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Me and we: Metacognition and performance evaluation of joint actions

Robrecht P.R.D. van der Wel

Department of Psychology, Rutgers University, Camden, NJ, United States

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ABSTRACT

Recent evidence suggests the existence of we-mode processing, but little is still known about how such processing influences the sense of control during intentional joint actions. To examine this issue, dyads performed a video game in which they moved a dot to the target of their choice out of a set of targets. By having each participant control the dot movements in only one dimension (orthogonal to their partner) and by varying the target locations, participants took on different roles. By chance, they also could have congruent or incongruent intentions prior to the movements. In a decider–follower scenario, where one actor decided on the target, judgments of control and judgments of performance depended on whether a prior intention was instantiated, but not on actor role. This finding is consistent with we-mode processing. When participants had conflicting intentions that needed to be resolved online, both the dominant and the nondominant participant showed a marked reduction in the perceived quality of the performance. Thus, dynamic intention negotiation reduced we-mode processing and shifted it toward I-mode processing. The nondominant actor also reported a strongly reduced sense of control. Implications for theories on the sense of agency and for applied settings are discussed.

1. Introduction

As intentional agents, we feel in control over most of our actions. Nonetheless, people may experience a sense of agency over action effects they did not cause, or they may fail to experience a sense of agency over action effects they did cause (see van der Wel & Knoblich, 2013, for a recent review). This observation puts the sense of agency squarely in the realm of psychological theorizing.

The sense of agency consists of a multitude of aspects. It includes the sense that one initiated an action as well as the sense that one is in control over the action, amongst other aspects (see Haggard & Tsakiris, 2009; Pacherie, 2008). Here, I will focus specifically on the sense of control in the context of actions that are intentionally produced together with another actor (i.e., joint actions). For such actions, an important theoretical question is to what extent an actor's sense of control is derived from control at the group-level versus the actor's individual contributions.

Studying how people sense agency over joint actions is important for our theoretical understanding of intentional action, and for applied reasons. People often work in pairs or teams, and the extent to which all actors involved have an agentic experience may influence the objective outcome quality of joint collaborations (e.g., Babcock & Loewenstein, 1997). It may also influence the subjective perception of the outcome quality, and subsequently influence whether people continue to collaborate with one another altogether (e.g., Caruso, Epley, & Bazerman, 2006). The subjective experience of collaborations over extended time spans may in part be driven by such experiences over much shorter time spans. Thus, a better understanding of the

E-mail address: r.vanderwel@rutgers.edu

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experience of joint actions over relatively short durations may benefit theories of intentional action, but may also inform settings in which team performance is key, be it on a pitch or in an office.

Two main accounts have been developed for how a sense of agency over actions is established. There is growing consensus that these accounts are complementary rather than conflicting in nature. One is a predictive account (e.g. Blakemore, Wolpert, & Frith, 2002; Haggard, 2005; Tsakiris, Prabhu, & Haggard, 2006) and one is a postdictive account (Wegner, 2002). The predictive (sensorimotor) account postulates that the sense of agency arises based on the match between the predicted and actual sensory consequences of an action. The closer this match is, the stronger of a sense of agency people experience. Whereas the predictive account establishes the sense of agency dynamically during the action, the postdictive account assumes that the sense of agency is established after the action is completed. In particular, this account focuses on the presence of a prior intention, the consistency between the intended and actual action effect, and whether an alternative cause for the action effect is present (priority, consistency, and exclusivity, respectively).

Empirical studies on the sense of agency have found some support for both of these accounts. The core issue in these studies has been how ambiguities about the cause of an action effect influence the sense of agency. These studies addressed which factors reliably influence the sense of agency (e.g., Metcalfe & Greene, 2007), and how discrepancies between the intention, the action, and action effect influence the sense of agency (e.g., David, Newen, & Vogeley, 2008; Knoblich & Kircher, 2004; Knoblich & Repp, 2009; van den Bos & Jeannerod, 2002).

