

The case of Dr. Jekyll and Mr. Hyde: A kinematic study on social intention

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Abstract

The aim of the present study was to investigate the effects of social intentions on action. Participants ($N = 13$) were requested to reach towards, grasp an object, and either pass it to another person (social condition) or put it on a concave base (single-agent condition). Movements' kinematics was recorded using a three-dimensional motion analysis system. The results indicate that kinematics is sensitive to social intention. Movements performed for the 'social' condition were characterized by a kinematic pattern which differed from those obtained for the 'single-agent' condition. Results are discussed in terms of a motor simulation hypothesis, which assumes that the same mechanisms underlying motor intention are sensitive to social intentions.

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1. Introduction

A current controversy concerns the role of the motor system in understanding social intentions (Beer & Ochsner, 2006; Jacob & Jeannerod, 2005). According to simulation theory, motor processes underlie the execution of actions as well as the understanding of other's people intended action (e.g. Decety & Grèzes, 2006; Gallese, 2001, 2003; Gallese & Goldman, 1998; Jackson & Decety, 2004). Each time an individual sees an action performed by another individual, motor simulation transforms audio–visual information about a physical movement into knowledge about an intentional action. This implicit knowledge is what allows us to penetrate the *motor intention* of another individual's action, i.e. to understand what she is doing.

A controversial issue is whether the same mechanism of motor simulation may account for our understanding of *social intentions*, i.e. intentions directed at other persons. Suppose an observer is watching another

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person's intentional action. Motor simulation allows the observer to represent the model's motor intention (e.g. grasping an apple). The question is: will motor simulation also allow him to distinguish whether the observed action is executed with a social goal (e.g. offering the apple) or with a purely individual goal (e.g. eating the apple)?

A reason of scepticism is that, differently from motor intentions, social intentions do not stand to actions in a one–one relation. Jacob and Jeannerod (2005), capitalizing on the so-called ‘mirror’ cells,¹ propose the following thought-experiment.

Consider Dr. Jekyll and Mr. Hyde. The former is a renowned surgeon who performs appendectomies on his anaesthetised patients. The latter is a dangerous sadist who performs exactly the same hand movements on his non anaesthetised victims. As it turns out, Mr. Hyde is Dr. Jekyll. Suppose that Dr. Watson witnesses both Dr. Jekyll's and Mr. Hyde's actions. Upon perceiving Dr. Jekyll, alias Mr. Hyde, execute the same motor sequence twice, whereby he grasps his scalpel and applies it to the same bodily part of two different persons, presumably the very same mirror neurons produce the same discharge in Dr. Watson's brain. Dr. Jekyll's motor intention is the same as Mr. Hyde's. However, Dr. Jekyll's social intention clearly differs from Mr. Hyde's: whereas Dr. Jekyll intends to improve his patient's medical condition, Mr. Hyde intends to derive pleasure from his victim's agony.

Simulating the agent's movements (through the mirror system) might allow an observer to represent the agent's motor intention, but will not allow him to represent the agent's social intention (Jacob & Jeannerod, 2005). A simply motor equivalence between observed action and its motor representation in the observer's brain, can tell us “what” the action is (e.g. that's a grasping), but not “why”, i.e. the social intention entertained by the agent.

This conclusion relies on the premises that Mr. Hyde's movements are the same as Dr. Jekyll. Social intentions, is claimed, stand to actions in a many–one relation: the very same action can be at the service of different social intentions (Jacob, 2006). The question addressed by the present study concerns the plausibility of this *many–one assumption*. Is it possible that different social intentions correspond to exactly the same external movements? Is it possible that the same bodily movements are in one occasion a set of individual acts, and, on another occasion, constitute a social action?

A partial answer may come from kinematical studies. For example, it has been demonstrated that intention mechanisms modulate motor activation (Castiello, 2003; Castiello, Lusher, Mari, Edwards, & Humphreys, 2002; Edwards, Humphreys, & Castiello, 2003). In addition, Georgiou, Becchio, Glover, and Castello (2007) revealed kinematic patterns for cooperative and competitive behaviour, which were distinct from those obtained by the same participants for movements having similar requirements in terms of speed and accuracy, but performed in isolation. In this study, two participants acted together coordinating their actions in space and time, therefore a direct influence of the action of the partner might explain the social effect on kinematics.

In the present study, we ask whether kinematics is sensitive to the social intention to affect the behaviour of another person. Specifically, we asked participants to produce intentional actions in two different contexts provided by either an individual or a social task. For the individual task, participants were requested to act in isolation (single-agent condition). They were requested to reach towards and grasp an object and to move it from one spatial location to another. For the social task participants were requested to reach towards and grasp the same object as for the ‘individual’ task, but to pass it to a partner (social condition). Moving an object and passing an object are both intentional action; both involve a movement of translation, from one spatial location to another spatial location. The critical difference is in the intentional component: whereas moving an object realizes a purely individual intention, passing an object necessarily involves a social intention, i.e. the intention to affect a conspecific's behaviour as part of one's reason to act. This is what happened in the social condition, in which participants passed the object to a partner, who received the object and then re-positioned it on the initial target position. What we were interested in was the effect of social intention on kinematics.

¹ Discovered within the ventral premotor cortex of the monkey brain, these neurons discharge both when the agent performs an action and during the observation of a similar action (Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996). This interpersonal mirroring has been proposed as the fundamental mechanisms of motor simulation (Jacob, 2006).

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