

Assessing the influence of a schematic drawing of the hand on vibrotactile discrimination performance

6th Annual Meeting of IMRF in Rovereto, June 5-8th, 2005

1: Tokyo Metropolitan University
2: NTT Communication Science Laboratories
3: University of Oxford

e-mail: igarasi-yuka@c.metro-u.ac.jp

Yuka Igarashi¹, Norimichi Kitagawa², Charles Spence³, and Shigeru Ichihara¹

Introduction

Seeing one's own body parts either directly or indirectly affects tactile perception (e.g., via mirror reflection, video monitor, or cast shadow).

Recently we found that seeing even a simple line drawing of a hand can modulate speeded tactile discrimination performance (Igarashi et al., 2004).

Is the modulatory effect of the picture of the hand on tactile performance due to the sight of the picture of the hand itself?

Or, is the modulatory effect mediated by other cognitive processes such as:

- Thinking of the particular body site (the tip and base of the forefinger),
- The simple orientation cue provided by the picture of the hand?

Experiment 1

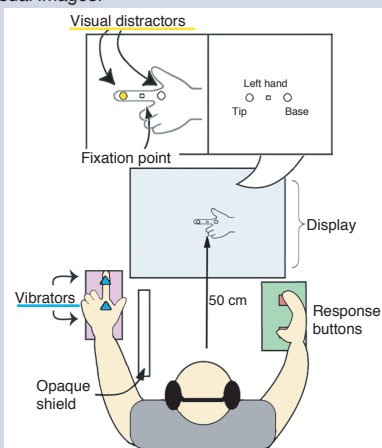
Does referring to the correspondence between the tactile target and the visual distractor position modulate visuotactile interactions?

Methods

12 participants were assigned to either a right or left hand stimulation condition.

The participants made speeded discrimination responses to the location of vibrotactile targets presented to either the tip or base of their forefinger, while ignoring simultaneously-presented visual distractors positioned horizontally.

Either a picture of a hand or the words describing a hand were superimposed by the visual distractors. The participants were instructed to ignore these visual images.



Four within-participants factors:

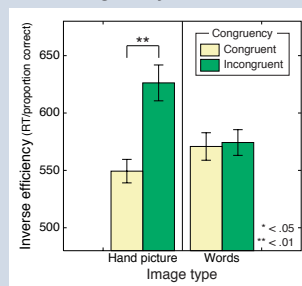
- Image type (Picture vs. Words)
- Correspondence between the stimulated and presented hand (Congruent vs. Incongruent)
- Image Orientation (Inward vs. Outward)
- Congruency between the tactile target and the visual distractor (Congruent vs. Incongruent)

Results

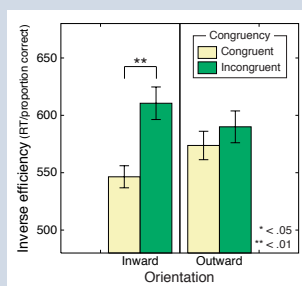
We analyzed Inverse efficiency (IE), calculated as mean RT divided by the proportion of correct responses (higher IE values indicate worse performance in the tactile discrimination task).

Significant effects:

- Congruency
- Image type × Congruency interaction
- Orientation × Congruency interaction



Seeing the picture of a hand modulated crossmodal interactions but seeing the words did not.



The effects of the visual distractors increased when the visual images were presented along the natural hand posture (i.e., inward orientation).

However, hand correspondence which is thought to be important for the identification of one's own hand, had little effect on visuotactile interactions.

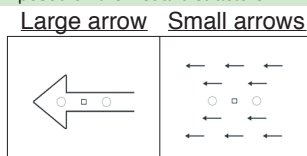
Experiment 2

Is the orientation cue provided by the hand picture sufficient to modulate the visuotactile interaction?

Methods

14 participants were assigned to either a right or left hand stimulation condition.

The hand picture, large arrow, or small arrows were superimposed on the visual distractors.



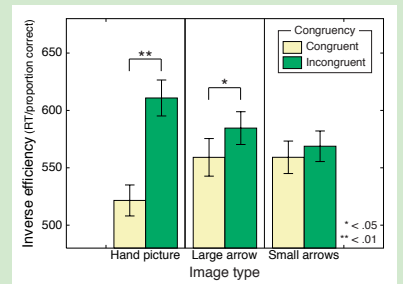
Hand correspondence was not examined (i.e., the picture of the hand was always congruent with the stimulated hand).

Otherwise, the methods were the same as those of Experiment 1.

Results

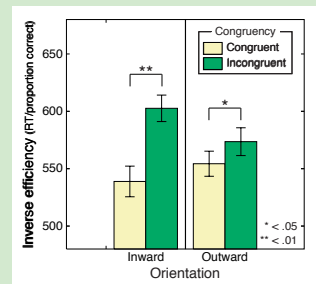
Significant effects:

- Congruency
- Image type × Congruency interaction
- Orientation × Congruency interaction



Orientation cue only (i.e., the small arrows) did not modulate visuotactile interactions.

The large arrow image resulted in a modulatory effect, but it was markedly smaller than that produced by the picture of the hand.



The modulatory effects of the orientation of the visual images were also observed.

Discussion

These results suggest that:

Visuotactile interactions are not modulated by cognitive cues such as:

- Simple semantic referral to the relevant body site
- Visual orientation cue provided by visual image

The small modulatory effect of the large arrow on visuotactile interactions might be attributed to the shape similarity between the arrow and the picture of the hand.

Visuotactile interactions are also influenced by proprioception. The modulatory effects were larger when the orientation of the image was consistent with the natural posture (i.e., the inward posture) of the stimulated hand.

References

- Igarashi, Y., Kitagawa, N., & Ichihara, S. (2004). Vision of a pictorial hand modulates visual-tactile interactions. *Cognitive Affective, & Behavioral Neuroscience*, 4, 182-192.
- Maravita, A., Spence, C., & Driver, J. (2003). Multisensory integration and the body schema: Close to hand and within reach. *Current Biology*, 13, R531-R539.