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# The effect of co-actor group membership on the social inhibition of return effect

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ABSTRACT

Being part of a group is a crucial factor in human social interaction. In the current study we explored whether group membership affects reflexive automatic cognitive functioning, and specifically the social inhibition of return effect (SIOR; Welsh et al., 2005). SIOR is characterized by slower reaction times (RTs) to a location already searched by another agent. To examine whether group membership modulates SIOR, we recruited Muslim and Jewish students from the University of Haifa to perform a task with either an in-group member or an out-group member. Both IOR and SIOR were suggested to act as a foraging facilitator (Klein, 2000; Welsh et al., 2005). Accordingly, we predicted that the SIOR effect would be larger when performing the task with an in-group member than with an out-group member. The results confirmed our prediction by indicating that the co-actor's group membership modulated the SIOR effect. These findings are consistent with the notion that social factors play a critical role in producing the SIOR effect and provide a novel indication of the influence of social factors such as group membership on basic reflexive cognitive processes.

## 1. Introduction

Humans are social creatures who live and define themselves in reference to groups (Andersen & Chen, 2002; Tajfel & Turner, 1979). From the earliest times humans have searched together for food and hunted together. Indeed, most human behavior takes place in a social context. The ability to function successfully alongside others and to understand their behavior and intentions is essential for individual and group survival (Sebanz, Bekkering, & Knoblich, 2006; Tomasello, Carpenter, Call, Behne, & Moll, 2005).

Yet, cognitive studies usually disregard the effect of social context on cognition and focus primarily on exploring cognitive function in individual set-ups (Smith & Semin, 2004). Recent research has begun to consider the influence of social factors such that more and more cognitive tasks that were traditionally examined in individual setups are now being tested with social factors (Böckler, Knoblich, & Sebanz, 2011, 2012; Cole, Welsh, & Skarratt, 2019; Constable, Pratt, & Welsh, 2018; Frischen, Loach, & Tipper, 2009; Gobel, Tufft, & Richardson, 2018; Kuhlen & Rahman, 2017; Sebanz, Knoblich, & Prinz, 2003; Spence, Pavani, & Driver, 2004; Welsh et al., 2005).

Studies have suggested that when people perform a joint task together, they share a common task representation (the stimulus-response mapping). In some tasks, such as the joint Simon task, this common representation causes interference when discrete actions are necessary (Knoblich & Sebanz, 2006; Sebanz et al., 2003, see also Brass, Bekkering, & Prinz, 2001 for action co-representation). Remarkably, it has even been suggested that beside the action representation at the individual level, when people act together they represent joint-action at a group level (i.e., "We representation"; Kourtis, Woźniak, Sebanz, & Knoblich, 2019; Tsai, Sebanz, & Knoblich, 2011; van der Wel, 2015).

Recent research has demonstrated that representing the actions of another person and/or their task representations (the s-r mapping) is modulated by social processes; for example, whether the co-actor is perceived as an intentional agent or not (Müller et al., 2011; Tsai, Kuo, Hung, & Tzeng, 2008, but see Stenzel et al., 2014). Moreover, research has shown that the joint Simon effect is modulated by the quality of the social interaction, namely the personal relationship between the two co-actors, such that the effect was present only when the relationship between the two participants was positive (Hommel, Colzato, & van den Wildenberg, 2009; McClung, Jentzsch, & Reicher, 2013).

One crucial social factor influencing human social interaction is group membership. According to the *social identity theory* (Tajfel, 1970; Tajfel & Turner, 1979), being a member of a group, the process of social categorization, is a meaningful part of an individual's self-concept (see also Smith & Henry, 1996). Group membership influences one's thoughts, beliefs, feelings and behavior toward other in-group partners

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as well as toward out-group members. For example, social categorization influences our perception that in-group members are similar to us and out-group members are different (Allen & Wilder, 1975; Allen & Wilder, 1979), enhances the self/other overlap with others who belong to the in-group (Aron et al., 2004) and increases negative evaluations of the out-group which can even result in the dehumanization of the out-group (Haslam, 2006; Leyens et al., 2001).

