Cognition 146 (2016) 223–228

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

Short Communication

Social task switching: On the automatic social engagement of executive functions

Veronica Dudarev [a,*], Ran R. Hassin [a,b,*]

[a] Department of Psychology, The Hebrew University, Jerusalem, Israel
[b] Department of Psychology and The Federmann Center for the Study of Rationality, The Hebrew University, Jerusalem, Israel

ARTICLE INFO

Article history:
Received 6 March 2015
Revised 19 August 2015
Accepted 1 October 2015

Keywords:
Automatic executive functions
Joint action
Shifting
Social cognition
Task-switching

ABSTRACT

Humans are quintessentially social, yet much of cognitive psychology has focused on the individual, in individual settings. The literature on joint action is one of the most prominent exceptions. Joint-action research studies the sociality of our mental representations by examining how the tasks of other people around us affect our own task performance. In this paper we go beyond examining whether we represent others and their tasks, by asking whether we also automatically do their tasks with them, even if they require effortful executive functions. To this end we examine one of the core executive functions, shifting, in a new paradigm that allows us to investigate task-switching in a joint-action setup.

1. Introduction

Humans are quintessentially social, yet much of cognitive psychology has focused on the individual, in individual settings. The literature on joint action is one of the most prominent exceptions. Joint-action research studies the sociality of our mental representations by examining how the tasks of other people around us affect our own task performance. In this paper we go beyond examining whether we represent others and their tasks, by asking whether we also automatically do their tasks with them, even if they require effortful executive functions. To this end we examine one of the core executive functions, shifting, in a new paradigm that allows us to investigate task-switching in a joint-action setup.

1.1. Joint action

The groundbreaking research on joint action has demonstrated that our mental representations are more social than cognitive psychologists had traditionally assumed (Gallotti & Frith, 2013; Knoblich, Butterfill, & Sebanz, 2011; but see Dolk, Hommel, Prinz, & Liepelt, 2013). Take, for example, the flanker task, in which a target stimulus is flanked by other stimuli. When target and flankers require the same response, performance is fast and accurate. But when they require different responses, response conflicts may arise, and performance drops. In the joint-action literature, this task was divided between two participants so that each would respond to only one target. There was no reason to expect conflict under such circumstances – after all, each participant could concentrate solely on her simple task. The literature shows, however, that performance dropped when one's target was flanked by the partner's stimuli, thus providing evidence that participants include the partner in their representation of the task (Atmaca, Sebanz, & Knoblich, 2011).

The effects of joint actions have been demonstrated in various paradigms, such as the Simon and the Navon tasks (e.g., Böckler, Knoblich, & Sebanz, 2012; Ruys & Aarts, 2010; Sebanz, Knoblich, & Prinz, 2003; for overviews see Knoblich et al., 2011; Obhi & Sebanz, 2011). The results of experiments in this literature suggest that participants represent their partner's task, and her relevant actions, in a way that is similar to how they represent their own tasks and actions (Knoblich et al., 2011). Given this similarity in representations, performance in these kinds of tasks drops when there is a conflict between *one's required action* and *that of the other participant*. The representation of the other's actions – and the response conflict that this representation brings with it – occurs despite the fact that neither task instructions nor incentives call for this sharing of cognition.

What is the nature of these representations? The modal view in the joint-action literature holds that we represent the *when* and

* Corresponding authors at: Department of Psychology, The Hebrew University, Jerusalem, Israel.

E-mail addresses: veronica.dudarev@mail.huji.ac.il (V. Dudarev), ran.hassin@huji.ac.il (R.R. Hassin).

http://dx.doi.org/10.1016/j.cognition.2015.10.001
0010-0277/

the *what* of our partner's task, i.e., when is it her turn and what should she do (Sebanz & Knoblich, 2009). An alternative view suggests that we only represent the *when* (Wenke et al., 2011). According to this view, the uncertainty regarding whose turn it is to respond can itself create the joint-action effect. As we will argue below, the new paradigm we develop here allows for an improved understanding of the nature of representations during joint-action tasks. The data we will present suggest that knowing *when* is not enough.[1]

