METACOGNITION OF MOTOR CONTROL

Are you sure you hit that target?

Caroline Peters[1],[2],[3], Elisa Filevich[1],[2]

caroline.peters@bccn-berlin.de
Metamotorlab.filevich.com

[1] Humboldt-Universität zu Berlin, Faculty of Life Sciences, Department of Psychology
[2] Humboldt-Universität zu Berlin, Berlin School of Mind and Brain
[3] Bernstein Center for Computational Neuroscience (BCCN) Berlin

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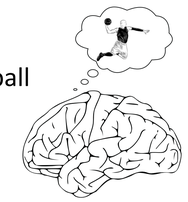
WHAT & WHY



Imagine someone asked you to throw a ball into a basket:
What matters more to you:

- ***Did I hit the basket?***
- ***At what speed or angle did I release the ball?***

Using a virtual throwing task embedded in a metacognitive paradigm, we aim at investigating this question.
In earlier experiments we showed that humans do have metacognitive access to their movements. In the current research we ask specifically which aspects of a movement are monitored by comparing whether the outcome of a movement (did I hit?) or its low level parameters such as speed at release are informative for the metacognitive judgement.

HOW

Fig. 1: Subjects were playing a virtual version of the 'Skittles game': a ball tied to a pole is swung around the pole in order to hit a target behind it. In the type 1 task, subjects needed to choose 'their' trajectory out of two possible trajectories (2AFC).

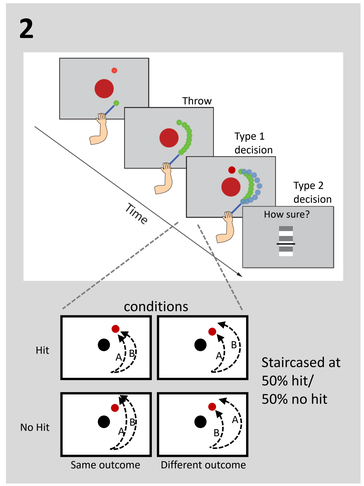
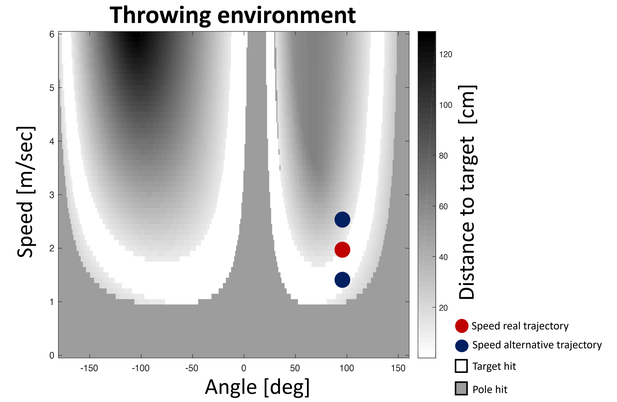


Fig. 2: Time course of the experiment and conditions (2x2: subject behavior [hit/no hit] x condition [same/different]). In the same condition, the outcome of the throw (hit/no hit) is not informative since it is the same for both trajectories. In the different condition, however, the outcome is informative since one trajectory hits whereas the other one does not. Hence, in the different condition more information is available.



Depending on subject behavior (hit/no hit) and condition (same/different), the second trajectory shown either hit or did not hit the target. This was achieved by increasing/lowering the speed at release (upper/lower blue dot respectively).

