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FlashReport

When competition merges people's behavior: Interdependency activates shared action representations☆

Kirsten I. Ruys *, Henk Aarts

Utrecht University, Utrecht, The Netherlands

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ABSTRACT

Previous research suggests that friendly, cooperative situations cause one to integrate a co-actor's actions into one's own action system. Departing from an interdependency perspective, we predict the activation of shared action representations even in hostile, competitive situations as a result of attending to the intentions of the co-actor. To test this, in Experiment 1 we manipulated the interdependency between actor and co-actor in a joint Simon task and observed a stronger activation of shared action representations in a cooperative as well as competitive context compared to an independent context. Experiment 2 replicated the competitive context effect on activation of shared action representations and provided additional evidence for the mediating role of attending to others' intentions by taking into account the individual tendency to attend to others' intentions. Together, our findings suggest that interdependency merges people's behavior even in competitive contexts, which we argue encourage actors to attend to others' intentions.

Introduction

People coordinate joint actions like lifting a table, giving a high five, or playing tennis by incorporating the actions of others into their own action system (Sebanz, Bekkering, & Knoblich, 2006). The question is what triggers this activation of shared action representations? We hypothesize that activation of shared action representations occurs when actors take into account their co-actor's intentions, which is more likely to occur when actor and co-actor are interdependent. Actors attend to a co-actor's intentions and incorporate a co-actor's actions into their own action system when their personal goals (such as earning money) depend on the other's actions, or when a tendency to attend to others' intentions is naturally present. Crucially, this perspective predicts that people not only integrate actions of others into their action system in friendly, cooperative situations. They also activate shared action representations in a more hostile, competitive context where actors often dislike the other actor. Here, we examine this important and intriguing possibility.

An interesting and unobtrusive way to show activation of shared action representations was first proposed by Sebanz, Knoblich, and Prinz (2003) by using a joint Simon task. In a typical Simon task (Craft & Simon, 1970), participants respond with right and left keys to green and red colored stimuli that appear right or left on the screen. Responses are facilitated with matching spatial locations of key and color-stimulus (compatible trials) and delayed with non-matching spatial locations of key and color-stimulus (incompatible trials). Responding to only one color (in a go/no-go task) strongly attenuates the compatibility effect. In a joint Simon task, two participants each take care of one color. Intriguingly, performing a joint Simon task reinstates the compatibility effect, as if one participant takes care of both responses (Sebanz et al., 2003; Sebanz, Knoblich, & Prinz, 2005).

Sebanz, Knoblich, & Prinz (2003, 2005) demonstrated that actors incorporated the actions of co-actors into their own action system, even when this hindered task performance, suggesting that activating shared action representations is a rather spontaneous and automatic process. Neurophysiological research indicates that actors confuse their own physical body with the body of a co-actor so to speak: A stimulus referring to the co-actor's action elicited a similar electro-physiological response as a stimulus referring to the actor's own action (Sebanz, Knoblich, Prinz, & Wascher, 2006; Tsai, Kuo, Jing, Hung, & Tzeng, 2006). Thus, embedding a co-actor into one's action representation to a certain extent activates one's own inactive hand.

An important question is whether physical or psychological factors drive the activation of shared action representations. Is it necessary to see a co-actor's actions or is it sufficient to believe that a co-actor is acting? In disagreement with ideomotor and common-coding approaches suggesting that seeing a co-actor's actions is necessary to activate motor representations of these actions (Greenwald, 1970; Jeannerod, 1999; Prinz, 1997), research demonstrated that knowing about the co-actors' actions also produced a joint Simon effect (Sebanz et al., 2003; Tsai, Kuo, Hung, & Tzeng, 2008). Furthermore, Tsai and Brass (2007) showed that a joint, or so-called social Simon

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* Corresponding author. Department of Psychology, Utrecht University, P.O. Box 80140, 3508 TC Utrecht, The Netherlands. Fax: +31 30 253 4718.
E-mail address: k.i.ruys@uu.nl (K.I. Ruys).