1.2. Executive functions and joint actions

Executive functions are a family of general-purpose cognitive processes that allow us to regulate cognition. The main executive functions are inhibition, shifting, and updating of working memory (Meiran, 2010; Miyake et al., 2000), and the modal view holds that they are voluntary, effortful, and consciously controlled (Baddeley, 2003; Norman & Bobrow, 1975). Importantly, given our limited resources (Baddeley & Hitch, 1974; Kahneman, 1973), we can engage in little executive functioning at any given moment (Hassin, 2013; Hassin & Sklar, 2014). Thus, using our executive functions to interact with other people is a costly decision, one that we should carefully consider, simply because scarce resources are better kept to promote one's own goals. However, growing evidence suggests that executive functions can be automatically activated in non-social contexts (Hassin, Bargh, & Zimerman, 2009; Reuss, Kiesel, Kunde, & Hommel, 2011; van Gaal, de Lange, & Cohen, 2012; Zimerman & Hassin, in preparation) as well as social ones (Emberson, Lupyan, Goldstein, & Spivey, 2010).

We conducted two experiments that examine whether joint-action effects extend to executive functions. In other words, we test whether people automatically engage in doing the tasks their partners do even when it requires executive functions. Previous research on executive functions in joint-action conditions has yielded mixed results (Liepelt & Prinz, 2011; Wenke et al., 2011). Yet, we were encouraged by ERP and fMRI studies, which showed increased inhibition in joint-task situations (Sebanz, Knoblich, Prinz, & Wascher, 2006; Sebanz, Rebbechi, Knoblich, Prinz, & Frith, 2007).

We used a task-switching paradigm to examine one of the core executive functions: shifting. In a typical shifting paradigm, participants are asked to perform two simple tasks interchangeably, say, A and B. Some A trials are preceded by A trials (repeat), while others are preceded by B trials (switch). Typically, performance is better on repeat trials; the difference between the two is called *switch cost* (Meiran, 2010).

We distributed a switching task between two participants. Each participant performed only one of the tasks, and did nothing on the trials of the other. There were no incentives – explicit or implicit – to engage in the other person's task. If, despite a lack of incentives, participants represent their partner's task, and engage their executive functions to shift tasks, switch costs should arise. If, conversely, joint-action effects do not extend to executive functions, then there should be no switch costs.

As executive functions are traditionally considered to be conscious and intentional, we also wanted to test whether our participants intended to track their partner's task or felt they did it. We used a debriefing questionnaire at the end of the experiment to collect data about participants' subjective experiences. Throughout this paper, the notion of automaticity is used to refer to unintentional processes that are largely unconscious.

[1] A related challenge to the modal view has recently been proposed by Hommel and colleagues, who demonstrated similar effects in less social or non-social contexts (Dolk, Hommel, Prinz, & Liepelt, 2014; Dolk et al., 2013; Klempova & Liepelt, 2015). We discuss this challenge in Section 4.

2. Experiment 1

In this experiment we compared two conditions. In the social condition, two participants shared a computer. Each performed her task on her trials, and did nothing on the trials of the other participant. In the solo (control) condition there was only one participant, who passively viewed the stimuli when it was not her turn. The design was a 2 (Trial Type: Repeat vs. Switch; within-participant) $\times$ 2 (Condition: Solo vs. Social; between participants).

Our logic was simple. If executive functions are automatically engaged in this joint-action situation, then participants should switch tasks during their partner's turn. Thus, switch costs should be evident in the social condition. If, however, executive functions are not activated by other people, there should be no switch costs in either condition. Both views hold that there should be no switch costs in the control condition. Thus, we hypothesize an interaction.

2.1. Method

2.1.1. Participants

Sixty-two participants (M_{age} = 22) took part in the experiment in exchange for either payment (~$5) or course credit. We consulted with scientists who conduct research on dyad performance, and they advised against running mixed-gender couples. Nonetheless, due to a technical error, seven of our couples were of mixed gender. We have not included their results in the main analyses. Since our experiment ultimately entailed only female couples, we have also excluded five male participants from the non-social group. The pattern of results is little changed when all data are analyzed, although significance levels shift slightly. For analyses that include these data, please see Appendix B.

These procedures have left us with sixteen participants in the social condition and twenty-seven in the control condition. This sample size is similar to those usually used in research on joint actions (e.g., Wenke et al., 2011). The variance in the two conditions was comparable, and this allowed us to use ANOVAs.

