factor or if context needs a time advantage on task-relevant features to be processed.

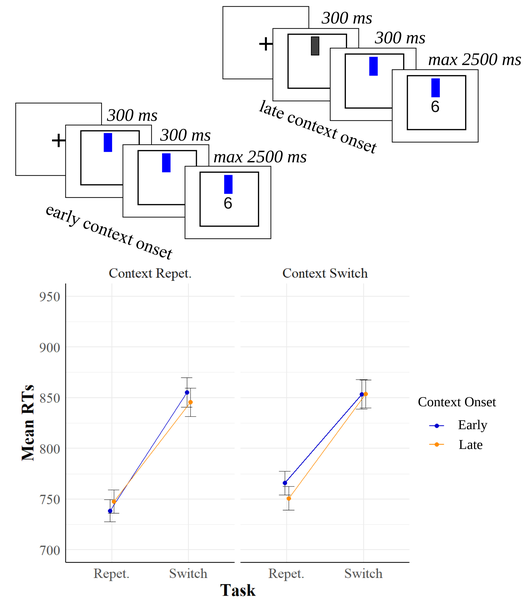
Context Binding Effects With an Early Context Only

Across different studies, we manipulated the onset of the context compared to the cue or target, and we consistently found effects of context repetitions only with an early-onset context and not with a late-onset context. We hypothesize that the possible mechanisms are:

i. context-triggered retrieval is a slow process that needs time to unfold;
ii. an early context gets an advantage on the other features to win the race of attention (Moeller & Frings, 2012);
iii. an early context that repeats establishes continuity of the episode from the previous trial into the current trial, thus facilitating task and response repetitions. An early context that switches segments (Zacks & Swallow, 2007) the current episode from the previous one, stopping the maintainance of the n-1 task and response.

Context Together With Versus Later Than the Cue

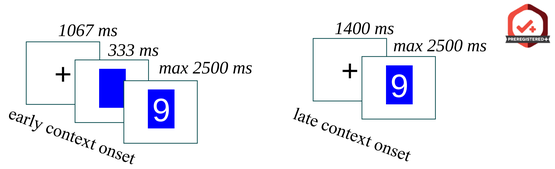
In half of the blocks of Exp. 1 in Benini et al., 2022, *QJEP*, we introduced a late context which appears 300 ms after the cue. Repeating the context increased task repetition benefits, but only in the early-onset context blocks.



Context Before Versus Together With the Target

With univalent stimuli and no cue, context was operationalized as a coloured box behind the target (Benini et al., in prep.).

- **Only the early-onset context** modulated the task by response interaction.
- Previous context binding effects are not due to the context being a feature of the cue → Context is bound also when is an irrelevant object.



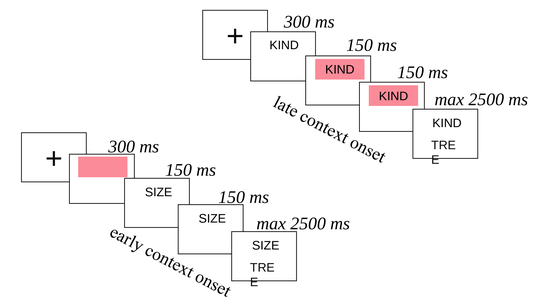
Context needs to appear early enough, as the first stimulus of a trial:

- when the cue is present, context must appear with the cue (together with the first task-relevant stimulus).
- when there is no cue, context must appear before the target (*before* the first task-relevant stimulus).

Disentangle Retrieval Duration From Early-Onset Advantage

Manipulate context onset keeping **presentation duration constant** (300 ms). We will use various context onset values, from -300 ms to +300 ms.

If mechanism (i), no difference in binding effects at any SOA; if (ii) or (iii), larger binding effects with negative SOA.



Objectives and Open Issues

Examine the effect of an early versus late context onset without confounding onset with total presentation duration.

- It seems that the context must usher in the next trial to have an effect. Ruling out presentation duration would strengthen this hypothesis.
- What accounts could accommodate the finding that only an early context yields binding effects?

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