MULTISENSORY INTEGRATION IN HAND LATERALITY JUDGEMENTS

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INTRODUCTION

Motor imagery is a mental process by which people rehearse or simulate an action in their mind without actually performing the movement (Decety, 1996). Motor imagery has been the dominant explanation for the feeling of illusory movement experienced during the hand laterality task (HLT) (Kosslyn et al. 1998 Parsons et al. 1995). However, a recent study showed that motor imagery may not be the sole strategy employed to judge the laterality of hands (Mibu et al. 2020) and is, at best, employed by only 50% of participants. Indeed, sex differences have been shown in spatial transformation tasks and more recently in implicit motor imagery tasks (Conson et al. 2020) with different strategies employed by male and female participants. Judging the laterality of a seen hand may also involve optimal multisensory integration: whereby information from the seen hand is matched to proprioceptive information from the observers own felt hand (Viswanathan et al. 2012).

HYPOTHESES

The advance preparation of the response hand will induce observers to selectively attend to that hand's proprioceptive representation while suppressing inputs from the other (nonresponding) hand.

Hand stimuli congruent to the palm-down response hand should lead to successful binding, but stimuli with shapes corresponding to the palm-up view of the response hand should not, even though the palm-up stimuli are congruent with the palm-down view of the nonresponding (unattended).

Given that successful binding is postulated to be necessary for the subsequent illusory feeling of movement, we expected that the RT profiles for all palm-down stimuli would conform to the characteristic asymmetric-RT signature of illusory feelings of movement, but the RT profiles for all palm-up stimuli, for which binding was predicted to fail, would not.

The mirror-reversed RT profiles for left-hand and right-hand stimuli arise from the correspondingly mirror-reversed biomechanical constraints on right-handed and left-handed movements (Parsons, 1987, 1994; Parsons et al., 1995).

ANALYSIS-PLAN

The experiment will be pre-registered on OSF after piloting, and will then be run online via Pavlovia, with participants using their own computers. Data like RTs, participant sex and the coding of each stimulus will be recorded by Pavlovia and then downloaded for analysis.
A 5 (orientation: −120°, -60°, 0°, 60°, 120°) × 2 (view: palm-up, palm-down) × 2 (sex: male, female) repeated measures analysis of variance (ANOVA) will be employed to check for a three-way interaction of orientation, view and sex on RTs.

RESEARCH QUESTIONS

1) Does optimal visuo-proprioception integration influence the experience of illusory movement in hand laterality judgements?

2) Do sex differences exist when attention to proprioceptive inputs are controlled?
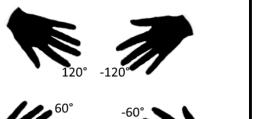
METHODS

Participants: 200 participants (100 male, 100 female). Age range: 18 - 40
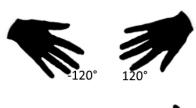
We will manipulate participants' attention to proprioceptive inputs by requiring them to judge the view of a seen hand shape of known laterality.

On each trial, participants will be presented with an advance cue specifying the laterality of the forthcoming test stimulus and the hand the participant should use to respond on that trial; participants will then be instructed to prepare the cued hand to respond rapidly to the forthcoming test stimulus. After a short delay, a test stimulus depicting only a hand shape will be presented; each hand-shape stimulus will be presented in one of five possible orientations (–120°, –60°, 0°, 60°, or 120°). Participants will judge whether the test stimulus depicted the palm-up or the palm- down view of the hand.

Fig. 1) Hand stimuli in 5 orientations (0°, 60°, 120°, -120°, -60°), 2 views (palm-down and palm-up) and 2 lateralities (left and right)

Fig. 2) Participants will sit in front of a screen and be shown a laterality cue, followed by a stimulus, and then they will give a palm-up or palm-down response

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