2.1.2. Materials and procedure

On each trial, a number from 1 to 9 (excluding 5) appeared on the screen (Koch & Allport, 2006). Each number was framed either by a diamond or by a square, and each frame cued a different task. Participants performed either a parity task (odd or even) or a magnitude task (bigger or smaller than 5), according to the frame. Each trial started with a blank screen for 1 s, followed by the appearance of the frame, and 900 ms later a number appeared in the middle of the frame (see Fig. 1).

In both conditions, participants were instructed to perform only one of the two tasks. Accordingly, they needed only to respond to numbers appearing in "their" frame (Fig. 1). In the solo condition, trials that did not "belong" to the participant stayed on the screen for 750–800 ms. These presentation times were based on the average RT observed in a pilot study involving 10 participants.

In both conditions, we familiarized participants with the two tasks in two single-task practice blocks (48 trials each). The task in the last practice block was always the one to which participants had been assigned. Next, participants performed the main task for 264 trials, divided into four blocks. In the social condition, participants were told that they would perform their task with another participant, and they were asked not to talk to each other. Finally, all participants performed two blocks of full task-switching. In these two blocks, each participant was instructed to respond on all of the trials, i.e., to perform the two tasks interchangeably. Each participant performed practice and full task-switching alone in a cubicle. Upon completion, participants were debriefed.

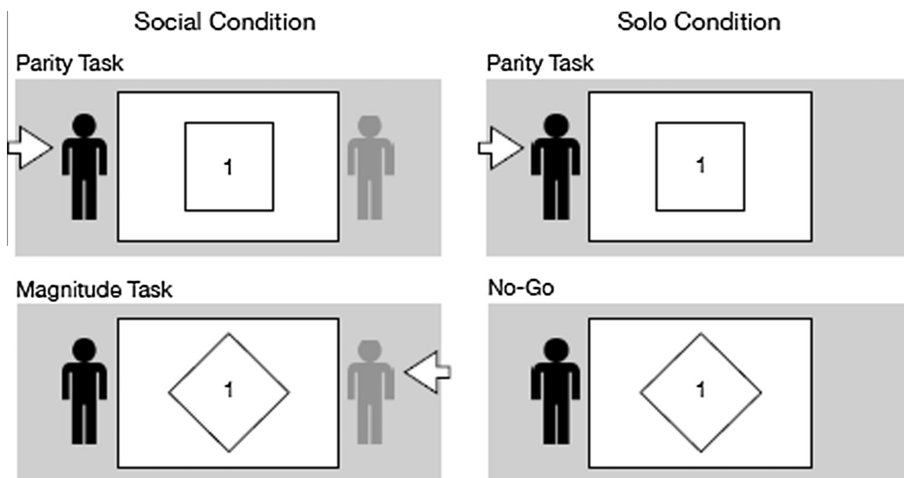

Fig. 1. An illustration of two random trials in Experiment 1. The human figures represent participants; the arrows point to the responding participant (none appeared in the experiment). The task/participant is cued by the square/diamond frame. In the social condition, participant A (black) responds when the frame is the square, and participant B (gray) responds to the diamond. In the solo condition, participant A performs her task alone.

2.2. Results

Responses were coded as repeat (e.g., A preceded by A) or switch (e.g., A preceded by B). All reported analyses use an inverse efficiency score (IES; Heed, Habets, Sebanz, & Knoblich, 2010; Townsend & Ashby, 1983), computed as average RT, divided by the proportion of correct responses. Analyses of RTs and accuracy generally concur; means and standard deviations are presented in Appendix A.

A mixed 2 (Trial Type: Repeat vs. Switch; within-participant) × 2 (Condition: Solo vs. Social; between participants) ANOVA revealed a significant main effect of trial type, $F(1,41) = 14.1$, $p < .001$, $\eta^2_p = .26$, which was qualified by an interaction with condition, $F(1,41) = 13.13$, $p < .001$, $\eta^2_p = .24$. In the social condition, performance on the switch trials was worse than that on repeat trials (in IES units, $M = 630$, $SD = 134$ and $M = 573$, $SD = 98$, respectively; $t(15) = 4.43$, $p < .001$). There was no effect in the solo condition, $t(26) = .11$, $p = .91$. These results show that there were switch costs for participants in the social condition, but not for those in the solo condition. Hence, the data provide support for the idea that our executive functions are automatically recruited by the tasks of other people around us, even when the circumstances do not call for it.