In contrast to the view that awareness of group membership is sufficient for triggering group identification, which, in turn, influences one's representation of others (e.g., *the minimal group paradigm* [1]; Billig & Tajfel, 1973; Tajfel & Billic, 1974; Tajfel, Billig, Bundy, & Flament, 1971), some researchers have proposed that perceived interdependence is a precondition for group identification and by extension for outgroup discrimination (Iani, Anelli, Nicoletti, Arcuri, & Rubichi, 2011; Rabbie & Horwitz, 1969; Ruys & Aarts, 2010). Indeed, people who must work together and who share the same goals and means perceive each other more positively (Deutsch, 1949; Heider, 1958; Rabbie & Horwitz, 1969). In contrast, individuals with opposing goals who work against one another tend to perceive each other more negatively. In the current study we explored whether religious group membership can affect a reflexive automatic cognitive function.

Researchers have proposed the existence of three attentional networks that differ in their function and their anatomy (ANT: Fan, McCandliss, Sommer, Raz, & Posner, 2002; Posner & Fan, 2008; Posner & Petersen, 1990, but see Hommel et al., 2019 for a more synthetic approach). These three functions are: alerting, orienting, and executive attention. Many studies examining the influence of social processes on attention have focused on the executive network (e.g., the joint Simon effect). Executive control of attention pertains to more complex and high level operations, such as identifying and settling conflicts arising in a task, as well as to the ability to guide voluntary actions to overcome automatic responses (Botvinick, Carter, Braver, Barch, & Cohen, 2001; Bush, Luu, & Posner, 2000; MacDonald, Cohen, Andrew Stenger, & Carter, 2000).

In the joint Simon task, for example, two participants are instructed to respond only to a certain color stimulus (e.g., a red or a green ring on a pointing hand) while ignoring irrelevant spatial location or information of the stimulus (presenting/pointing left or right). Findings have demonstrated that people represent the stimulus-response mapping of the other participant as well (Sebanz et al., 2003, for review see Dolk et al., 2014). Müller et al. (2011) found that the joint Simon effect is modulated by a characteristic of the cue (belonging to an in-group or an out-group). On the other hand, Iani et al. (2011), who used the *minimal group paradigm* (see Tajfel, 1970; Tajfel et al., 1971; Tajfel & Billic, 1974), did not find any modulation of the joint Simon effect by group membership. Yet, when McClung et al. (2013) introduced continuous reminders of category membership, they also demonstrated that participants automatically represented the actions of their in-group members but did not exhibit evidence of representing the actions of out-group members.

As can be seen in the above review, the influence of group membership on the executive attentional network has yielded mixed findings. The role of social factors in the other attentional networks still needs to be clarified. Accordingly, in the current study we explored whether group membership also affects the orienting network, which pertains to information selection processes that can be voluntary (endogenous, top-down search) or reflexive (exogenous, bottom-up stimulus capturing the attention; Posner & Cohen, 1984; Posner & Petersen, 1990). To this end, we focused on the social inhibition of return effect (SIOR; Welsh et al., 2005).

Inhibition of Return (IOR) is a well-established phenomenon that demonstrates the orienting attentional network (Posner & Cohen, 1984). IOR pertains to an inhibitory effect toward cued locations manifested in slower reaction times (RTs) in response to targets appearing at previously cued locations than in response to locations that were not cued (Posner & Cohen, 1984). The IOR effect is attributed to an inhibitory mechanism which delays the tendency to reorient attention away from a previously attended location (Klein, 2000; Klein & MacInnes, 1999). Klein (2000) proposed that this effect has an evolutionary origin in that it helps improve foraging abilities: the inhibition of previously searched locations facilitates the investigation of new locations in the visual field (Klein, 2000; Klein & MacInnes, 1999). Researchers also suggested that similar to IOR, a social inhibitory effect also exists for locations already acted upon by another agent—an effect termed Social Inhibition of Return (SIOR; Welsh et al., 2005, 2007). In light of the foraging facilitator hypothesis (Klein, 2000), searching an environment already inspected by another agent would be inefficient. Thus, another person's behavior with respect to an already searched location can also evoke a reflexive inhibitory process.

In the typical SIOR task (Welsh et al., 2005), two participants, in turn, perform rapid aiming movements to lateralized targets. Each participant responds during two successive trials. The aim of the first trial is to test social IOR, while the second aims to test personal IOR. Thus, participants' performance is influenced by their own previous actions and by the previous actions of their counterpart. The typical pattern of results in this task is that participants have longer RTs for targets presented at locations to which they previously reacted than to locations to which they did not react (personal IOR). In addition, RTs are longer for targets presented at locations to which the counterpart reacted than to targets presented at locations to which the counterpart did not react (SIOR).

