# The Effects of Racial Similarity and Dissimilarity on the Joint Simon Task

**Steve Croker (s.croker@ilstu.edu), J. Scott Jordan (jsjorda@ilstu.edu),**
**Daniel S. Schloesser (dschloe@ilstu.edu), Vincent Cialdella (vtciald@ilstu.edu)**
Department of Psychology, Illinois State University
Campus Box 4620
Normal, IL 61790-4620 USA

### Abstract

We examined the effects of individual versus joint action and racial similarity and dissimilarity on a Simon task using mouse tracking to explore the implicit cognitive dynamics underlying responses. Participants were slower to respond when working with a partner than when working alone, and their mouse movements also differed across conditions. Participants paired with a different-race partner took longer to respond than participants paired with a same-race partner. We argue that, in the joint conditions, participants' longer responses were the result of automatic inhibitory processes that arise within the social context.

**Keywords:** Joint action; Simon effect; Mouse tracking

The Simon Effect is an increase in reaction times that occurs when a stimulus dimension (e.g., color) primes one response (e.g., press right for green) while the stimulus' spatial location primes another (e.g., the green stimulus appears on the left of the screen). Sebanz, Knoblich, and Prinz (2003) found a Simon Effect for dyads by presenting a picture of a hand wearing a ring pointing to the left or right. Response buttons were located to the left or right of the screen. A joint Simon effect (Dolk et al., 2014) emerged when the participants did the task together by responding to one component of the stimulus (e.g., one participant responded right to a green ring, the other, left to a red ring). In this paradigm, each trial was effectively a go/no-go trial for each participant. Participants generated a response when the stimulus was the appropriate color (i.e., a "go" trial), and did not generate a response when the stimulus did not match the target color (i.e., a "no-go" trial). Response times (RTs) to the ring stimulus were significantly longer if the finger pointed in the direction opposite the response option indicated by the color of the ring (e.g., participant responds with a right press and the finger points to the left). Interestingly enough, this Simon effect did not occur if a participant completed the same "go/no-go" type task alone. Whether or not the response primed by the color of the ring and the direction the finger pointed were the same (a *compatible* trial) or different (an *incompatible* trial), only mattered when the participant did the task with another person. Sebanz et al. (2003) proposed that the Simon effect emerged in the joint condition and not the individual condition because, during the former, participants automatically represented the action option of their partner (i.e., action co-representation). As a result, when their partner's co-represented action conflicted with their own action, a response conflict emerged. Different authors have proposed different accounts of (1) the content entailed in the representation of the 'other' in joint action tasks, as well as (2) the degree of automaticity with which such co-representations are constructed. Sebanz, Knoblich, and Prinz (2005) assert that the content regarding the other is formatted in terms of the other's stimulus-response mapping (e.g., press the right button in response to a green stimulus), what they referred to as *task co-representation*. Sebanz et al. (2005) assert such representations are constructed quasi-automatically due to the neural overlap in systems involving action planning and action perception. On the other hand, Hommel, Colzato, and Wildenberg (2009) propose that co-representations are constructed separately (i.e., not as part of an overall shared task representation), and influence each other as a function of the relationship between the co-actors (i.e., either a positive or a negative relationship). Hommel et al.'s account is based on a manipulation whereby participants were paired with a "nice" confederate, or an "intimidating" confederate. RTs were faster for the latter group, and there was no spatial compatibility effect.

As is clear in the studies mentioned above, most research to date has focused on the content and the necessity of co-representation. However, despite their differences, both of the above-mentioned frameworks make the assertion that representing the 'other' leads to a response conflict. Both accounts also assert that response conflict is overcome by inhibiting the inappropriate response. Given the important role that inhibition is assumed to play in such tasks, the purpose of the present study was to introduce variables into a joint Simon task that might vary the amount of inhibition generated prior to response execution. Consistent with the ego depletion model, additional inhibitory demands may affect the participants' ability to inhibit the incorrect response (Lurquin, McFadden, & Harbke, 2014). Thus, like Sebanz et al. (2005) we asked participants to complete the joint action task by giving them a color task (i.e., respond to the right for a green ring) either alone, or with a confederate who was given either (1) a color task—the *joint-color condition* (i.e., respond to the left for a red ring), or a direction task—the *joint-direction condition* (i.e., the confederate responds to the direction of the pointing hand). Sebanz et al. (2005) originally utilized the joint direction condition to investigate whether or not an action conflict would arise when a stimulus primed a competing response for both participants even though the two were responding to different stimulus dimensions (e.g., a right-pointing finger wearing a green ring primes the "color-task" participant for a right response, and the "direction-task" primes a left response because the former responds right to a green ring, while the latter responds left to a right-pointing