A within-subject analysis of the full task-switching each participant performed in the last part of the experiment revealed a significant effect of trial type, $F(1,41) = 22.12$, $p < .001$, $\eta^2_p = .35$. In both social and solo conditions participants were less efficient on switch than repeat trials (in IES units, $M = 940$, $SD = 303$ and $M = 793$, $SD = 212$, respectively).

2.2.1. Debriefing

Note that, in the social condition, neither the task itself nor the instructions required cooperation. But was there a demand? Did subjects interpret the situation as one in which they were required to attend to the other task? To address this possibility, we asked participants to rate how much attention they had paid to the other task. If indeed participants in the social condition perceived the situation as a demand to attend to the partner's task, or for some reason consciously chose to do so, their ratings should have reflected it. Thus, their ratings should have been higher than those in the control condition.

The data revealed the (un-hypothesized) opposite effect: participants in the social condition reported paying less attention to the other's task than did those in the solo condition, $t(41) = 3.98$, $p < .001$, Cohen's $d = 1.26$ ($M = 3.31$, $SD = 1.85$ and $M = 6.37$, $SD = 2.72$, respectively). These results strongly suggest that the documented behavioral effect is not simply a demand. Moreover, they strongly indicate that engaging one's executive functions during the task was not a conscious, intentional process.

3. Experiment 2

It might be argued that, in the social condition, participants were distracted by the presence of a partner, or that they were sometimes uncertain about whose turn it was, and that these factors lowered their efficiency (Wenke et al., 2011). We refer to these costs as *turn-taking costs*. In order to address this issue, we attempted to isolate turn-taking costs from task-switching costs by adding a condition in which two participants took turns, but they performed an *identical task*. Tracking each other's task in this condition would not result in switch costs, as the task was always the same. Any decline in efficiency should therefore be interpreted as turn-taking cost.

This condition was compared to solo and social different-tasks conditions (identical to Experiment 1), resulting in a 2 (Trial Type: Repeat vs. Switch; within-participant) × 3 (Condition: Solo, Social Same-Task, Social Different-Tasks; between participants) mixed design. If switch costs in Experiment 1 are merely turn-taking costs, they should be identical in the two social conditions. If, however, participants do indeed switch tasks with their partners, switch costs in the social different-tasks condition should be larger than turn-taking costs observed in the same-task condition.

3.1. Method

3.1.1. Participants

Seventy-three participants ($M_{age} = 22.7$) took part in the experiment in exchange for payment (~$3) or credit.

3.1.2. Materials and procedure

The paradigm was identical to that utilized in Experiment 1, with one exception: the numbers and their frames could appear on either a green or a yellow background. As in Experiment 1, the frame shape served as a task cue. The color served as a turn cue. In each pair of participants, one member was instructed to respond to the yellow trials, and the other to the green. By assign-