RESULTS

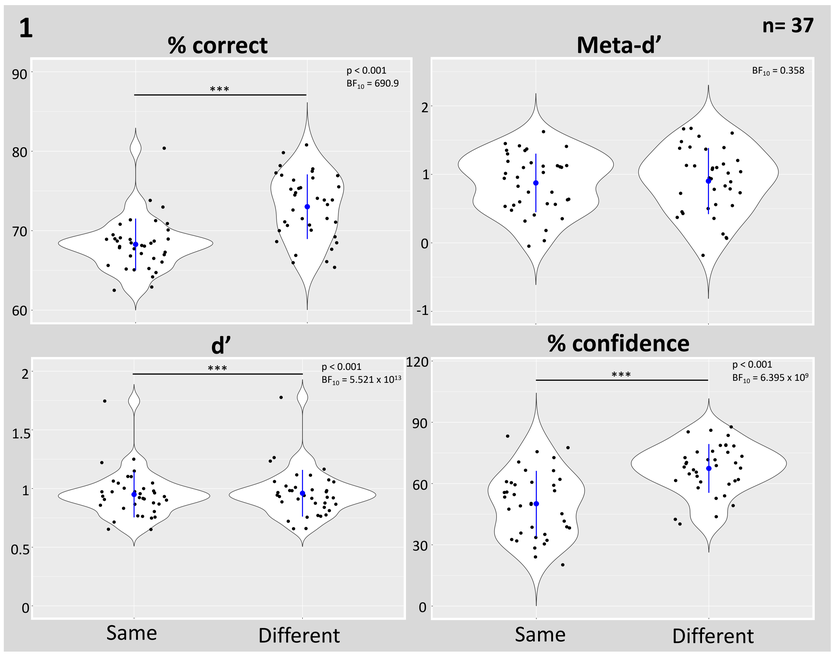


Fig.1: Performance (% correct), d' and confidence ratings differ between conditions. Meta-d' does not.

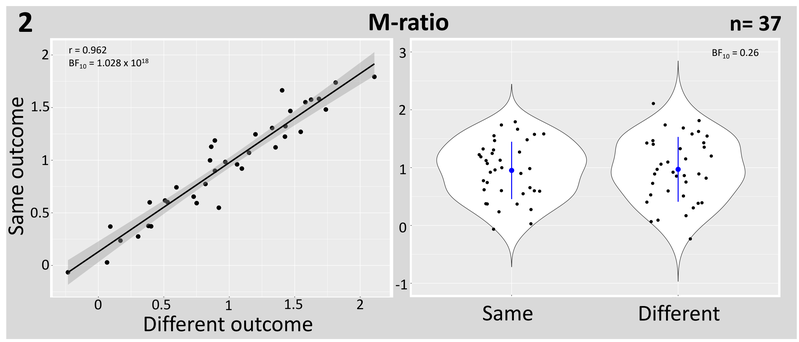


Fig. 2: M-ratios are correlated but not different in same and different outcome conditions.

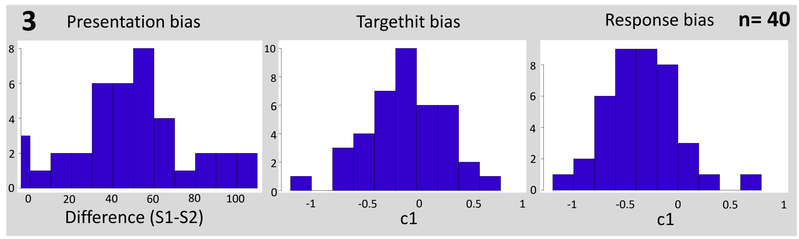


Fig. 3: Biases: Due to an error in the code, presentation of S1 and S2 was not balanced. Moreover, subjects' decision criteria were shifted when looking at two aspects of the data: people tended to answer that their trajectory was the one that hit the target (targethit bias) and they tended to select the left trajectory of the two (response bias) independent of it being the correct one respectively.

SUMMARY & OUTLOOK - AGENCY

1. **Monitoring the outcome of the movement led to better type 1 performance (% correct and d')**
   - ➢ More info to base decision on in different condition
2. **This did not permeate to type 2 (metacognitive) efficiency (m-ratio)**
   - ➢ People did not use type 1 information for the metacognitive judgement

In the metacognitive judgement, we asked for the effect (trajectory) of the throw. However, we manipulated the outcome (target hit). **Those seem to be two different things.**

➢ **Outcome information might have been accessible for the metacognitive judgement if we had asked about the outcome directly.**

This finding potentially relates to an ongoing discussion on whether there are two different kinds of agency:

1. **Agency over the body** and its movements
2. **Agency over the consequences** in the outside world

➢ Design of an experiment combining metacognition and agency