Sequence preparation is not always associated with a reaction time cost

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Background

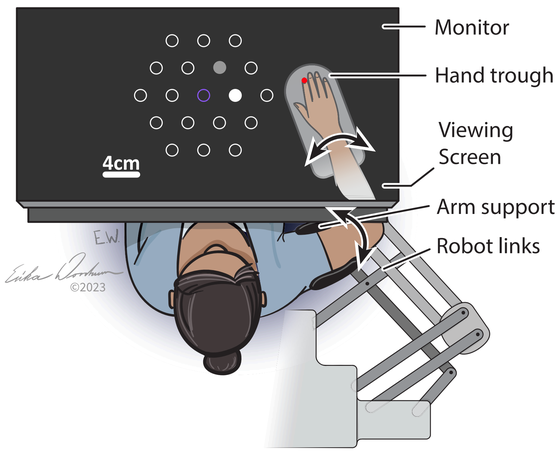
Numerous studies have shown that reaction time **(RT) increases as more elements of a movement sequence are cued** in advance. This increase has been taken as evidence that **multiple movements are being prepared** before the initiation of the first movement.

Here, we provide a fresh perspective on RT and how it should be interpreted when it comes to the preparation of sequential movements by answering what causes the RT cost.

We specifically ask:

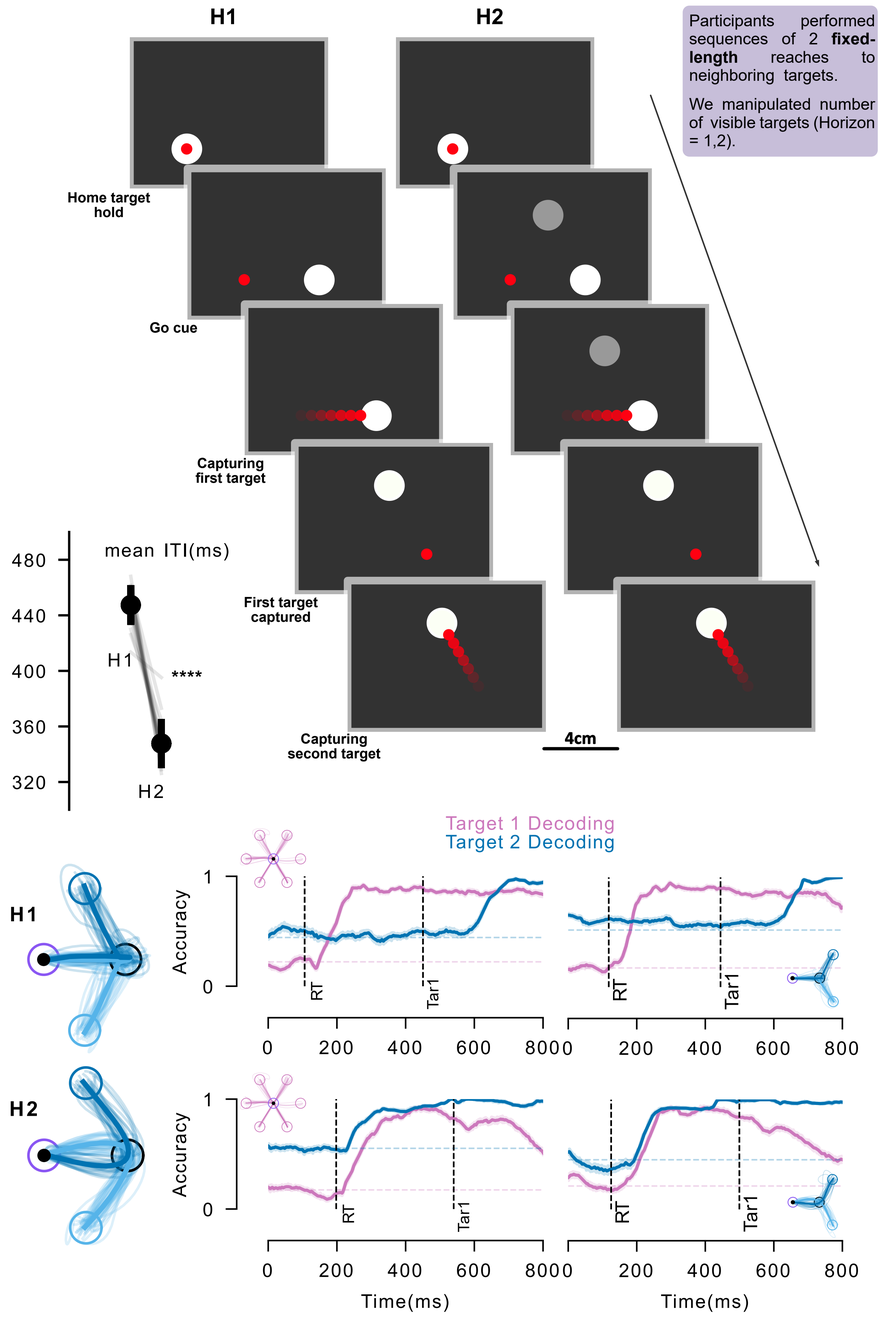
- Does sequential preparation happen before sequence initiation?
- Is sequential preparation reflected in RT?
- What causes RT increase when facing a longer sequence?