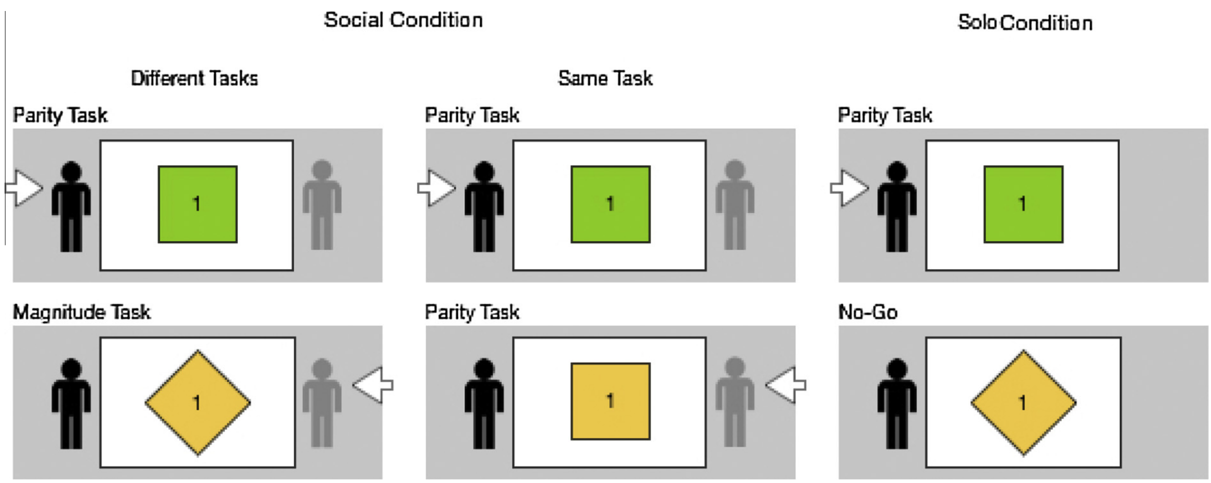

Fig. 2. Two random trials in Experiment 2. The human figures represent participants; the arrows point to the responding participant. The task is cued by the shape of the frame; the background color indicates whose turn it is. In the social condition, participant A (black) responds to a green background and performs the parity task, as cued by the frame. Participant B (gray) responds to a yellow background and performs the *magnitude task* in the different-tasks condition, but the *parity task* in the same-task condition. In the solo condition, participants performed their task alone. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

ing separate cues to (a) tasks and (b) participants' turns, we disentangled task-switching from turn-taking in the social conditions (Fig. 2). As in Experiment 1, participants in the solo condition responded to only half of the trials.

The procedure was identical to that in Experiment 1. We added a manipulation check to the debriefing, asking participants to identify their partner's task.

3.2. Results

Sixteen participants failed the manipulation check: they could not recall their partner's task. Put differently, they did not manifest the basic knowledge required to be a participant in this study (i.e., it was inherently unclear whether they belonged to the same-task or different-tasks condition, or neither). They were therefore excluded from all analyses. One participant performed at chance in the full task-switching, and was excluded as well. The exclusions left us with only one male participant in the *social different-tasks* condition, and none in the *social same-task* condition. All male participants were therefore excluded from the main analyses (the pattern of results is similar with male participants; for analyses that include these data, please see Appendix C). The analyses here present the data of nineteen female participants in the *solo condition*, thirteen in the *social same-task* condition, and thirteen in the *social different-tasks* condition.

Responses were coded as repeat or switch. As in Experiment 1, all analyses used IES. Descriptive statistics of RTs and accuracy are presented in Appendix A.

A 2 (Trial Type: Repeat vs. Switch; within-participant) × 3 (Condition: Solo, Social Same-Task, or Social Different-Tasks; between participants) ANOVA revealed a significant main effect for trial type, $F(1,42) = 8.35$, $p = .006$, $\eta^2_p = .17$, which was qualified by a significant interaction with condition, $F(2,42) = 12.5$, $p < .001$, $\eta^2_p = .37$. Switch cost emerged in the social different-tasks condition, $t(12) = 3.31$, $p = .006$, but not in the social same-task condition, $t(12) = 1.31$, $p = .21$. In the solo condition, switching benefit was revealed: switch trials appeared to be *easier* in this condition than repeat trials, $t(18) = 3.13$, $p = .006$. This latter result was not revealed in Experiment 1, and neither did we hypothesize it. It may reflect the advantage of taking breaks during some trials, but the exact interpretation and meaning are unclear.

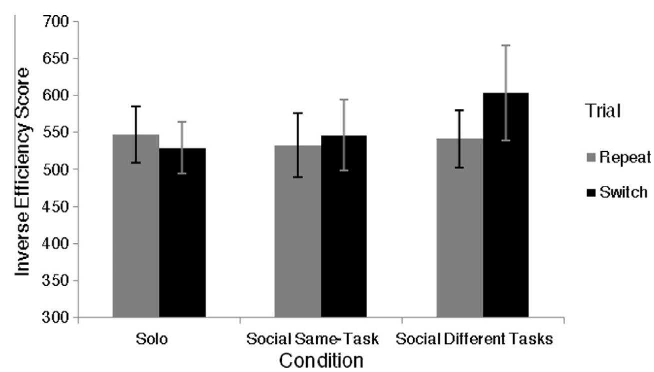

Fig. 3. Mean IES in Experiment 2. Error bars represent one standard deviation.

Most important, a 2 (Trial Type) × 2 (Condition: Social Same vs. Social Different) analysis shows that switch cost was stronger in the social different-tasks condition than in the social same-task condition, $F(1,24) = 5.15$, $p = .03$, $\eta^2_p = .18$ (see Fig. 3).

Taken together, these results show that switch costs were evident only when there was a partner in the cubicle *and* when she performed a different task. This suggests that we automatically engage our executive functions with others around us. The mere fact that participants take turns does not, in itself, create switch costs.

