



Self-attributed body-shadows modulate tactile attention [☆]

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Abstract

Our body-shadows are special stimuli in the visual world. They often have anatomical resemblance with our own body-parts and move as our body moves, with spatio-temporal correlation. Here, we show that self-attributed body-shadows cue attention to the body-part they refer to, rather than the location they occupy. Using speeded spatial discrimination for tactile or visual targets at the hands, or for visual targets delivered near the hand-shadows, we demonstrate that mere viewing of task-irrelevant shadows can selectively facilitate tactile discrimination at the body-part casting the shadow (Experiment 1). In addition, such facilitation only develops through time for cast-shadows that have no resemblance with the body-part, but move in spatio-temporal correlation with it (Experiment 2). Conversely, facilitation fades away rapidly for shadow-like images that resemble the stimulated body-part, but are in fact static pictures (Experiment 3). Thus, recognising oneself as the owner of a shadow affects distribution of tactile attention.

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1. Introduction

In daily life, shadows are a constant feature of our visual world. Shadows on the surface of objects modify their appearance and provide critical information about their shape, while projected or cast shadows give important cues as to the relative location of objects in the scene (for review see Mamassian, Knill, & Kersten, 1998). Recent years have witnessed a renewed interest for the influence of cast shadows in visual perception, with research showing that cast shadows can change the perceived layout of scenes (Allen, 1999) as well as the perceived trajectory of moving objects (Kersten, Knill, Mamassian, & Bulthoff, 1996; Kersten, Mamassian, & Knill, 1997), their shape identification (e.g., Castiello, 2001) and the trajectory of grasping movements executed towards them (Bonfiglioli, Pavani, & Castiello, 2004).

Our own body also casts shadows in the environment. However, a number of distinct features make our own body-shadows a unique visual stimulus, that should be considered in its own right. Body-shadows not only refer to a location in space different from the one they physically occupy (a feature shared with all cast shadows), they are also visual stimuli in the world that refer to a location (a part of our own body) for which we have interoceptive experience. In addition, body-shadows often have anatomical resemblance with parts of our own body and move as our own body moves, with spatio-temporal correlation. In this respect, body-shadows are visual stimuli that could play a critical role in the consolidation of our perceived image of body shape and extension (the so called body image), in the definition of the internal representation of our own body boundaries and kinematics (the body schema), and more generally in the crucial task of self-recognition.

Pavani and Castiello (2004) were the first to address the special role of body-shadows in relation with the body schema, using a visuo-tactile interference task (e.g., Pavani, Spence, & Driver, 2000; Spence, Pavani, Maravita, & Holmes, 2004). With such a paradigm, robust evidence has been reported that a task-irrelevant visual stimulus presented near a tactually stimulated hand significantly hampers tactile localization performance when it is spatially incongruent with the tactile target location. In the study by Pavani and Castiello (2004), distracting visual stimuli were always presented 30 cm away from the hands but in the vicinity of the shadow cast by one of the two hands, while tactile targets were delivered either to the hand casting the shadow or to the other hand. Participants were instructed to localise tactile stimuli at the hands, and ignore all visual events (i.e., visual distractors and cast shadows). Despite visual distractors being equidistant to either hand, the results showed systematically larger visuo-tactile interference when tactile targets were delivered to the hand casting the shadow compared to when they were presented at the other hand. Such modulation of visuo-tactile interference did not emerge when participants wore polygonal shaped gloves that cast an un-natural hand-shadow, or when participants viewed the static outline of either the stimulated or unstimulated hand in front of them. Pavani and Castiello (2004) argued that natural shadows may favour the binding between personal and extra-personal space, and possibly modify the perceived image of the body shape and extension.

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