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Is attentional capture by a color singleton modulated by visuo-motor associations?

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CONTEXT

Attentional capture = salient items are automatically prioritized in a visual search task.

- **Past relevance** of a distractor modulates its effect on visual search:
  - **Reward** - A color previously associated to a reward will increase reaction times according to its previous value (*Anderson et al., 2011*)
  - **Selection history** – Without any reward association, results are controversial (*Sha & Jiang, 2016; Anderson & Halpern, 2017*)
- **Previous actions** on a stimulus modulates its salience :
  - **Action effect** – Acting upon a stimulus makes its detection faster in a subsequent task *(Buttaccio & Hahn, 2011; Wang et al., 2017; Wang et al., 2021)*
- **Unexpected events** capture attention and trigger global **motor inhibition** (*Wessel & Aron, 2017; Tatz et al., 2021*)

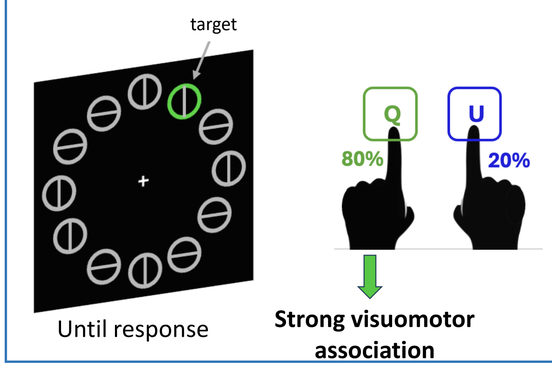
HYPOTHESES

- ❑ Visuomotor associations generate an activation of the task-irrelevant previously associated effector
- ❑ Selection history and visuomotor associations increase attentional capture
- ❑ A salient singleton generates (global) action inhibition

METHODS

1. TRAINING 800 trials

Task = respond to target color

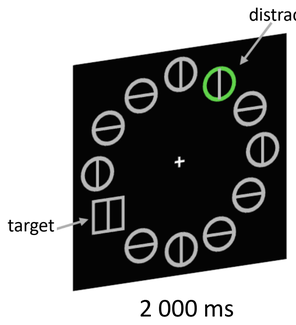


Until response

Strong visuomotor association

2. TESTING 720 trials

Task = respond to the orientation (horizontal or vertical) of the line in the target



2 000 ms

spTMS (rM1)
MEPs on left FDI + ADM

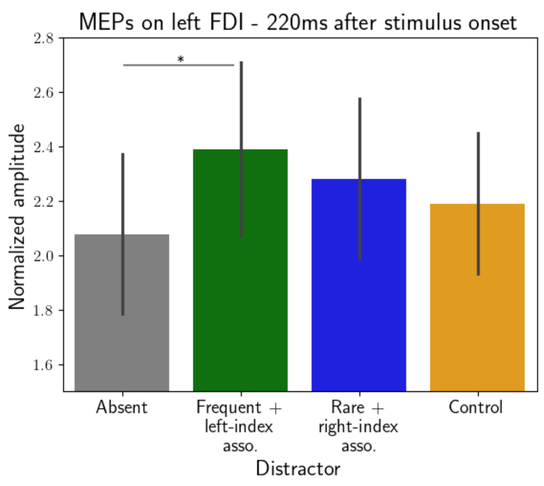
3 timepoints:
150 – 220 – 300 ms

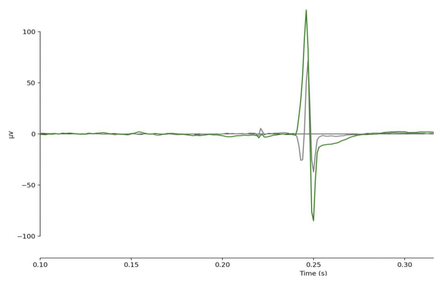
Different distractors (20% of trials each):
- Green (left-index finger association + frequently selected in training)
- Blue (right-index association + rarely selected during training)
- Orange (never responded to + never seen)

