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Cooperative and competitive contexts do not modify the effect of social intention on motor action

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ABSTRACT

In social interactions, the movements performed by others can be used to anticipate their intention. The present paper investigates whether cooperative vs competitive contexts influence the kinematics of object-directed motor actions and whether they modulate the effect of social intention on motor actions. An “Actor” and a “Partner” participated in a task consisting in displacing a wooden dowel under time constraint. Before this *Main action*, the Actor performed a *Preparatory action* which consisted in placing the dowel at the center of the table. Information about who would make the forthcoming *Main action* was provided only to the Actor through headphones. Results demonstrate an exaggeration of spatial and temporal actions’ parameters when acting for the Partner, in cooperative, as well as in competitive context. This finding suggests that the motor manifestation of social intention is largely determined by non-conscious implicit processes that seem little influenced by the context of social interaction.

1. Introduction

Compared to the vast majority of animal species, humans occupy a very particular place relative to the complexity of their social life (Wilson, 1975). In this respect, it has been shown that we spontaneously adapt our behavior to the situation and to others in order to optimize social interactions (Sebanz, Bekkering, & Knoblich, 2006; Sebanz & Knoblich, 2009). Furthermore, identifying in others the intention that has originated an observed behavior provides a clear advantage for understanding that behavior, but also for anticipating and preparing an appropriate motor response in situations of social interaction. The latter can however be cooperative or competitive in nature, suggesting that giving access to intention that is linked to a motor activity might be in some cases not beneficial and even detrimental. The present paper investigates, in an interactive social situation, the effect of cooperative and competitive context on the motor expression of social intentions.

This last decade, a large number of studies has investigated the role of social context in the planning and execution of voluntary motor actions (for reviews, see Becchio, Sartori, & Castiello, 2010; Quesque & Coello, 2015). Researchers have reported that when a voluntary object-directed movement (e.g., grasping a glass of water) is performed with the aim to interact with a confederate, the execution of the motor action is influenced by the posture of the confederate (Becchio, Sartori, Bulgheroni, & Castiello, 2008a; De Stefani, Innocenti, Secchi, Papa, & Gentilucci, 2013; Ferri, Campione, Dalla Volta, Gianelli, & Gentilucci, 2011; Innocenti, De Stefani, Bernardi, Campione, & Gentilucci, 2012), as well as by the intimacy shared by the two agents (Gianelli, Scorolli, & Borghi, 2011), while the mere presence of a conspecific is not sufficient to influence movement execution (Becchio, Sartori, Bulgheroni, & Castiello, 2008b; Georgiou, Becchio, Glover, & Castiello, 2007; Quesque, Lewkowicz, Delevoye-Turrell, & Coello, 2013). Interestingly, it has been demonstrated that when people have a certain explicit communication goal (e.g., when one individual seeks to communicate

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through a movement an information to another individual), they tend to modify the trajectories of their movements (Cleret de Langavant et al., 2011; Sartori, Becchio, Bara, & Castiello, 2009). Typically, when endorsing a social intention, that is, when motor actions are performed with the aim of influencing someone else (Ciaramidaro et al., 2007), people exaggerate the spatial and temporal characteristics of their motor actions, with longer reaction time (Quesque & Coello, 2014; Quesque, Delevoeye-Turrell, & Coello, 2015; Quesque et al., 2013; Straulino, Scaravilli, & Castiello, 2015) movement duration (Ferri, Campione, Dalla Volta, Gianelli, & Gentilucci, 2010; Quesque & Coello, 2014; Quesque et al., 2013; Straulino et al., 2015) and higher trajectories amplitude (Becchio et al., 2008b; Quesque & Coello, 2014; Quesque et al., 2013, 2015) compared to actions performed to achieve a personal goal (that is, when others are not relevant for the accurate completion of the goal). These deviations were viewed as a natural tendency to consider the perspectives of others in order to make movements more intelligible when the latter represents the communication support in social interactions (Cleret de Langavant et al., 2011). They could potentially be also the expression of an automatic influence of others physical characteristics and locations (Quesque & Coello, 2014), and in particular of their eyes due to their critical role in social interaction (De Stefani et al., 2013; Ferri et al., 2011; Innocenti et al., 2012; Quesque & Coello, 2014). Supporting the latter interpretation, the tendency to modify the kinematics of voluntary motor action was observed in the case of explicit communication, but also in the context of more general non-informative movements that are performed in interactive context (e.g., passing an object to a partner, Becchio et al., 2008b; Ferri et al., 2010; Straulino et al., 2015) and even for actions that are socially irrelevant according to the goal of the current task (e.g., placing an object at the center of a table for a subsequent use by one of the social agents, Quesque & Coello, 2014; Quesque et al., 2013, 2015).

