Within-trial Task Switching, Can People Prepare for Probabilistic Switch ?

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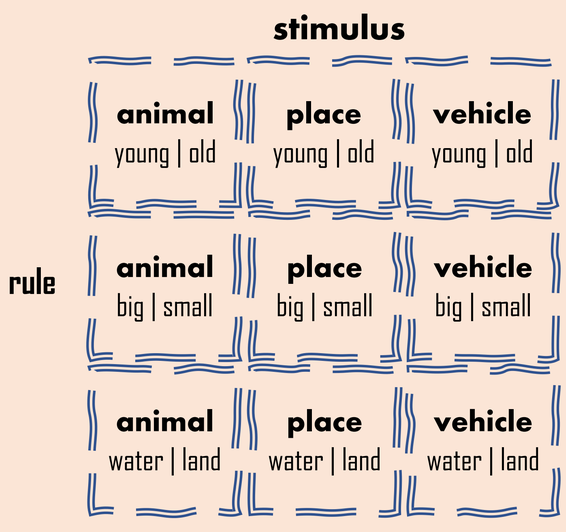
Background:

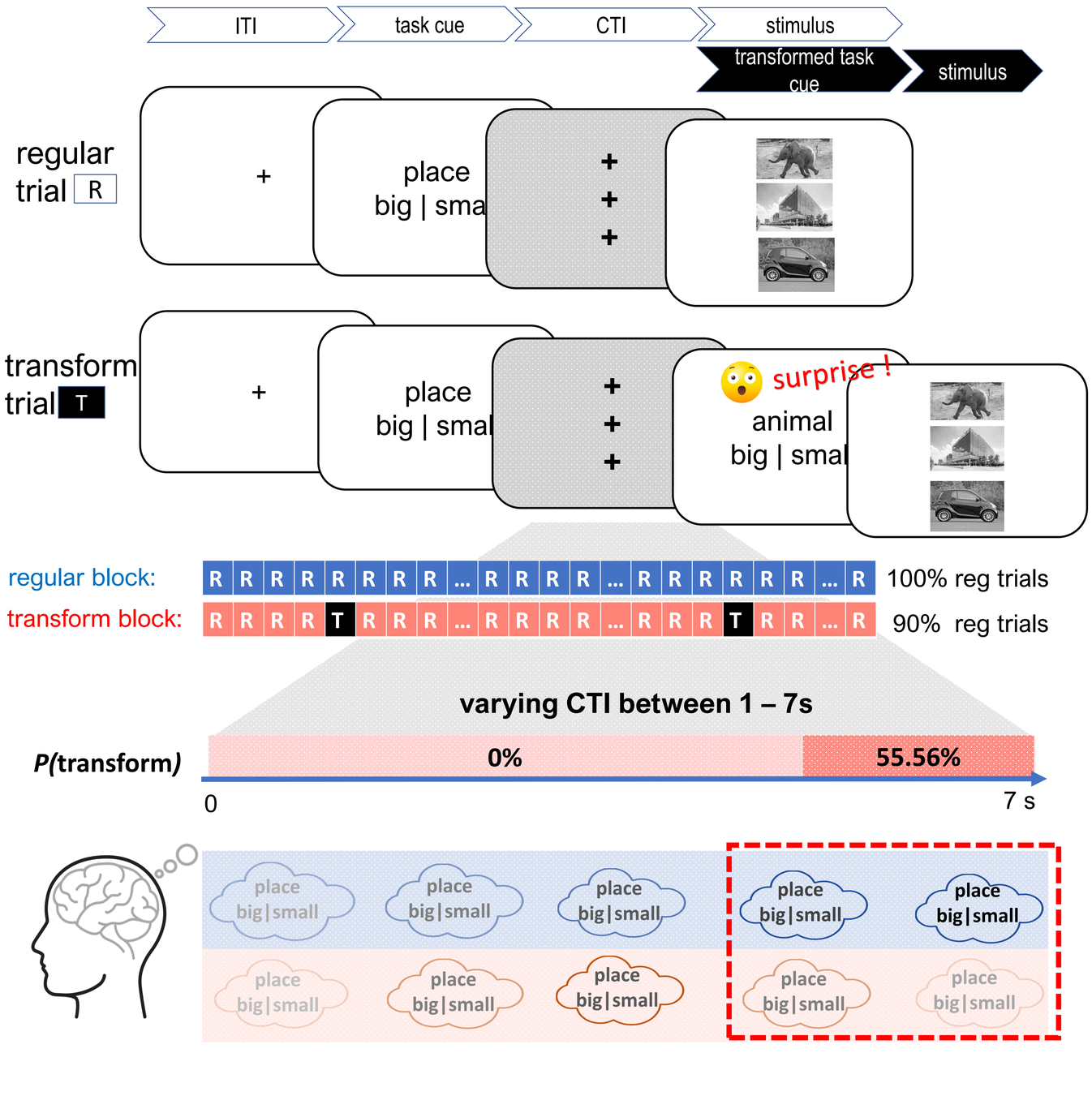
- A key element of human behaviour concerns the ability to predict and prepare for sudden changes in tasks or actions.
- Previous research showed that both human[1] and animals[2] are able to learn and exploit the time-based contingencies of either incoming task or reward delivery.
- However, it remains elusive whether and how humans can prepare for switching to another task, before knowing which task to switch to.
- Here, we test whether human can dynamically update their belief states, and regulate task set representations accordingly, when expecting novel task information.