The role of the social factor in eliciting the SIOR effect has been the topic of much debate. According to the attentional-transient explanation of SIOR (Cole et al., 2019; Cole, Skarratt, & Billing, 2012), the social aspects of the co-actor are irrelevant to the SIOR effect. That is, any spatial cue can trigger the effect, regardless of its social nature (see also Dolk et al., 2011; Guagnano, Rusconi, & Umiltà, 2010; but see Manzone, Cole, Skarratt, & Welsh, 2017). Alternatively, accumulated evidence strengthens the notion that social factors are indeed essential. For instance, Skarratt, Cole, and Kingstone (2010) found that SIOR is elicited only when a real biological behavior/stimulus is observed; Welsh, Ray, Weeks, Dewey, and Elliott (2009) found that people on the autism spectrum did not demonstrate the SIOR effect. In a recent study we further confirmed the important role of social context in the SIOR effect (Nafcha, Shamay-Tsoory, & Gabay, 2020). We found that under the same visual display a participant acting alone produced no SIOR, while giving the participant the mere impression that there was a partner was sufficient to elicit the social effect.

Building on these findings, we examine here whether the SIOR effect is modulated by social factors. Previous studies failed to demonstrate modulation of the SIOR effect when the perceived psychological relations between the co-actors (e.g., competitive or cooperative context) were manipulated (Atkinson, Millett, Doneva, Simpson, & Cole, 2018; Doneva, Atkinson, Skarratt, & Cole, 2017).

In the present study we explored whether group membership affects reflexive automatic cognitive functions, specifically in the SIOR effect. We examined whether the identity of the agent is relevant to this effect by looking at whether acting alongside a co-actor who is either an in-group member or an out-group member influences the presence and magnitude of the SIOR effect. On the one hand, it is possible to predict an increased need to represent another person's acted-upon location if the participant perceives the other as a rival or as someone whose

[1] According to the minimal group paradigm, the only difference between in-group and out-group members should be the fact of their belonging to different groups or categories that are based on arbitrary and randomly assigned criteria (e.g., the ability to estimate the numbers of dots presented on a computer screen or preference for the Spice Girls or the Backstreet Boys). This paradigm was designed for the purpose of demonstrating that social categorization per se is sufficient to evoke inter-group discrimination (ruling out explanations such as prejudice, conflict, or stereotypes) (Billig & Tajfel, 1973; Tajfel, 1970; Tajfel et al., 1971).

actions and intentions are threatening. Prioritization of the other's behavior in a competitive environment seems to be adaptive for survival. Out-group members are associated with a conflictual context since people inherently compete with out-group members, even in the absence of an apparent or actual conflict (Tajfel & Turner, 1979). If this is the case, participants will more closely attend to the actions of a partner from an out-group rather than from an in-group (see also Doneva et al., 2017, Experiment 3). On the other hand, if the SIOR effect also functions as an in-group foraging facilitator (based on the notion that the IOR effect is a foraging facilitator (Klein, 2000) and similar to the findings from the joint Simon task), the effect should emerge only when the two participants collaborate and have a positive in-group relationship. From this evolutionary perspective, in order to maximize group resources, a member from the same group should not search again in an area that was already searched by another group member since this would be less efficient. Therefore, based on Klein (2000) and on our own previous findings (Nafcha et al., 2020), we predict that the SIOR effect will be larger when performing the SIOR task with an in-group member than with an out-group member.

An exploration of whether a co-actor's social properties modulate the SIOR effect should indicate that social properties can also influence a more reflexive automatic attention network. Moreover, such modulation can strengthen our previous findings (Nafcha et al., 2020) about the vital role played by social context in eliciting the SIOR effect and can also shed light on whether the social effect emerges automatically every time an individual acts in a social setting regardless of the identity of the other person.

## 2. Method

### 2.1. Sample size

In previous studies (see, e.g., Cole, Atkinson, D'Souza, Welsh, & Skarratt, 2018; Cole et al., 2012; Nafcha et al., 2020; Ondobaka, Newman-Norlund, De Lange, & Bekkering, 2013; Welsh et al., 2005; Welsh et al., 2007), the usual sample size for examining the SIOR effect ranged from 14 to 18 participants (7–9 couples). In the following experiments, we employed a similar sample size for each condition (see details below). The experiments were conducted by two experimenters, one Muslim and one Jewish. To examine whether the experimenter's group membership influences the results, each experimenter ran both conditions, yielding ~14–16 pairs in each condition.