As in Experiment 1, at the end of the experiment all participants performed full task-switching and displayed significant switch costs, $F(1,40) = 39.4$, $p < .001$, $\eta^2_p = .496$, $M_{switch} = 1012$, $SD_{switch} = 384$, $M_{repeat} = 837$, $SD_{repeat} = 280$.

3.2.1. Debriefing

Participants were asked how much they had focused on the other task. If our behavioral results reflect a demand, participants in the social conditions should report that they were more focused on their partner's task than those in the control condition. This did not happen, both *ps* > .19. Interestingly, the answers revealed a significant difference between the two social conditions, $t(24) = 2.2$, $p = .04$, Cohen's $d = .86$ ($M_{same\text{-}task} = 7.54$, $SD_{same\text{-}task} = 1.33$ and $M_{different\text{-}tasks} = 5.69$, $SD_{different\text{-}tasks} = 2.72$). Participants in the different-tasks condition felt less involved in the other's task – a pattern that was opposite in nature to their actual performance.

Thus, as in Experiment 1, participants' self-reports are opposite to those expected by a conscious, intentional view of executive functions. The results of the two experiments strongly suggest that executive functions are spontaneously activated in social situations.

4. Discussion

Two experiments examined whether people automatically shift to and from tasks of people around them. Both experiments revealed switch costs in social situations, even when the task of the other participant was neither explicitly nor implicitly relevant to one's own task. This result suggests that people track others' tasks and mentally do it with them, even when doing it engages effortful and costly executive functions, is neither implicitly nor explicitly rewarded, and is harmful to one's own task performance.

4.1. Joint action and executive functions

The results of the present study suggest that people not only represent the task sets of others, but that they also, in a sense, perform these tasks with them. They switch from their own task to that of the partner and back again, utilizing one of the most effortful executive functions: shifting. As data from debriefings suggest, participants were not aware of the extra attention they had paid to the partner's tasks. Thus, using executive functions to track other people's actions seems to be an unintentional process that is largely unconscious.

The modal view of executive functions holds that they are voluntary, effortful, and consciously controlled (Baddeley, 2003; Norman & Bobrow, 1975). Importantly, given our limited resources (Baddeley & Hitch, 1974; Kahneman, 1973), we can engage in little executive functioning at any given moment (Hassin, 2013; Hassin & Sklar, 2014). Thus, using our executive functions to interact with other people is a costly decision, one that we should carefully consider, simply because scarce resources are better kept to promote one's own goals. We call this view the *individualistic by default* view. Its main tenant is that executive functions will not be activated by others around us, unless we consciously decide to do so.

A more social perspective, however, suggests that executive functions may sometimes be automatically recruited by people around us. The present study provides initial evidence for a more social view. The social activation and engagement of executive functions might be one of the building blocks of our shared reality, and a way of increasing the power of the group by having many involved and investing resources. What the functions are of this "recruitment" of one's executive functions by others, and what advantages and prices come with it, are fascinating questions left open for future research.

4.2. Two potential challenges

The switching costs documented in the joint-action settings were weaker than those incurred in individual performance of the standard task-switching. This may reflect a difference between how we represent other's tasks and how we represent our own, but it doesn't have to be the case. Several studies on individual task-switching demonstrate reduced switch costs after the inhibition of a response on a previous trial (Koch & Philipp, 2005; Meiran, 2010). Since all switch trials in our studies were preceded by a partner's trial, i.e., trials in which the participant has had to withhold her response, it may be that it is this inhibition that reduced the switch costs. This question can be addressed in future research.

Before we conclude we would like to address two points. First, one alternative interpretation of our results holds that people do not track others' tasks, but merely encode others' stimulus–response associations, and those create interference (see, e.g., Kim & Hommel, 2015). In other words, each stimulus becomes associated with two responses: that dictated by one's own task and that produced by the partner. Though the experiments reported here were not designed to test this hypothesis, the data allows us to test it post hoc.

