Motor metacognition: How important is outcome information?

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Introduction

Previous studies have shown that we can metacognitively monitor our movements. Nevertheless, it is unclear what type of information is crucial for accurate monitoring. In this study we tested whether the metacognitive representations of the movement or the outcome are more important for this assessment.

Methods

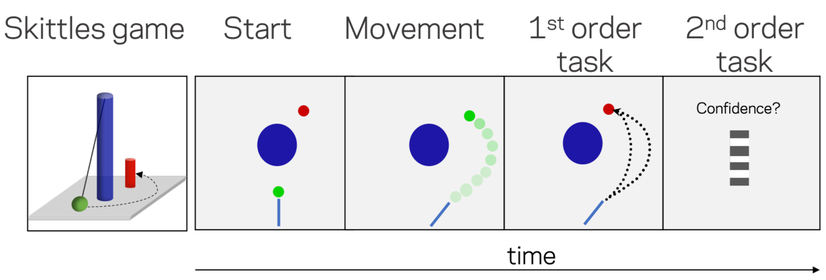

Fig. 1: Experimental set up and task. *Participants (n=28) played a virtual version of the Skittles-game. The goal was to hit the target behind the pole (red cylinder). After each ball throw, they discriminated which of the two trajectories displayed best corresponded to the movement they had just made and rated their confidence in their own discrimination decision.*

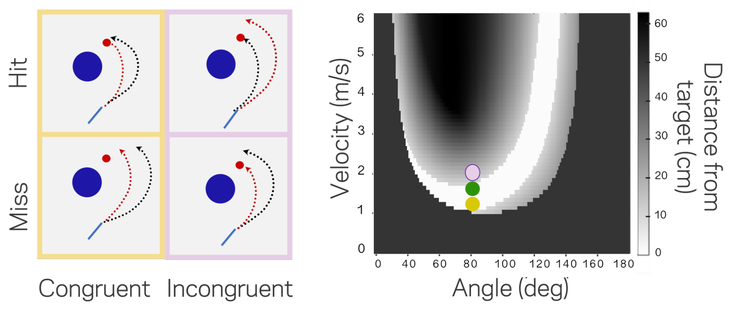

Fig. 2: Experimental conditions and outcome manifold. *The two conditions differed on whether the two trajectories shown matched (Congruent-yellow) or differed (Incongruent-pink) in terms of hitting the target or not (left). Alternative trajectories (black) were drawn by using a higher/lower velocity at time of ball release (right).*

Results

A. Effect of congruency

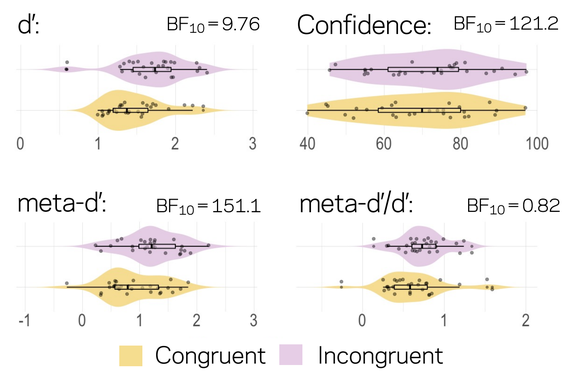

Fig. 3: First- and second-order performance measures. *d', mean confidence, and metacognitive sensitivity (meta-d') were higher for the Incongruent-outcome condition. No difference in the metacognitive efficiency (meta-d'/d').*

B. Effect of congruency and outcome

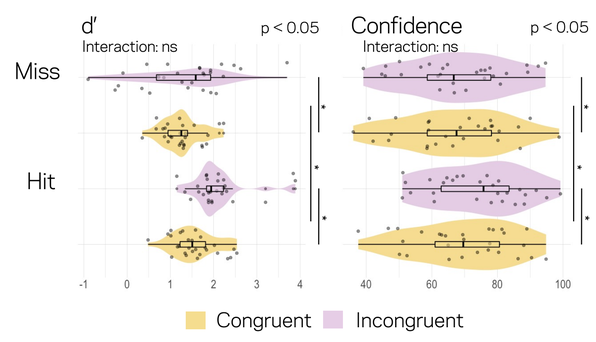

Fig. 4: Effect of congruency and outcome on first-order performance and confidence ratings. *First order performance and confidence were higher when participants hit the target.*

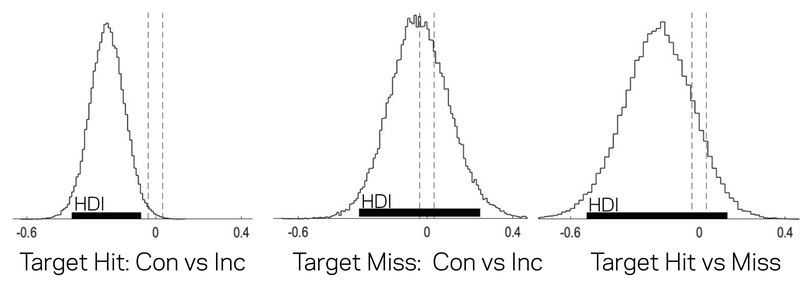

Fig. 5. Effect of congruency and outcome on metacognitive efficiency for the Congruent (Con) and Incongruent (Inc) conditions. *The dotted lines indicate the region of practical equivalence (ROPE). Hitting the target results in enhanced metacognitive efficiency.*

Discussion

In line with previous studies we found that participants can metacognitively monitor their motor performance. Outcome information improved their performance in the first order task. Nevertheless, at the metacognitive level outcome information was advantageous only when the outcome matched participants' intention to hit the target.

We argue that these findings underline the separation between the different levels of information that may contribute to body monitoring, which are often treated indiscriminately in the literature. On the basis of these results, we suggest a central role for motor intentions in metacognitive motor representations with an over-reliance on motor intentions in detriment of motor monitoring.

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