### 2.2. Participants

Ninety-two undergraduate Israeli Jewish and Muslim students participated in the experiment in exchange for course credit or payment (46 Jewish and 46 Muslim; age range:19–30; $M = 22.56$, $Sd = 2.6$). Considering that religious differences in dress codes apply mainly to women, we limited our sample to women who dressed according to traditional dress codes. Examining only one gender also helped keep the social characteristics constant (see Nafcha et al., 2020). Hence, in the Muslim sample we recruited only religious women since the dress code in Muslim society requires women to wear a hijab (a salient dress cue of group membership). We ran two experiments, one in which each member of the pair belonged to a different group (out-group) and a second experiment in which both members belonged to the same group (in-group). All participants were unaware of the purpose of the experiment.

### 2.3. Task and stimuli

We based the study on a computerized version of the SIOR task (Nafcha et al., 2020). Participants were tested in pairs, with participants seated facing the other. Each participant sat in front of a separate computer screen (see Fig. 1) and the screens were connected to a single computer. The participants were seated about 57 cm from the computer screen. Three boxes were displayed on the screen (size in visual angle: 1.5°*1.5°)—one in the middle of the screen and one at each side (13° from the central box). Each pair of participants completed 20 blocks of 33 successive key presses in response to the appearance of a target stimulus at one of two locations. Participants were required to react to the location of the stimulus by pressing the “p” key with their right index finger if the target appeared on the right side of the screen or by pressing the “q” key with their left index finger if the target appeared on the left side of the screen. Participants were instructed to respond only on their turns after presentation of their previously assigned specific color (see details below). Each block of 33 trials included 16 within-person trials and 16 social, different-person trials. The order of trials in each block was pseudo-random. Each participant started an equal number of blocks.

Each trial began with a color cue—a red or green flash presented in the middle box for 100 ms. The color of the flash indicated which participant should respond when the target appeared. After an interval of 400 ms, the target (“X”) was shown either in the left or the right box and remained on the screen until the active participant responded to the target's location As in our previous experiments (Nafcha et al., 2020) in order to rule out the attentional-perceptual explanation (Cole et al., 2012) - the observing participant could not see the target onset and offset since target locations were masked with a gray patch when it was not her turn. After each response, an arrow appeared in the middle box, informing both participants of the location at which the response was made (a left arrow indicated that the q key was pressed, and a right arrow indicated that the p key was pressed). The arrows were shown for 400 ms both after the self-initiated action and after the co-actor's action. After an interval of 400 ms, the next trial began. The SOA between the onset of the arrow and the onset of the following target was 1300 ms. Note that due to the experimental set-up, the participants could not directly observe the co-actor's actions. See Fig. 1 for an illustration of a trial and for a picture presenting the experimental set-up.

Panel A: the experimental setting as was used in the experiments. This setting prevents the participants from having a direct view of each other's actions. Panel B: an illustration of a typical experimental trial. On the left (player 1) is the display which the responding participant in this trial saw (i.e. red in this image). On the right is the display which the observing participant (player 2) saw.

### 2.4. Group membership manipulation

In addition to relying on dress code differences, we used a manipulation to implicitly emphasize group identification. At the beginning of the experiment, participants completed a questionnaire about their perceptions of group dominance without any explicit references to a particular conflict (e.g., the fact that some groups are on top really benefits everybody) (Social Dominance Orientation; Ho et al., 2012). The questionnaire answer sheet contained the same questions in both languages, Hebrew and Arabic. The language order was counterbalanced (sometimes Hebrew was first and sometimes Arabic was first; see the Supplemental Material, page 1). Although this questionnaire was used only as a manipulation bolster, we did test the correlation between the questionnaire score and the SIOR effect and no correlation was found for either experiment; see the Supplemental Material, page 1, for further details.