The two tasks used here require the same response for some stimuli, but not for others. For instance, 1 and 3 are both odd and smaller than five. Given how we set up the response keys for the different conditions, these numbers require the same response regardless of the task, whereas the numbers 2 and 4 require different responses depending on the task. If participants were distracted by incompatible stimulus–response associations of their partner, the cost would be evident ***only*** for the stimuli that require different responses. Crucially, however, this was not the case: switch costs were significant both for stimuli that required different responses and for those that required identical responses, $t_{different}(12) = 3.17$, $p = .008$, *Cohen's* $d = .56$ and $t_{identical} = 3.29$, $p = .006$, *Cohen's* $d = .55$ (the switch costs were not significantly different, $p = .076$). It therefore seems unlikely that the costs observed in the second experiment were caused solely by stimulus–response associations. Rather, they resulted from participants' shifting to and from their partner's task.[2]

Another general challenge to the interpretation of the results in joint-action settings was recently proposed by Hommel and colleagues, who demonstrated joint-action-like effects in less social or non-social contexts (Dolk et al., 2013, 2014; Klempova & Liepelt, 2015). We believe the paradigm we introduce here might shed light on this question. We argue that participants do more than represent others' actions. In addition, they represent others' *mental* tasks and act on them, too. Testing the limits of this paradigm in joint-action settings may shed light on the sociality of our mental representations.

Funding

This work was supported by a scholarship from the Ministry of Aliyah and Immigrant Absorption of Israel (to V. Dudarev).

Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.cognition.2015.10.001.

References

Atmaca, S., Sebanz, N., & Knoblich, G. (2011). The joint flanker effect: Sharing tasks with real and imagined co-actors. *Experimental Brain Research, 211*, 371–385. http://dx.doi.org/10.1007/s00221-011-2709-9.

Baddeley, A. (2003). Working memory: Looking back and looking forward. *Nature Reviews Neuroscience, 4*(10), 829–839. http://dx.doi.org/10.1038/nrn1201.

Baddeley, A. D., & Hitch, G. (1974). Working memory. *Psychology of Learning and Motivation, 8*, 47–89. http://dx.doi.org/10.1016/S0079-7421(08)60452-1.

Böckler, A., Knoblich, G., & Sebanz, N. (2012). Effects of co-actor's focus of attention on task performance. *Journal of Experimental Psychology: Human Perception and Performance, 38*, 1404–1415. http://dx.doi.org/10.1037/a0027523.

Dolk, T., Hommel, B., Prinz, W., & Liepelt, R. (2013). The (not so) social Simon effect: A referential coding account. *Journal of Experimental Psychology: Human Perception and Performance, 39*, 1248–1260. http://dx.doi.org/10.1037/a0031031.

Dolk, T., Hommel, B., Prinz, W., & Liepelt, R. (2014). The joint flanker effect: Less social than previously thought. *Psychonomic Bulletin & Review, 21*, 1224–1230. http://dx.doi.org/10.3758/s13423-014-0583-8.

[2] We thank Bernhard Hommel for drawing our attention to this potential mechanism.

Emberson, L. L., Lupyan, G., Goldstein, M. H., & Spivey, M. J. (2010). Overheard cell-phone conversations when less speech is more distracting. *Psychological Science, 21*, 1383–1388. http://dx.doi.org/10.1177/0956797610382126.

Gallotti, M., & Frith, C. D. (2013). Social cognition in the we-mode. *Trends in Cognitive Sciences, 17*, 160–165. http://dx.doi.org/10.1016/j.tics.2013.02.002.

Hassin, R. R. (2013). Yes it can: On the functional abilities of the human unconscious. *Perspectives on Psychological Science, 8*, 195–207. http://dx.doi.org/10.1177/1745691612460684.

Hassin, R. R., Bargh, J. A., & Zimerman, S. (2009). Automatic and flexible: The case of non-conscious goal pursuit. *Social Cognition, 27*, 20–36. http://dx.doi.org/10.1521/soco.2009.27.1.20.

Hassin, R. R., & Sklar, A. Y. (2014). The human unconscious – A functional perspective. In J. W. Sherman, B. Gawronski, & Y. Trope (Eds.), *Dual-process theories of the social mind* (pp. 299–313). New York, NY: Guilford Press.

Heed, T., Habets, B., Sebanz, N., & Knoblich, G. (2010). Others' actions reduce crossmodal integration in peripersonal space. *Current Biology, 20*, 1345–1349. http://dx.doi.org/10.1016/j.cub.2010.05.068.

Kahneman, D. (1973). *Attention and effort*. Engelwood Cliffs, NJ: Prentice-Hall.

Kim, D., & Hommel, B. (2015). An event-based account of conformity. *Psychological Science, 26*, 484–489. http://dx.doi.org/10.1177/0956797614568319.