finger). Results revealed that RTs were significantly longer on trials in which the stimulus primed responses for both participants. Sebanz et al. (2005) interpreted these data to imply that co-representation is practically automatic, regardless of whether or not the other's task is relevant to one's own. To further test this idea, we asked our participants to respond on every trial (i.e., respond right if the ring is green, or respond left if it is not green) instead of responding in the go/no-go fashion of Sebanz et al.'s (2005) participants. As a result, in our joint direction condition participants responded to color while the confederate responded to direction, and half of the trials were conflict trials (i.e., the stimulus primed opposite responses), while the other half were non-conflict trials. If co-representation of the 'other' is automatic, RTs should be slower in conflict trials. If no such difference occurs, it might indicate that the co-representation revealed in Sebanz et al. (2005) was contingent upon their go/no-go method.

To further manipulate inhibition, we systematically varied the in-group/out-group status of the pair (i.e., participants worked with a confederate who was from the same or a different racial group). He, Lever, and Young (2011) examined joint action effects on memory-based guidance of attention, and found that in-group and out-group relations modulated these effects. An in-group/out-group manipulation activates inhibition that is context relevant (i.e., one is currently in the presence of an out-group member), but completely task irrelevant. If such inhibition were to influence RTs in a joint-Simon task, it might encourage us to move our explanation of the joint Simon effect away from the content and automaticity of co-representations toward a focus on inhibition and the multi-scale social factors one must continuously navigate and regulate (i.e., who one allows to influence oneself) during any social interaction (Jordan & Wesselmann, 2014).

In addition to the above-mentioned differences between the Sebanz et al. (2005) paradigm and ours, instead of responding with button presses, participants indicated responses (i.e., right or left) using a computer mouse to move a cursor from a bottom-center location to a target symbol in either the left or right upper corner of the computer screen. In recent years, mouse trajectory recording has emerged as a technique for recording an implicit measure; specifically, the temporal motor dynamics of response choice. Mouse trajectories can illustrate the differences in hand movements across experimental conditions. In the Simon task, it is rare for participants to make an error: participants will almost always select the appropriate response. However, they may be differentially attracted to the distracter response, particularly on trials on which the spatial component of the stimulus is incompatible with the target response (e.g., the correct response is to the right, but the stimulus points to the left). On *compatible* trials, cursor trajectories should be attracted toward a single strong *attractor basin* in the state space for that problem. On *incompatible* trials there will be more competition between the two stimuli, because two responses have been primed,

and there will be greater deviation towards the distracter response (e.g., the correct response is right, but the hand points left). Such a finding can be interpreted as revealing an evolving response in which the activations of multiple competing and conflicting implicit evaluations change over time until the activation of one judgment inhibits others and resolves into an explicit response (e.g., Wojnowicz, Ferguson, Dale, and Spivey, 2009). Mouse tracking has been used in several social and cognitive domains, such as race categorization (Freeman, Pauker, Apfelbaum, & Ambady, 2010) and recognition memory (Papesh & Goldinger, 2012). However, there has been no research to date on the Simon task using this method. An analysis of mouse movements allows us to examine the cognitive dynamics underlying response choices in both individual and joint conditions of the Simon task, and it reveals aspects of the time-course of response inhibition that are difficult, if not impossible, to find with RTs.

## Method

Fifty undergraduate students from Illinois State University volunteered as participants for extra course credit. Participants identified themselves as belonging to the following racial categories: white (40), black (3), Asian (2), Hispanic (2), and other (3).

Stimuli consisted of a set of four images, and one image appeared center screen on each trial. Every image was comprised of two stimulus dimensions: hand direction and ring color. In each trial, a hand was presented pointing either left or right wearing a ring that was either green or red. This yields four possible stimulus combinations: left-pointing hand/green ring, left-pointing hand/red ring, right-pointing hand/green ring, and right-pointing hand/red ring (see Figure 1).