Task transform paradigm: image categorization

- 9 different tasks were created by factorially combining 2 task dimensions: **stimulus** and **rule** .
- For each trial, participants need to perform a image categorization task according to the preceding task cue.



Task transform paradigm: main manipulations



Experiments and analysis:

Exp 1: task transform

Exp2 : **rule** transform

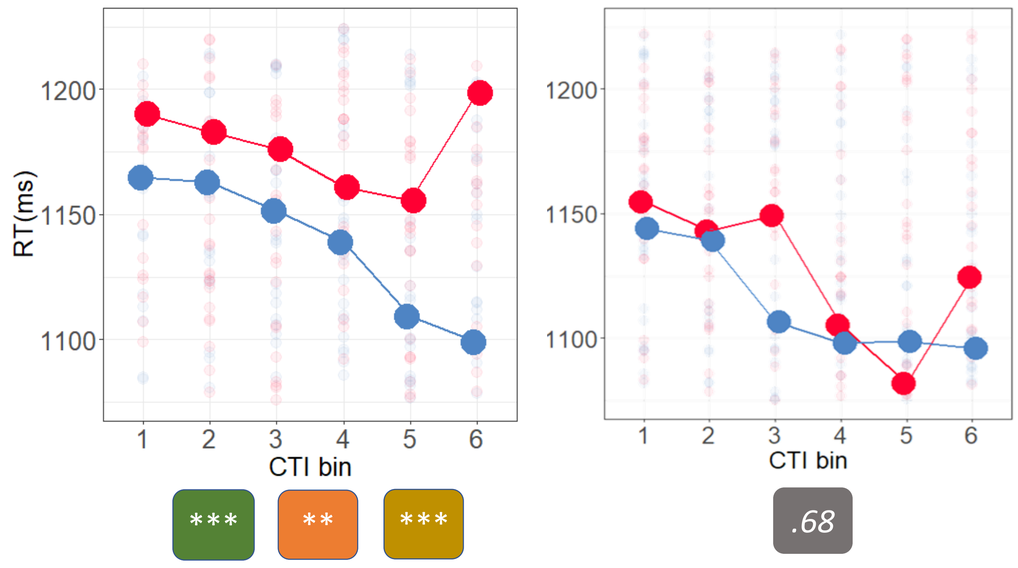
Exp 3: **stimulus** transform

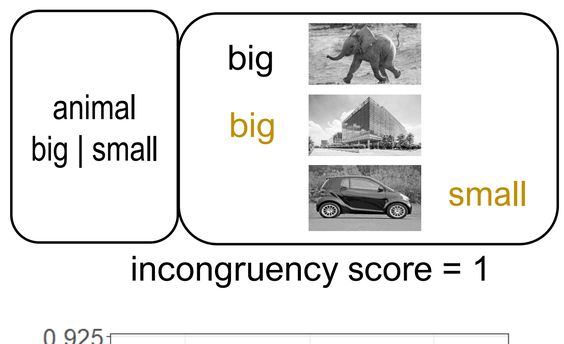
control Exp: task omission

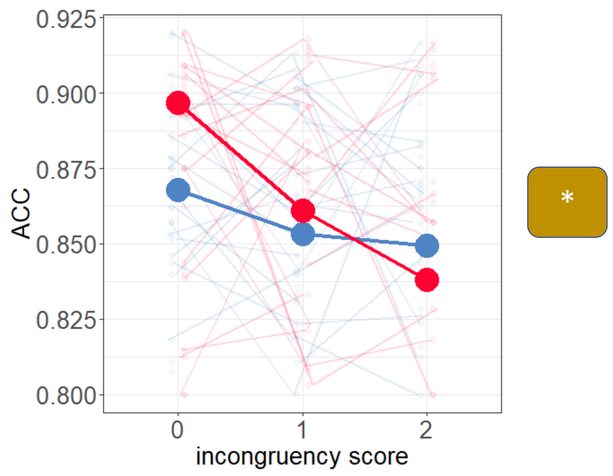
- Exp 1 investigates if participants are able to proactively regulate the strength of task set as a whole, whereas Exp 2 and Exp 3 examine if they are also able to only partially modulate one dimension of the task set (either **stimulus** or **rule** dimension) ;
- Control experiment aims to exclude the possible confound of passive task set decay that can be the case in Exp 1.
- **ONLY** regular trials of both regular and transform blocks are included in the analysis.

Results:

R trials in T blocks R trials in R blocks *p<.05 ** p < .01 *** p < .001







Conclusion:

- current study observed an extra RT cost and stronger congruency effect when participants expect a potential task transform.
- our behavioral results suggest that participants are able to adaptively adjust their cognitive control function by dynamically modulating the strength of a task set when detecting a higher likelihood of switching to an unknown task.

References:

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2. Starkweather, C. K., Babayan, B. M., Uchida, N., & Gershman, S. J. (2017). Dopamine reward prediction errors reflect hidden-state inference across time. *Nature neuroscience*, *20*(4), 581-589.

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