### 2.5. Procedure

Participants were told that they would participate in two separate experiments. In the first they would complete a questionnaire and in the second they would perform a behavioral task. At the beginning of the experiment, participants completed the questionnaire in their mother tongue (Hebrew or Arabic). The questionnaire was not directly relevant to their religious group membership (see section on Group membership

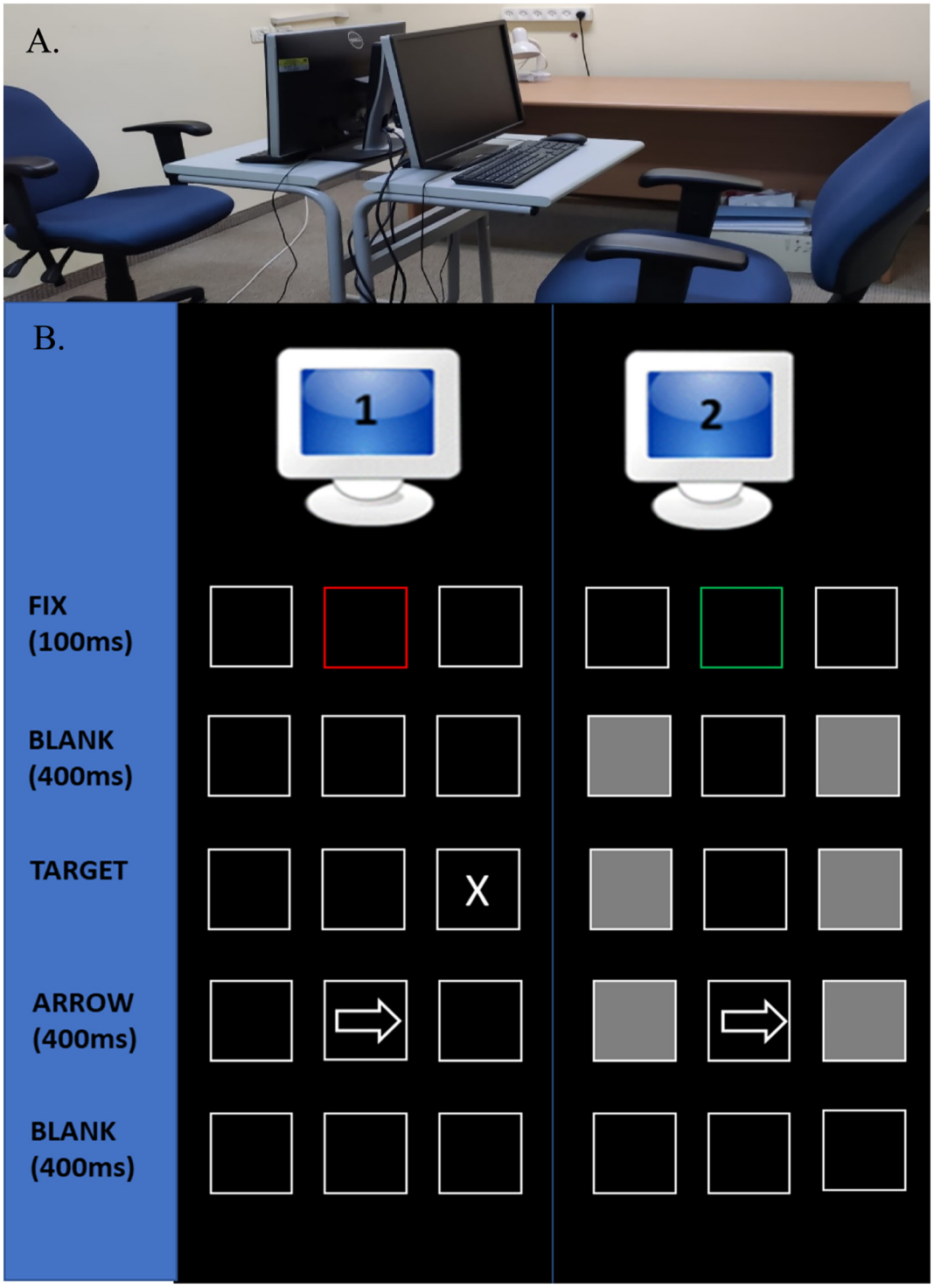


**Fig. 1.** Illustration of a typical trial and the experimental setup.

manipulation). Then, participants were seated opposite each other, each facing a computer screen and a keyboard. The participants were instructed to respond only on their turn, as indicated by the color cue. They were instructed to respond quickly and accurately upon seeing the target (x). Specifically, they were told to press the "p" key if the target appeared on the right side of the screen and to press the "q" key if the target appeared on the left side of the screen. Additionally, participants were informed that they would not see the targets of their co-actor but that an arrow would inform them of their co-actor's response location. At the end of the experiment, participants completed a demographic questionnaire. Note that in order to examine whether the experimenter's religious group might influence the pattern of results, a Jewish experimenter administered the task for half of the participants (in-group, out-group experiments) and a Muslim experimenter administered the task for the other half. No interactions were found between both the IOR and the SIOR effects and the experimenters' identity. This finding indicates that there was no experimenter bias, and therefore we omitted this variable from the analysis; see the Supplemental Material, page 3.

## 3. Results

Reaction time (RT) was calculated as the time from target onset until the participant pressed the response key. Trials in which participants responded incorrectly (1% for the in-group experiment, 0.9% for the out-group experiment) as well as trials in which RTs were above or below 2.5 standard deviations from the participant's average RTs for a specific condition were also removed from the data (2.9% for the in-group experiment, 2.7% for the out-group experiment). Moreover, for each experiment, participants whose general averaged RTs (across all variables) were 2.5 standard deviations above the average were excluded from the analysis. In order to rule out the possibility that one participant's outlier behavior influenced the other participant we excluded the pair altogether. One pair in the in-group condition and one pair in the outgroup condition were excluded. Overall, there were 54 participants in the in-group- experiment (27 pairs: 14 Jewish, 13 Muslim) and 34 participants in the out-group- experiment (17 pairs). For each ingroup/outgroup experiment we conducted an analysis of variance (ANOVA), with the person that responded in the previous trial (same, different) and target location (same, different) as within-subject factors, and religion (Muslim, Jewish) as a between-subject factor. RT was the dependent measure.