This experiment utilized the Sebanz et al. (2005) hand-pointing/ring color paradigm. At the beginning of each trial, participants were required to use the mouse to click a "start" button at the bottom of the screen, after which a stimulus and two response options were presented and remained on the screen until a response was selected. Participants were told to always click on the checkmark at the right of the screen if the ring was green, and click on the X at the left of the screen if the ring was not green. If participants took longer than 1000 ms to begin moving the mouse, a message was presented informing them to start responding earlier in



Figure 1. Screenshot of the experiment.

the trial. On trials in which participants responded incorrectly, a red X was presented in the center of the screen for 1000 ms. On trials in which a correct response was made, participants were presented with the next trial. After completing four practice trials, participants completed three blocks (100 trials each) of the Sebanz et al. task. In each block, all four images (left-pointing hand/green ring, left-pointing hand/red ring, right-pointing hand/green ring, and right-pointing hand/red ring) were presented 25 times each in a randomized order. In the *individual* block participants completed this task on their own. In the other two blocks, participants sat to the right of a confederate and were told that their partner would respond on every trial to the same stimuli at the same time using a response box, but that the partner was following a different rule. One of our confederates was black and one was white; depending on the race of the participant, each dyad was coded as same-race or different-race (e.g., a white participant with a black confederate is a different-race dyad). In the *joint-color* block, the confederate's rule was to press a button on the left of a button box (corresponding to the X at the left of the screen) if the ring was red, and press the right button if the ring was green. In the *joint-direction* block the confederate's rule was to press the left button if the hand was pointing in a particular direction, and the right button for the opposite direction. For half the participants, the confederate responded left to left-pointing hands, and for the other half, left for right-pointing hands. The order of the three blocks (individual, joint color, joint direction) was counterbalanced across participants.

## Design and Analyses

The dependent variables were *response time*, *maximum deviation* from an idealized trajectory toward the correct response, and *time to maximum proximity* to the distracter. Maximum deviation is computed by comparing the *x,y* coordinates of observed mouse trajectories for each trial with a direct line between the start button and the correct response. The greatest distance between the actual and idealized trajectories is the maximum deviation. Only correct responses were included for analysis. In order to compare trajectories we inverted all left-target trajectories, such that all correct responses are mapped to the right side of the screen. In order to compare multiple trials of differing lengths across and within participants, all individual trajectories were normalized to 101 timesteps. This method allows one to examine participants' ongoing cognitive dynamics as they decide which response to select. Time to maximum proximity is the point in time at which each trajectory was closest to the distracter response choice. For this analysis we used raw time data, sampled at 50Hz, rather than normalized data. We the recorded average *x,y* coordinates every 20ms for each participant's responses on each of the three tasks, separated into spatially compatible and incompatible trials. For each timestep, we divided the Euclidean distance between the mouse position and the distracter by the distance between the start button and the

distracter, and then subtracted the result from 1, yielding a measure of proportional proximity to the distracter at each timestep. From these data, we were able to find the point in time at which each participant's responses were closest to the distracter.

## Results

### Response Times

Response times (RTs), defined as the time between clicking the start button and clicking on one of the two response options, were analyzed using a 2 (dyad race: same or different) x 3 (task: individual, joint-color, joint-direction) x 2 (stimulus: compatible or incompatible) ANOVA (see Figure 2). There was a main effect of spatial compatibility, $F(1,48) = 36.02$, $p < .001$, $\eta_p^2 = .429$, in that participants were faster on compatible trials (i.e., the direction of the finger and the color of the ring implied the same spatial location) than incompatible trials. There was also a main effect of task, $F(2,96) = 11.35$, $p < .001$, $\eta_p^2 = .191$, in which participants were faster in the individual condition than in the joint conditions. Pairwise comparisons revealed no significant difference in RTs between the two joint tasks. There was also a main effect of dyad race, $F(1,48) = 4.32$, $p = .043$, $\eta_p^2 = .083$, in that participants were faster in the same race dyad condition. This effect of race interacted with task, $F(2,96) = 3.56$, $p = .032$, $\eta_p^2 = .069$, such that RTs were only faster in the individual versus the joint conditions for participants in a different race dyad.