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effect occurred when co-acting with a dynamic human hand and not when co-acting with a wooden hand, suggesting that actors incorporated the actions of a human rather than a non-human agent (see also Longo & Bertenthal, 2009). Recently, Hommel, Colzato, and Van den Wildenberg (2009) showed that actors tend to incorporate the actions of friendly rather than intimidating co-actors, suggesting that also more distal, social psychological factors influence the activation of shared action representations.

This research suggests that a positive relationship, perceived agency, or a common goal between actor and co-actor increases activation of shared action representations. Although different in nature, these previous findings hint to the social function of shared action representations: They all suggest that activation of shared action representations occurs when actors attend to the intentions of a co-actor. Interestingly however, this hypothesis predicts that the activation of shared action representations not only occurs in friendly, cooperative situations, but also in hostile, competitive situations. In both types of interdependent situations actors are induced to understand and attend to the intentions of a co-actor to optimally adapt to the co-actor's performance in service of a mutual or conflicting goal, respectively. Actors attend to a co-actor's intentions by observing a co-actor's performance (e.g., "does she intend to perform well?"). Observing the co-actor's intended action outcomes activates the action representations of the co-actor and thereby increases the likelihood of integrating the co-actor's actions into the actor's action system. In independent situations where one has a personal goal independently of others, attending to the co-actor's intentions is less important, thereby decreasing the likelihood of integrating the co-actor's actions into the actor's action system. However, activation of shared action representations may occur spontaneously in an independent context if the natural tendency to attend to other people's intentions is already strongly present (cf. Aarts, Gollwitzer, & Hassin, 2004).

Two experiments investigated this intriguing issue. Experiment 1 examines our main idea that cooperative as well as competitive interdependent situations activate shared action representations. Therefore, participants performed a Simon task with a co-actor and cooperated, competed, or worked independently to obtain a reward. We expected activation of shared action representations and thus a social Simon effect to emerge especially in the interdependent conditions. Thus, even the competitive context should enhance the activation of shared action representations. Experiment 2 served to provide further evidence for the mediating role of attending to others' intentions by examining the role of individual differences in understanding and attending the intentions of others.

Experiment 1

Method

Participants and design

Ninety-nine undergraduates participated for course credits and were randomly assigned to the conditions of a 3 (interdependency: independent, cooperation, competition) × 2 (response tone: high [500 Hz], low [200 Hz]) between-participant design. Within participants, we varied tone pitch (high, low) and tone location (left ear, right ear, both ears).

Procedure

Participants were recruited in couples and placed in separate, adjacent rooms. They performed an auditory Simon task (Simon & Rudell, 1967) together with the other participant (a co-actor) working in the adjacent room (see also Tsai et al., 2008). Participants responded to high (low) tones with the right key ("3" on the numeric keyboard), while the co-actor responded to low (high) tones with the left key ("z"). Before the task started, the computers of the two participants were coupled and synchronized, which took 7 s. In actuality, participants performed the task alone, responding to high- or low-pitched tones that appeared left, right, and in both ears simultaneously through headphones.

We presented 90 "go" and 90 "no-go" trials, with low and high tones appearing right, left, and in both ears simultaneously. On 30 compatible trials, tone and response key locations matched. On 30 incompatible trials, tone and response key locations mismatched. On 30 control trials, tones appeared in both ears.

Each trial started with a green light. After 1 s, a tone appeared for 250 ms. A red light on the right of the screen (correspondent with response key location) signaled the participant's responses and a red light on the left "signaled" the co-actor's responses (Tsai et al., 2008), appearing randomly between 250 and 700 ms following tone offset.

We manipulated interdependency between actor and co-actor by rewarding the fastest and most accurate participants with 10 Euros. In the independent condition, the 10 best performing participants each earned a reward. Thus, attainment of a personal goal was relatively independent of the co-actor. In the cooperation condition, both participants of the 5 best performing couples earned a reward. Hence, attainment of a mutual goal directly depended on the co-actor. In the competition condition, 10 winners were randomly selected for the reward. Thus, attainment of a personal goal depended on the co-actor's actions. Debriefing indicated that participants understood the instructions.