### 3.1. In-group analysis

Significant main effects were observed for religion (Jewish < Muslims), person (Different < Same) and target location (Different < Same) ($F_{(1,52)} = 14.57$, $p = .00$, $\eta_p^2 = 0.21$; $F_{(1,52)} = 5.56$, $p = .02$, $\eta_p^2 = 0.09$; $F_{(1,52)} = 28.77$, $p = .000$, $\eta_p^2 = 0.35$; respectively). The interaction between person and religion and the interaction between target location and religion were not significant ($F_{(1,52)} = 3.7$, $p = .06$, $\eta_p^2 = 0.06$; $F_{(1,52)} = 0.33$, $p = .56$, $\eta_p^2 = 0.006$, respectively). The interaction between target location and person was significant ($F_{(1,52)} = 10.14$, $p = .002$, $\eta_p^2 = 0.16$), indicating that the individual IOR was larger in magnitude than the SIOR. Planned comparisons revealed a significant effect of target location (same location RT > different location RT) for the same-person trials ($F_{(1,52)} = 23.8$, $p = .000$, $\eta_p^2 = 0.31$), indicating the presence of personal IOR, as well as a significant effect of target location (same location RT > different location RT) for the different-person trials ($F_{(1,52)} = 12.38$, $p = .000$, $\eta_p^2 = 0.19$) indicating the presence of SIOR. The triple interaction of target location, religion (Jewish/Muslim) and person was not significant ($F_{(1,52)} = 0.27$, $p = .60$, $\eta_p^2 = 0.005$). See Fig. 2 and the Supplemental Material for descriptive statistics and for separate analyses of each in-group condition.

### 3.2. Out-group analysis

Significant main effects were observed for religion (Jewish < Muslims), person (Different < Same) and target location (Different < Same) ($F_{(1,32)} = 4.83$, $p = .03$, $\eta_p^2 = 0.13$; $F_{(1,32)} = 9.87$, $p = .003$, $\eta_p^2 = 0.23$; $F_{(1,32)} = 36.91$, $p = .000$, $\eta_p^2 = 0.53$, respectively). The interaction between religion and person was not significant ($F_{(1,32)} = 1.81$, $p = .18$, $\eta_p^2 = 0.05$). The interaction between religion and target location was also not significant ($F_{(1,32)} = 2.21$, $p = .14$, $\eta_p^2 = 0.06$). The interaction between target location and person was significant ($F_{(1,32)} = 16.2$, $p = .000$, $\eta_p^2 = 0.33$). Planned comparisons revealed a significant effect of target location (same location RT > different location RT) for the same-person trials ($F_{(1,32)} = 29.28$, $p = .000$, $\eta_p^2 = 0.47$), indicating the presence of personal IOR. No significant effect of target location emerged for the different-person trials ($F_{(1,32)} = 1.18$, $p = .28$, $\eta_p^2 = 0.03$), indicating the absence of SIOR; see Fig. 2). The triple interaction of target location, religion (Jewish/Muslim) and person was not significant ($F_{(1,32)} = 1.7$, $p = .2$, $\eta_p^2 = 0.06$). See Fig. 2 and the Supplemental Material for descriptive statistics and for analysis of each religious group separately.