### Maximum Deviations

Maximum deviations (MDs) were analyzed using a 2 (dyad race: same or different) x 3 (task: individual, joint-color, joint-direction) x 2 (stimulus: compatible or incompatible) ANOVA (see Figure 3). There was a main effect of spatial compatibility on MD, $F(1,48) = 185.64$, $p < .001$, $\eta_p^2 = .795$. Participants made relatively linear mouse movements towards the correct response on compatible trials, compared to incompatible trials. There was also a main effect of task, $F(2,96) = 30.70$, $p < .001$, $\eta_p^2 = .390$. Pairwise comparisons revealed that MDs were significantly larger on the individual task than the joint tasks. MDs did not differ between the joint direction and joint color tasks. A task x spatial compatibility interaction, $F(2,96) = 4.06$, $p = .020$, $\eta_p^2 = .078$, revealed greater differences between the individual and joint tasks for trials on which the stimulus was spatially incompatible with the response. There was no main effect of, or interactions with, dyad race.

### Action Co-representation

According to Sebanz et al. (2005), the Joint Simon effect occurs because participants automatically represent the action option of their partner, even if the two respond to different stimulus dimensions. To address whether or not this finding generalizes beyond Sebanz et al.'s (2005) go/no-go paradigm, we examined whether there were differences between *conflict* trials (i.e., the participant and confederate made different responses) and *no-conflict* trials
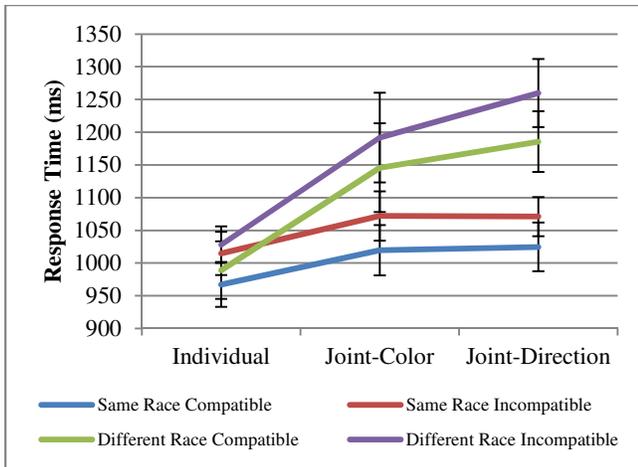
Figure 2. Response times, with standard error bars.



Figure 3. Maximum deviations, with standard error bars.

(i.e., both participant and confederate responded to the left or to the right). All joint-color trials are no-conflict trials as, if the ring is red, the confederate and partner both select left, and if the ring is green, both select right. In the joint-direction condition, some trials are conflict trials, and some are no-conflict trials. We distinguish between conflict and no-conflict trials by focusing on the confederate's task (i.e., either left responses to left pointing fingers, or left responses to right-pointing fingers). If the confederate is tasked with making *left responses to left-pointing fingers*, then trials that are spatially compatible for the participant (e.g., right pointing finger/green ring) are no-conflict trials for the dyad because both members make responses to the same spatial location (e.g., both press right for a green ring on a right-pointing finger), while trials that are spatially incompatible for the participant (e.g., left pointing finger/green ring), are conflict trials because the members make responses to different spatial locations (e.g., a green ring on a left-pointing hand leads to a right response for the participant and a left response for the confederate). This pattern of conflict and no-conflict trials is reversed if the confederate is tasked with the opposite mapping (i.e., *left responses to right-pointing fingers*) because spatially compatible trials for the participant are conflict trials for the dyad (i.e., the members make responses to different spatial locations) and spatially incompatible trials for the participant are no-conflict trials for the dyad (i.e., both members make the same response).