Even if facial information has been identified as a crucial component to identify others intentions (Manera, Becchio, Cavallo, Sartori, & Castiello, 2011), there is converging evidence suggesting that the attribution of social intention can also deeply rely on characteristics of observed motor actions. In accordance with this, Sartori, Becchio, and Castiello (2011) have shown that observers are able to categorize social intention even when the stimuli are point light displays of reaching movements, i.e. excluding all information related to body properties. In line with this, Lewkowicz, Quesque, Coello, and Delevoeye-Turrell (2015) presented to participants video clips showing a reaching movement performed according to an individual or social purpose. They modified the video presentation by standardizing reaction time only, or reaction time and movement duration. The results showed that the more the kinematic deviations were standardized, the less accurate were the participants in detecting social intention from action patterns, supporting the crucial importance of early movement characteristics in intention attribution. Remarkably, these differences in motor execution allow naïve observers to accurately identify, from observed kinematic patterns, the social intention followed by an actor and to adapt their own motor actions accordingly (e.g., Lewkowicz et al., 2015; Sartori et al., 2011). In line with this, Quesque et al. (2015) showed that the motor deviation resulting from social intention are implicitly processed in social interaction situations and spontaneously influence the preparation and the execution of complementary motor actions performed by the observer. Different factors have been found however to moderate the accuracy of intention attribution from observed motor action including, among others, individual explicit social cognition abilities (e.g. empathy score, Lewkowicz et al., 2015), and environmental cues (e.g. the surrounding objects, Stapel, Hunnius, & Bekkering, 2012). This comforts the crucial importance of individual sensitivity but also contextual cues in intention ascription (Brass, Schmitt, Spengler, & Gergely, 2007; Iacoboni et al., 2005). As a consequence, it seems of particular importance to investigate the effect of social intention on movement kinematics in different social and situational contexts.

Every social interaction can be cooperative or competitive according to the type of resource sharing that takes place (Manstead & Hewstone, 1996; Schneider, Benenson, Fülöp, Berkics, & Sandor, 2011). A situation is then defined as cooperative when the different actors implied collaborating in order to attain a common goal and when the benefits are shared across individuals. On the contrary, a given situation is defined as competitive when the different actors implied follow antagonist goals that cannot be simultaneously reached. In the latter context, if one actor achieves the predefined goal, the others will not. Previous studies on the influence of the social context on task implying motor skills showed that participants' performances tend to be higher in cooperative rather than in competitive context (for a meta-analysis, see Stanne, Johnson, & Johnson, 1999). However, these differences were essentially found in the case of biased competition and other evidence also supports higher performances in competitive context (e.g. Triplett, 1898). In addition, more recent studies using executive function tasks report benefits of both cooperative and competitive contexts (Huguet, Dumas, & Monteil, 2004; Huguet, Galvaing, Monteil, & Dumas, 1999; MacKinnon, Geiselman, & Woodward, 1985; Ybarra, Winkielman, Yeh, Burnstein, & Kavanagh, 2010). The vast majority of these studies investigated the effect of the social context on performance through temporal measures such as reaction time and response time. To our knowledge, only one study focused on the influence of the type of social interaction at stake on movements' kinematics (Georgiou et al., 2007) and reported that humans tend to produce slower movements, with an increase of the deceleration phase, in cooperative compared to competitive contexts. In the latter study, however, different instructions were given to the participants depending on the social component of the task: in the competition task, participants had to reach and grasp an object in order to be the first to move it at the center of the working space, whereas, in the cooperation task, they were both required to reach and grasp an object and to move the two objects at the center of the working space according to a specific configuration. The tasks were thus different depending on the type of interaction selected, suggesting that any conclusion in terms of effect of the type of social interaction on movement kinematics was unwarranted. As a consequence, the goal of the present study was to investigate whether the context of social interaction (cooperation vs competition) influences the kinematics of an object-directed motor action and whether it modulates the effect of social intention on motor actions, while keeping unchanged the instructions given to participants.

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