## 4. Discussion

In the present study, we explored whether group membership of a co-actor influences the orienting attention network, and particularly the presence and magnitude of SIOR. When participants performed the task with a co-actor from their in-group (same religion), SIOR was observed. On the contrary, no SIOR was observed when participants performed the task with an out-group member. The finding that co-actor group membership modulates the social effect strengthens the notion that social factors such as group membership influence the orienting attention network. Furthermore, these results reinforce our previous findings (Nafcha et al., 2020) regarding the unique and important role of social context in the SIOR effect.

Previous studies that examined the influence of group membership on one significant executive function task, the joint Simon task, yielded mixed findings (Iani et al., 2011; McClung et al., 2013). For instance, Iani et al. (2011) did not find any influence of the minimal group paradigm on the joint Simon effect. In contrast, McClung et al. (2013) did find such modulation when participants were reminded about group membership during the task. In particular, they found no joint Simon effect when participants acted with an out-group member rather than with an in-group member. These authors (McClung et al., 2013) proposed that group membership influences whether participants will represent the actions of the other. This raises the possibility that group membership is not always remembered when only simple cues (e.g., colors) are used for group designation (minimal group paradigm). In the current study we used religion as a group designator, perhaps insuring more salience for group identity.

Doneva et al. (2017) did not find that social factors such as partner characteristics (e.g., positive versus negative co-actor) influence the SIOR effect. Note, however, that in planned follow-up contrasts, SIOR was apparent only when the co-actor was perceived negatively. This seems to contradict our findings and those of Hommel et al. (2009), which found that the degree of closeness between the actors enhanced the joint Simon effect. The assumption in our study is that in-group membership evoked a more positive attitude than out-group membership. Future studies should further examine the influence of relationship quality (positive versus negative) between the actors on different cognitive functions.

Furthermore, there is much debate about whether SIOR is an expression of a perceptual-attentional process similar to those establishing IOR or whether the social factor plays a special role. On the one hand, if the effect emerges as a result of a perceptual cue that captures attention, it should not matter with whom one performs the task, so long as the information is salient (Cole et al., 2012, 2019). On the other hand, if the social context is essential for establishing a representation of the other's actions toward a specific location, then knowing the identity of one's partner should be relevant and influential. A previous study (Nafcha et al., 2020) found that it was enough to believe that there was another person performing the task to elicit the SIOR effect, while when the participants knew that there was no co-actor, no SIOR was elicited. The finding in the current experiment that no SIOR was observed when acting with a member from an out-group reinforces the notion that social context plays an important role in the SIOR effect and that this effect is not purely perceptual (Cole et al., 2012, 2019). In addition, the results strengthen the evolutionary perspective according to which it is more adaptive for survival to represent the location upon which an in-group acted rather than an out-group (Klein, 2000; Nafcha et al., 2020; Welsh et al., 2005). It is possible that when searching with an out-group member, the locations searched by the co-actor represent potential locations for reward, and hence they should not be ignored or inhibited. In contrast, when searching with an in-group member, it is preferable to search for new nearby locations since the reward obtained by the co-actor is shared. Thus, searching a location already examined by a co-actor from one's own group becomes less prioritized than a search in a new location in order to make the gathering outcome more efficient.