In order to examine whether participants responded differentially on conflict trials, we conducted mixed ANOVAs on the joint-direction condition, with confederate task (left for *left*-pointing hands or left for *right*-pointing hands) and spatial compatibility for the participant as the independent variables. Given that each confederate task entailed conflict trials, with the conflict occurring in the incompatible trials for the left to left-pointing hands condition, and the compatible trials for left to right-pointing hand conditions, an action conflict between the participant and the confederate should increase RTs in the conflict
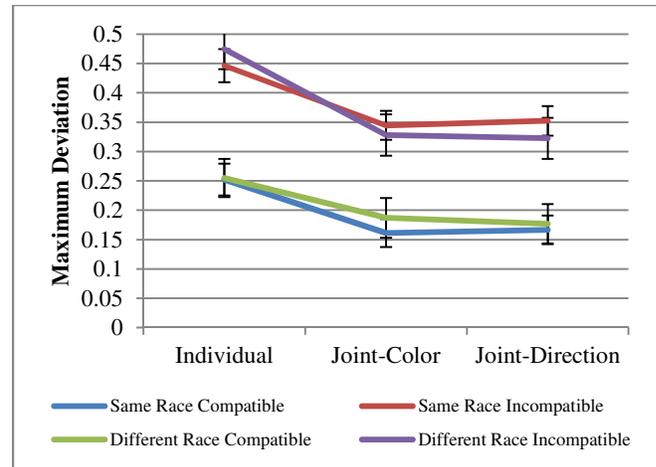
trials, leading to an interaction between task and compatibility. We found no such interaction for RT, $F(1,48) = 2.08$, $p = .156$, $\eta_p^2 = .042$, or MD, $F(1,48) = .42$, $p = .522$, $\eta_p^2 = .009$.

## Time to Maximum Proximity to Distracter

As described above, we computed the average proportional proximity to the distracter on each task, separated for compatible and incompatible trials, yielding six timepoints (3 tasks x 2 spatial compatibility) per participant. Times to maximum proximity (TMP) were analyzed using a 2 (dyad race: same or different) x 3 (task: individual, joint-color, joint-direction) x 2 (stimulus: compatible or incompatible) ANOVA (see Figure 4). There was a main effect of compatibility, $F(1,48) = 4.34$, $p = .043$, $\eta_p^2 = .083$, such that participants were quicker to reach MP on compatible trials than on incompatible trials. There was also a main effect of task, $F(2,96) = 7.48$, $p = .001$, $\eta_p^2 = .135$. Pairwise comparisons revealed that TMP was earlier on the individual task than either of the joint tasks, and there was no difference between the joint-color and joint-direction tasks. There were also no significant effects involving dyad race. This latter fact is worth noting, for it reveals that while participants in same- and different-race dyads reached MP at roughly the same time, the *overall* RTs were different, with participants in different-race dyads talking longer in the joint-direction versus the joint-color task, and participants in the same-race dyads expressing no such increase. Collectively, these TMP and RT findings reveal that the overall RT differences between participants in same- and different-race dyads emerged later in the trial, *after* the participant had reached the TMP.

## Discussion

As expected, the spatial compatibility of a stimulus had an effect on RTs; this is the basic Simon effect whereby participants take longer to respond to stimuli with conflicting spatial and non-spatial cues. In addition, the

Simon effect was present in all three task-conditions. This pattern of differences was basically replicated in the MD data, with incompatible trials producing larger MDs in all three task-conditions. Collectively the RT and MD data reveal the presence of a Simon effect in all three conditions, with longer RTs being at least partially due to the generation of mouse trajectories that were more robustly attracted to the stimulus-primed, incompatible response.

The finding of a Simon effect in all three conditions is counter to Sebanz et al.'s (2003) finding of a Simon effect in their joint condition, but not in their individual condition. This difference is probably due to the fact that participants in our study made a response on every trial, whereas participants in the Sebanz et al. (2003) study only responded when their target stimulus was presented (e.g., respond right to a green ring). Given their participants were participating in a go/no-go fashion, while ours were responding on every trial, our participants may have been more vulnerable to a Simon effect because they conceptualized both responses primed by an incompatible trial (e.g., green ring on left-pointing finger) as being "their" responses, simply because they were required to be prepared to make either response on every trial. Sebanz et al.'s (2003) participants were able to conceptualize the task in terms of only one response because they had been trained to complete a go/no-go task.

On the one hand, these findings seem obvious, for the very point of the go/no-go method of Sebanz et al. (2003) was to test for the presence of the Simon effect in the joint condition, and if they had found a Simon effect in their go/no-go individual condition, there would have been nothing remarkable about finding it in the joint condition. On the other hand, by having participants in our experiment make responses on every trial, we were able to test whether Sebanz et al.'s (2005) finding that participants' RTs were longer in the joint condition when the stimulus primed responses for both participants, even though both were responding to different stimulus dimensions (i.e., color and direction), was contextually dependent on their go/no-go method. Given that we found no significant differences in RTs between conflict and no-conflict trials, it seems that asking our participants to respond on every trial prevented a stimulus that primed opposite responses for the participant and the confederate from producing an action conflict. This result implies that the action conflict experienced by Sebanz et al.'s (2005) participants was contextually contingent upon the go/no-go method. More experiments are needed to confirm this conclusion, but the finding is consistent with other joint action research (Hommel et al, 2009) that revealed shorter RTs and no Simon effect in the joint condition when the confederate was an intimidating co-actor versus a nice co-actor. In short, while activating a co-actor's response option seems to be an automatic process, whether or not the automatic activation occurs seems to be a contextually contingent phenomenon.