Joint actions provide a challenge for both the predictive and the postdictive account on the sense of agency. As actors in a joint action do not have access to the sensorimotor information of their co-actors, the matching between expected an actual sensorimotor signals that is central to the predictive account is not fully possible. Prediction may still take place at a perceptual level, but this raises the question how sensorimotor signals of one's own contribution and perceptual signals of the joint performance are integrated. From a postdictive account, exclusivity is intentionally absent for joint actions. How then do people derive a sense of control over joint actions?

The past decade has seen a surge of interest in research on joint actions. This research has revealed that people may automatically track others' tasks (e.g., Sebanz, Knoblich, & Prinz, 2005), perspectives (e.g., Samson, Apperly, Braithwaite, Andrews, & Bodley Scott, 2010), attentional focus (e.g., Böckler, Knoblich, & Sebanz, 2012), and beliefs (e.g., Kovács, Teglas, & Endress, 2010; van der Wel, Sebanz, & Knoblich, 2014). Group membership has also been shown to modulate perception–action links (Obhi & Hall, 2011a, 2011b; Tsai, Sebanz, & Knoblich, 2011; Weiss, Herwig, & Schütz-Bosbach, 2011). Based on such findings, Gallotti and Frith (2013) proposed the existence of a 'we-mode' that supports social interaction (see also Tuomela, 2005; Tuomela, 2006).

The presence of a we-mode raises the question whether we-mode processing influences the sense of control over joint actions. Actors may represent co-actors during a joint action, but this need not imply that we-mode processing influences the sense of control experienced by the individuals involved in the joint action. Here, I tested whether and when metacognitive assessments of control (i.e., whether people are able to monitor their own agency, Metcalfe & Greene, 2007) and performance evaluations reflect we-mode processing when people engage in joint actions.

One previous study has examined the role of we-mode processing on the sense of control for joint actions (Dewey, Pacherie, & Knoblich, 2014). In their study, two participants controlled the movements of a dot to track a moving target on a computer screen by controlling one joystick each. When participants controlled overlapping dimensions of the dot movements (i.e., both controlling the horizontal dimension), participants' ratings of control were most consistent with egocentric processing, and the co-actor's movements were essentially treated as a perturbation. In contrast, when participants had complementary roles (i.e., one controlling movements to the left and one controlling movements to the right), the results appeared to be consistent with we-mode processing. In particular, participants reported a stronger sense of control when their co-actor controlled the complementary dimension versus when the computer did. However, the results of the critical experiments in Dewey et al. (Experiments 2 and 3) indicated differences in the objective quality of performance between the conditions that coincided with differences in the reported judgments of control (i.e., as error increased, judgments of control decreased). As such differences were not controlled for in their analyses (i.e., added as a random intercept in a mixed linear model), this study does not provide conclusive evidence for we-mode processing for the sense of control. In addition, the complementary task in Dewey et al. (2014) effectively involved a turn-taking task rather than a parallel joint action task. It thus remains to be seen whether we-mode processing underlies the sense of control for joint parallel actions, and under what circumstances.

Here, I examined when the sense of control depends on we-mode processing for tasks in which actors perform parallel complementary actions. Based on we-mode processing, performance of a joint action is evaluated at the level of the group instead of at the level of the individuals' particular contributions (to which I will refer as the I-mode, Tuomela, 2005). Thus, based on we-mode processing the sense of control and performance evaluation should not depend on the particular role an actor plays in a joint action (see Pacherie, 2013). In the case of rowing, the coxswain who is steering the boat and the rowers creating forward motion should have similar experiences of control, just as the surgical assistant and the surgeon should. In contrast, based on I-mode processing, actor role should influence the sense of control.

I also examined the relationships between objective performance, judgments of control, judgments of performance, and movement parameters of both the participant and the action partner to test for we-mode versus I-mode processing. In this respect, I-mode processing would predict correlations between an actor's own movement