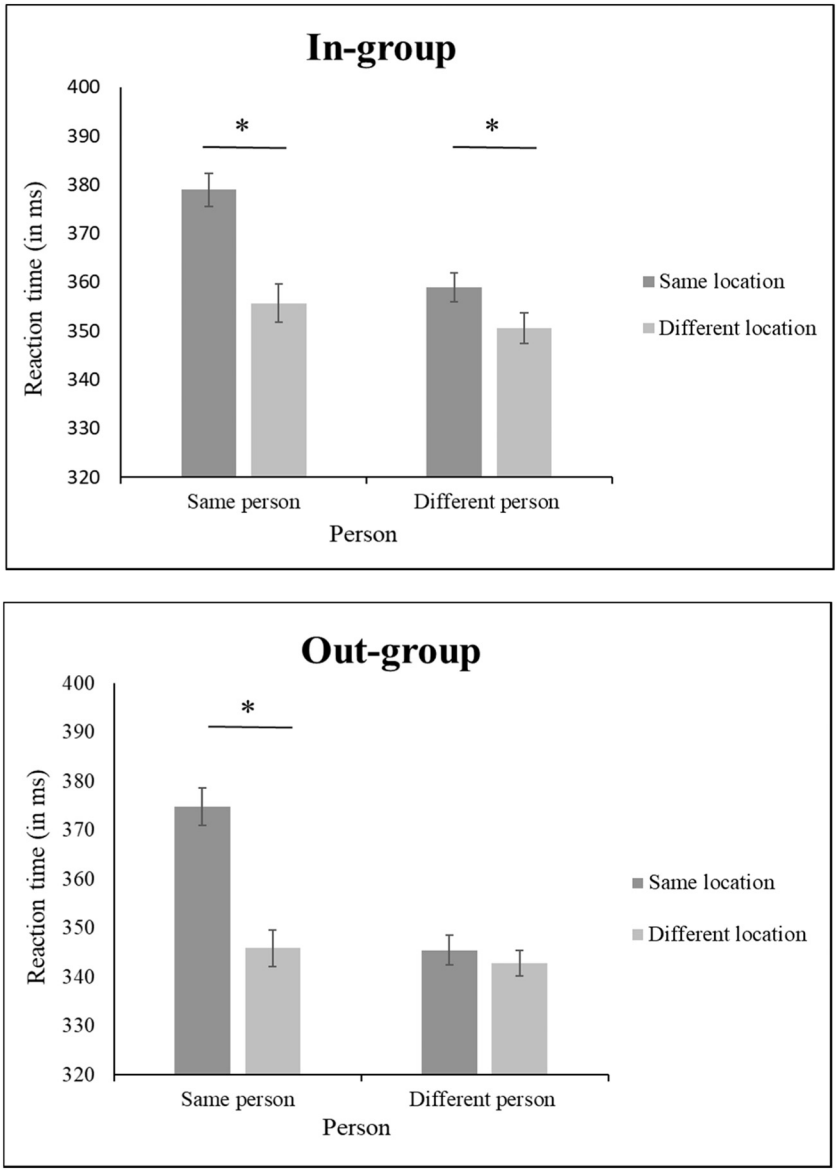


**Fig. 2.** Reaction times (RTs) of the In-group condition (top) and the Out-group condition (bottom) by target location (same, different) and effect (self-effect, social effect). The Y axis shows the RTs in ms. Error bars represent one standard error from the mean using a method to compute error bars in a within-subject design (Cousineau, 2005). * = significant at $p < .01$.

This study strengthens this last hypothesis.

In conclusion, the current study suggests that during social interactions, even those in which no collaboration or competition is required, group identity influences participants' performance. Participants who performed the task with a co-actor whom they perceived as an out-group member acted as if they were on their own. These results provide a novel indication of the influence of social factors on cognition. This suggests that the influence of social factors is not specific to tasks requiring high executive cognitive functions, such as the joint Simon task. Rather, these factors may also modulate tasks that are considered automatic and reflexive. The social context should not be disregarded when examining cognition since it may offer new insights and perhaps provide more ecological validity. These findings also open the possibility that in the future SIOR could be used as an implicit indicator of the quality of relationships between people and groups.

## CRediT authorship contribution statement

**Orit Nafcha:** Conceptualization, Methodology, Software, Investigation, Formal analysis, Writing - original draft. **Aya Morshed-Sakran:** Investigation, Formal analysis, Writing - review & editing. **Simone Shamay-Tsoory:** Conceptualization, Methodology, Writing - review & editing, Supervision. **Shai Gabay:** Conceptualization, Methodology, Formal analysis, Writing - review & editing, Supervision, Resources.

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## Appendix A. Supplementary material

Supplementary material to this article can be found https://doi.org/10.1016/j.actpsy.2020.103119

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