In addition to finding a Simon effect for RTs and MDs in all three task-conditions, we further found that while RTs were significantly larger in the joint versus the individual
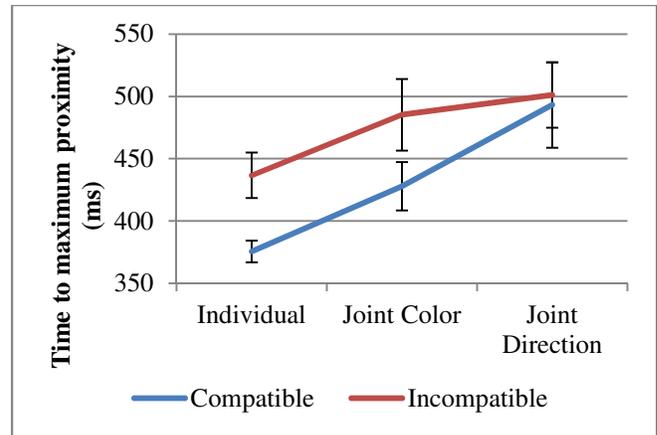


Figure 4. Time to maximum proximity to distracter.

conditions—replicating Sebanz et al's (2003) finding—MDs were actually *smaller* in the joint conditions. That fact that participants took more direct routes to the answer location (i.e., smaller MDs) in the joint conditions, yet took longer to get there (i.e., longer RTs) implies that the longer RTs were not due to the distractor, as longer RTs due to the distractor should have been associated with larger, not smaller, MDs. Rather, it may be the case that the longer RTs were due to the presence of another person during task performance. That is, simply by being in the room with another person, as opposed to being alone, participants took longer to reach the response location because their overall level of automatic inhibition was higher. This interpretation is consistent with a host of findings in developmental psychology, social psychology, and neuroscience (Asendorpf, 1990; Dijksterhuis & Bargh, 2001; Kinsbourne & Jordan, 2009) that reveal that the perception of another's behaviors automatically primes one for the same behaviors. As a result, competent social interaction requires the ability to continuously inhibit socially primed responses. In short, simply being around other people necessitates the inhibition of actions generated by others.

Our inhibitory account of the social effects on RTs and MDs is further supported by our finding of an interaction between task and dyad race: RTs were significantly longer in the joint condition than in the individual condition, and were longer still for different-race dyads than for same-race dyads. Many researchers (Bargh, Chen, & Burrows, 1996; Kim, 2003) have demonstrated that the activation of racial stereotypes is an automatic process requiring inhibition. Our finding that RTs are even longer for different-race dyads implies that in addition to the inhibition necessitated by being in a social context (i.e., individual versus joint difference), further inhibition was brought to bear due to the presence of a different-race confederate.

While the RT data support an inhibition account of the social effects in the present experiment, the MD data are, at first glance, unclear. To be sure, the joint conditions do have larger RTs and smaller MDs than the individual condition, but the MDs do not become smaller in the different race

dyads versus the same race dyads. Thus the different race effect on RTs does not seem to be present in the MDs. The analysis of time to maximum proximity (TMP), however, revealed a pattern that renders the mouse data consistent with an inhibitory account. Specifically, while TMP was significantly faster in the individual versus the joint conditions, there were no differences between the same and different race dyads, despite the fact the latter group took longer to reach the response location. If one operationalizes the location of the maximum proximity to the distracter as a "decision point" at which the participant has decided among response options (i.e., successfully inhibited competing responses), the time following the TMP can be thought of as post-decision time. From this perspective, (1) the longer TMP in the joint conditions reflects additional overall inhibition due to being in social situation, (2) the similar TMPs in the same- and different-race dyads reveals participants took the same amount of time to "develop" the correct response, and then (3) following the TMP, additional inhibition in the different-race dyads led them to take longer than the same-race dyads to actually complete the trial.