24 right-handed participants

RESULTS

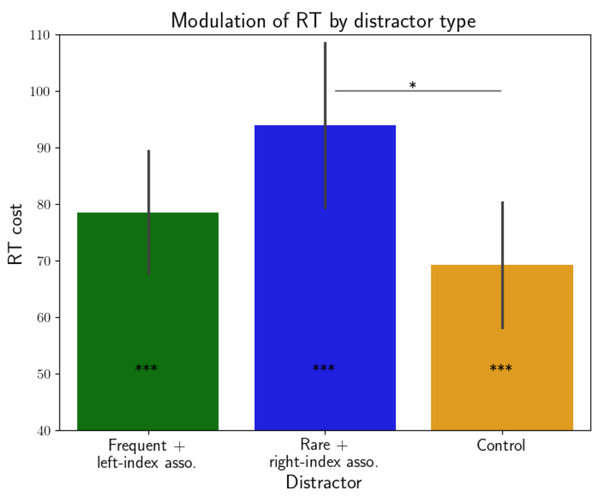
Automatic activation of distractor-associated effector





- **Decreased MEPs (FDI, not ADM) in presence of the control distractor**, **150** ms after stimulus onset.
- **Increased MEPs in presence of the green distractor** (frequently selected and responded to with the left index finger during training), **220** ms after stimulus onset.

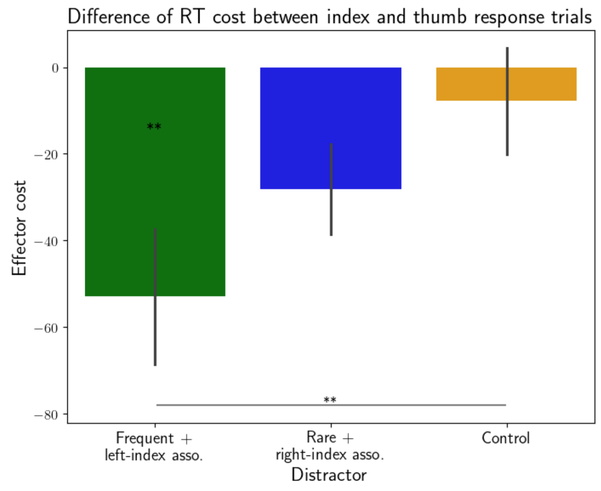
Attentional capture by different distractors



RT cost = RT in a given condition – RT in no-distractor condition

- **All distractors slow down responses compared to no distractor condition.**
- **No difference in RT cost between green distractor** (frequently selected and responded to with the left index finger during training) **and control distractor**
- **Increased RT cost for the blue distractor** (rarely selected and responded to with the right index finger during training)

Effector-specific RT cost with different distractors



Negative value indicates that RT cost was stronger in trials with index response than in trials with thumb response.

- **Additionnal RT cost** when response is given **with the right index finger**, specifically in presence of the **green distractor** (frequently selected and responded to with the left index finger during training).

- ✓ Salient and new singleton generate action inhibition, 150 ms after stimulus onset.
- ✓ Visuomotor associations generate an activation of the task-irrelevant previously associated effector 220 ms after stimulus onset.
- X Visuomotor associations do not increase attentional capture (at least with this paradigm).
- ? The rarely selected color during training captures attention more than the control color.

DISCUSSION

○ Selective inhibition instead of global → could be context-dependent, here it is irrelevant to suppress all actions (usually studied in Stop-signal tasks)

○ Dissociation of motor and attentional effects: previous visuomotor associations affect motor performance without significantly enhancing (green) distractor's saliency

○ Enhanced attentional cost for previously rare target (blue): effector re-use between training and testing inducing motor conflict or condition difficulty effect ?

➔Selection history is a very complex construct *(Anderson, 2024)*

➔Visuomotor associations are long lasting and are triggered even if the stimulus is not relevant anymore, affecting performance without increasing distractor's saliency

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