Klempova, B., & Liepelt, R. (2015). Do you really represent my task? Sequential adaptation effects to unexpected events support referential coding for the joint Simon effect. *Psychological Research*, 1–15. http://dx.doi.org/10.1007/s00426-015-0664-.

Knoblich, G., Butterfill, S., & Sebanz, N. (2011). Psychological research on joint action: Theory and data. In B. Ross (Ed.). *The Psychology of Learning and Motivation* (Vol. 54, pp. 59–101). Burlington, MA: Academic Press. http://dx.doi.org/10.1016/B978-0-12-385527-5.00003-6.

Koch, I., & Allport, A. (2006). Cue-based preparation and stimulus-based priming of tasks in task switching. *Memory and Cognition, 34*, 433–444. http://dx.doi.org/10.3758/BF03193420.

Koch, I., & Philipp, A. M. (2005). Effects of response selection on the task repetition benefit in task switching. *Memory & Cognition, 33*(4), 624–634. http://dx.doi.org/10.3758/BF03195329.

Liepelt, R., & Prinz, W. (2011). How two share two tasks: Evidence of a social psychological refractory period effect. *Experimental Brain Research, 211*(3–4), 387–396. http://dx.doi.org/10.1007/s00221-011-2703-2.

Meiran, N. (2010). Task switching: Mechanisms underlying rigid vs. flexible self-control. In R. R. Hassin, K. N. Ochsner, & Y. Trope (Eds.). *Self-control in society, mind and brain* (pp. 202–220). New York: Oxford University Press.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49–100. http://dx.doi.org/10.1006/cogp.1999.0734.

Norman, D. A., & Bobrow, D. G. (1975). On data-limited and resource-limited processes. *Cognitive Psychology, 7*, 44–64. http://dx.doi.org/10.1016/0010-0285(75)90004-3.

Obhi, S. S., & Sebanz, N. (2011). Moving together: Toward understanding the mechanisms of joint action. *Experimental Brain Research, 211*, 329–336. http://dx.doi.org/10.1007/s00221-011-2721-0.

Reuss, H., Kiesel, A., Kunde, W., & Hommel, B. (2011). Unconscious activation of task sets. *Consciousness and Cognition, 20*(3), 556–567. http://dx.doi.org/10.1016/j.concog.2011.02.014.

Ruys, K. I., & Aarts, H. (2010). When competition merges people's behavior: Interdependency activates shared action representations. *Journal of Experimental Social Psychology, 46*, 1130–1133. http://dx.doi.org/10.1016/j.jesp.2010.05.016.

Sebanz, N., & Knoblich, G. (2009). Prediction in joint action: What, when, and where. *Topics in Cognitive Science, 1*, 353–367. http://dx.doi.org/10.1111/j.1756-8765.2009.01024.x.

Sebanz, N., Knoblich, G., & Prinz, W. (2003). Representing others' actions: Just like one's own? *Cognition, 88*, B11–B21. http://dx.doi.org/10.1016/S0010-0277(03)00043-X.

Sebanz, N., Knoblich, G., Prinz, W., & Wascher, E. (2006). Twin peaks: An ERP study of action planning and control in co-acting individuals. *Journal of Cognitive Neuroscience, 18*, 859–870. http://dx.doi.org/10.1162/jocn.2006.18.5.859.

Sebanz, N., Rebbechi, D., Knoblich, G., Prinz, W., & Frith, C. D. (2007). Is it really my turn? An event-related fMRI study of task sharing. *Social Neuroscience, 2*, 81–95. http://dx.doi.org/10.1080/17470910701237989.

Townsend, J. T., & Ashby, F. G. (1983). *The stochastic modeling of elementary psychological processes*. CUP Archive.

van Gaal, S., de Lange, F. P., & Cohen, M. X. (2012). The role of consciousness in cognitive control and decision making. *Frontiers in Human Neuroscience, 6*, 121. http://dx.doi.org/10.3389/fnhum.2012.00121.

Wenke, D., Atmaka, S., Hollander, A., Liepelt, R., Baess, P., & Prinz, W. (2011). What is shared in joint action? Issues of co-representation, response conflict, and agent identification. *Review of Philosophy and Psychology, 2*, 147–172. http://dx.doi.org/10.1007/s13164-011-0057-0.

Zimerman, S., & Hassin, R. R. (2015). Implicit motivation makes the brain grow younger: Improving executive functions of older adults [in preparation].