Collectively, the present data are consistent with the assertion that inhibition played a major and constructive role across the entire temporal span of the mouse movement. The need to inhibit the stimulus-primed, incompatible response led to longer RTs and larger MDs. The need to inhibit simply due to being in the presence of another led to joint RTs and MDs being longer and smaller than individual RTs and MDs, respectively. Finally, the additional inhibition brought on by the presence of a different race confederate rendered the "post-decision" movement time even longer. To be sure, more research is necessary to confirm these conclusions. What we can say for sure, however, is that by measuring RTs alongside mouse trajectories, we were able to gain access to the multi-scale factors (i.e., stimulus-response compatibility, alone versus social, and same- versus different-race dyad) that continuously interacted and influenced every moment of the participants' mouse movements. In short, the movements were much more than simple responses to stimuli. Rather, they were real-time expressions of the manner in which the participants addressed the constellation of interacting stimulus and social factors that needed to be taken into account in order for the participant to do the task (Jordan, 2003). Given what we found, we believe the mouse tracking method will allow researchers to peer ever more keenly into the continuous, multi-scale nature of joint-action in particular, and cognition in general.

## References

Asendorpf, J. B. (1990). Development of inhibition during childhood: Evidence for situational specificity and a two-factor model. *Developmental Psychology, 26*, 721

Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology, 71*, 230-244.

Dijksterhuis, A. & Bargh, J.A. (2001). The perception-behavior expressway: Automatic effects of social perception on social behavior. In M. Zanna (Ed.), *Advances in experimental social psychology, 33*. San Diego, CA: Academic Press.

Dolk, T., Hommel, B., Colzato, L. S., Schütz-Bosbach, S., Prinz, W., & Liepelt, R. (2014) The joint Simon effect: a review and theoretical integration. *Frontiers in Psychology, 5*:974.

Freeman, J. B., & Ambady, N. (2010). MouseTracker: Software for studying real-time mental processing using a computer mouse-tracking method. *Behavior Research Methods, 42*, 226-241.

Freeman, J. B., Pauker, K., Apfelbaum, E. P., & Ambady, N. (2010). Continuous dynamics in the real-time perception of race. *Journal of Experimental Social Psychology, 46*, 179-185.

He, X., Lever, A. G., & Humphreys, G. W. (2011). Interpersonal memory-based guidance of attention is reduced for ingroup members. *Experimental Brain Research, 211*, 429-438

Hommel, B., Colzato, L. S., & van den Wildenberg, W. P. M. (2009). How social are task representations? *Psychological Science, 20*, 794-798.

Jordan, J. S. (2003). Emergence of self and other in perception and action. *Consciousness and Cognition, 12*, 633-646.

Jordan, J. S. & Wesselmann, E. D. (2014) The contextually grounded nature of prosocial behavior: A multi-scale, embodied approach to morality. In D. A. Schroeder & W. G. Graziano (Eds.), *The Oxford handbook of prosocial behavior*. Oxford: Oxford University Press.

Kim, D. Y. (2003). Voluntary controllability of the implicit association test. *Social Psychology Quarterly, 66*, 83-96.

Kinsbourne, M. & Jordan, J. S. (2009). Embodied anticipation: A neurodevelopmental interpretation. *Discourse Processes, 46*, 103-126.

Lurquin, J. H., McFadden, S. L., & Harbke, C. R. (2014). An electrophysiological investigation of the effects of social rejection on self control. *The Journal of Social Psychology, 154*(3), 186-197.

Papesh, M. H., & Goldinger, S. D. (2012). Memory in motion: Movement dynamics reveal memory strength. *Psychonomic Bulletin & Review, 19*, 906–913.

Sebanz, N., Knoblich, G., & Prinz, W. (2003). Representing others' actions: just like one's own? *Cognition*, 88, 11-21.

Sebanz, N., Knoblich, G., & Prinz, W. (2005). How two share a task: Corepresenting Stimulus-Response mappings. *Journal of Experimental Psychology: Human Perception and Performance, 31*, 1234-1246.

Wojnowicz, M. T., Ferguson, M. J., Dale, R., & Spivey, M. J. (2009). The self-organization of explicit attitudes. *Psychological Science, 20*, 1428-14.