Methods



- Participants (n=15) performed a continuous reaching task using exoskeleton kinarm.
- Sequences were randomly generated from a grid of equidistant circular targets.
- Each target was captured for 50ms (Dwell time).
- Sequence order was indicated by **target brightness.**

Preparation extends beyond the first movement



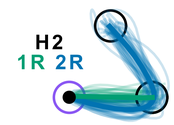
Participants performed sequences of 2 **fixed-length** reaches to neighboring targets.

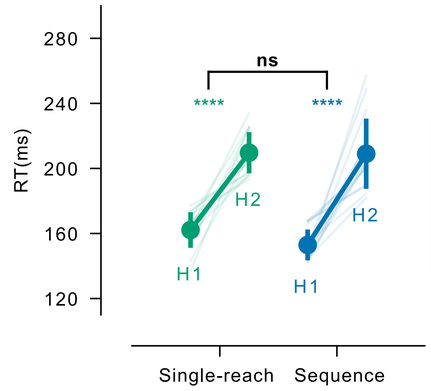
We manipulated number of visible targets (Horizon = 1,2).

With the understanding that sequence preparation occurs during RT, we can now examine how RT is affected.

Sequence preparation has no RT cost

We manipulated number of reaches to be performed, while keeping visual complexity constant (horizon).

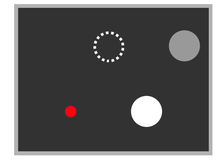


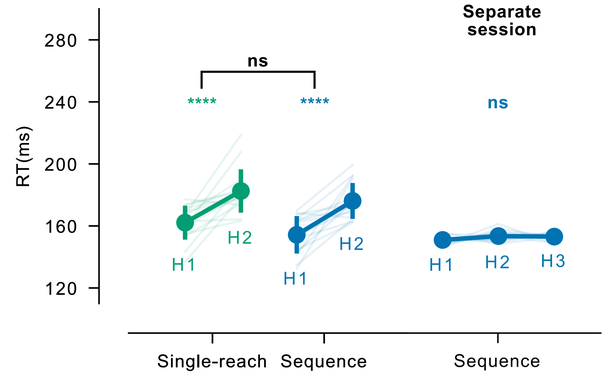


Sequence prepartion does not result in increased RT. Instead, RT increases with additional sequence elements only due to **ambiguity in selecting the initial response.**

Spatial ordering facilitates resolving of sequence order

In **spatial** trials, participants could use **both distance and brightness cues** to identify the first target compared to **non-spatial** trials in which **only brightness** can be used.





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Summary

- Preparation extends beyond the first movement prior to sequence initiation.
- This preparation does not result in increased RT.
- RT increase when facing longer sequences is due to more abiguity on first response.

Discussion

- Sequence preparation, motoric or just cognitive?
- Express arm responses not just for single targets, but for sequences of targets?
- Direct vs conceptual specification of motor targets in a sequence.

sensorimotor superlab

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