Results

Responses below 100 ms or above 1000 ms were removed (Ratcliff, 1993). We computed mean RTs on compatible, incompatible, and control trials, collapsing across tone pitch, tone location, and response keys (Table 1). We conducted a 3 (interdependency: independent, cooperation, competition) between-participants x 2 (trial-type: compatible, incompatible) within-participants ANOVA on the mean RTs, with mean RTs on control trials as covariate. This revealed the predicted interdependency by trial-type interaction, $F(2,95) = 3.16$, $p < .05$, $\eta_p^2 = .06$. The compatibility effect was stronger in the interdependency than independency conditions (cooperative versus individual: $F(1,65) = 3.86$, $p < .05$, $\eta_p^2 = .06$; competitive versus individual: $F(1,62) = 5.92$, $p < .02$, $\eta_p^2 = .09$, with no difference between the interdependency conditions ($F < 1$).

The Simon effect increased in both interdependent conditions compared to the independent condition. This offers new and strong evidence for the idea that actors integrate a co-actor's actions into their action system when attending to the co-actor's intentions, and that this integration of actions even occurs in a hostile, competitive context.

Table 1
The Simon effect (ms) and mean RTs (ms) and SDs on compatible, control, and incompatible trials in the independent, cooperation, and competition conditions.

Condition		Trial type			
		Simon effect	Compatible	Control	Incompatible
Independent					
	Mean	24	386	390	409
	SD	27	92	93	99
Cooperation					
	Mean	38	387	393	426
	SD	34	82	91	87
Competition					
	Mean	41	361	375	402
	SD	29	70	65	66

Note: The Simon effect was computed by subtracting the mean RTs on compatible trials from the mean RTs on incompatible trials. In a go/no-go version of the auditory Simon task with a different subsample of participants ($n = 33$) the mean Simon effect was 23 ms (SD = 25).

Experiment 2

The purpose of Experiment 2 was two-fold. First, given the perhaps counterintuitive idea that people incorporate actions of others in their action system in hostile, competitive situations, we aimed to replicate this effect. Second, we aimed to provide more compelling evidence for the idea that attending to others' intentions is the potential mechanism for activation of shared action representations by examining the moderating role of people's natural tendency to attend to intentions of others. Accordingly, people with a natural disposition to more carefully understand and attend to others' intentions incorporate a co-actor's actions in their action system, regardless of the interdependency of the situation. However, people who are less disposed to carefully understand and attend to others' intentions use interdependency as a trigger to attend to a co-actor's intentions and incorporate their co-actor's actions in their action system. Thus, we predicted that actors having a weak tendency to attend to others' intentions activate shared action representations only in the interdependent condition, whereas actors with a strong tendency to attend to others' intentions activate shared representations in interdependent and independent conditions.

Method

Participants and design

Fifty-nine undergraduates participated for course credits and were randomly assigned to the conditions of a 2 (interdependency: independent, competition) × 2 (response tone: high, low) between-participant design. Tone pitch (high, low) and tone location (right ear, left ear, both ears) were varied within participants.

Procedure

The procedure was identical to Experiment 1, only participants also completed the revised, adult version of the "The Eyes Test" designed to measure social sensitivity as to people's ability to understand and attend to other people's intentions by focusing on conveyed emotions in the eyes of other people (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Although designed to measure ability, the eyes-test may also be a proxy of people's tendency to understand and attend to others' intentions. A natural tendency to understand and attend to other people's intentions increases one's experience, which may be reflected in one's ability to understand and attend to other people's intentions.

In the eyes-test, participants observe eye-regions of 36 facial expressions on the computer and select for each expression (of four options that surround the expression) the mental state term that matches the expression. These terms refer to relatively complex mental states, for example "reflective," "arrogant," "scheming." Participants were encouraged to quickly select the appropriate term. Similar to previous work we computed the proportion of correct answers ($M = .59$, SD = .14). The more carefully participants attend to the intentions of others, the more accurate their scores on the eyes-test.

Results

Responses below 100 ms or above 1000 ms on the Simon task were removed. We computed mean RTs on compatible, incompatible, and control trials, collapsing across tone pitch, tone location, and response keys. We conducted a 2 (interdependency: independent, competition) between-participants × 2 (trial-type: compatible, incompatible) within-participants ANOVA on the mean RTs, with eyes-test score as continuous variable and mean RTs on control trials as covariate. This revealed the predicted three-way interaction of interdependency, trial-type, and eyes-test score, $F(1,54) = 7.33$, $p < 001$, $\eta_p^2 = .12$.

To examine this interaction, we assessed the effect of interdependency on the compatibility effect for participants with high eyes-test scores (1 SD above the mean) and low eyes-test scores (1 SD below the mean) separately (Aiken & West, 1991), see Fig. 1. For low scoring participants, the compatibility effect was stronger in the competitive ($M = 49$) than the independent condition ($M = 11$ ms), $F(1,55) = 10.54$, $p < .002$, $\eta_p^2 = .16$, while for high scoring participants no difference appeared ($M_{comp} = 33$, $M_{ind} = 42$ ms), $F < 1$. Also, in the independent condition the compatibility effect was stronger for high rather than low scoring participants, $t(58) = 2.71$, $p < 009$, $\eta_p^2 = .12$.

This confirms that actors with a weak tendency to attend to others' intentions only activated shared action representations in the competitive context, whereas actors with a strong tendency to attend to others' intentions activated shared representations in competitive *and* independent contexts.

Discussion

Two experiments show that the activation of shared action representations not only occurs when people cooperate, but also when they compete. Furthermore, we showed that people who are naturally disposed to attend to others' intentions activated shared action representations in interdependent (competitive) and independent contexts. People with a weaker disposition to attend to others' intentions activated shared action representations only in the interdependent (competitive) context. Thus, a strong disposition to attend to others' intentions caused integration of a co-actor's actions in one's action system to occur irrespective of the context, whereas a weak disposition only caused this integration to occur in a competitive context. Together, these findings support our idea that interdependency activates shared action representations as a result of attending to a co-actor's intentions by observing the co-actor's performance.

An intriguing implication is that people merge their behavior more strongly in interdependent situations, even though they are in competition. Whereas common knowledge often stresses that competition renders people more individualistic or personal-oriented (Baldwin, 1911), our findings suggest that competition connects people at the behavior level, as competition increases activation of shared action representations.

Another interesting implication is that incorporating a co-actor's actions does not improve task performance. Even actors who are typically less inclined to attend to others' intentions activated shared action representations when in competition, suggesting that activating shared action representations is a rather spontaneous and automatic process (Sebanz et al., 2003). This suggests that measuring

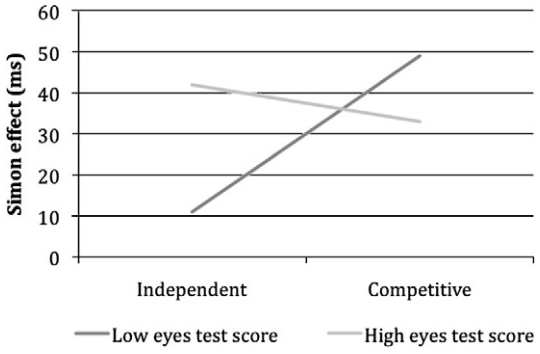

Fig. 1. Mean Simon effect (ms) on the joint auditory Simon task as a function of interdependency (independent or competitive) for participants with a low score on the eyes-test (1 SD below the mean) and a high score on the eyes-test (1 SD above the mean).

the activation strength of shared action representations in a joint (Simon) task is an interesting and unobtrusive method to examine the overlap in behavior between people in interdependent situations in general, and competitive situations in particular.

More generally, our work sheds light on the mechanism underlying effects of interdependency on interpersonal behavior. Research has shown for example that feelings of interdependency (as compared to independency) increase our mimicking behavior (van Baaren, Maddux, Chartrand, de Bouter, & van Knippenberg, 2003) and that interdependency between people increases their tendency to infer and copy the other person's goals (Dik & Aarts, 2007; Loersch, Aarts, Payne, & Jeffris, 2008). The present research suggests that these increased mimicry and goal-contagion effects result from attending to other's intentions in interdependent situations.

In sum, our findings substantiate the novel hypothesis that we integrate a co-actor's actions into our action system when trying to secure our personal outcomes, especially when these outcomes depend on others. Whether interdependency was friendly, cooperative or hostile, competitive was unimportant for the activation of shared action representations.

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