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Publication date

01-01-2021

Published in

European Journal of Social Psychology;51, pp. 1007– 1018

Received: 2 May 2021 | Accepted: 10 September 2021

DOI: 10.1002/ejsp.2803

EASP WILEY

RESEARCH ARTICLE

The cognitive cost of closeness: Interpersonal closeness reduces accuracy and slows down decision-making

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Abstract

Interpersonal closeness increases the overlap between mental representations of the self and the other, thus rendering it more difficult to differentiate between self- and other-related information. We suggest that closeness challenges computational capacity during decision-making when the decision requires a differentiation between self- and other-related information. Correlational Study 1 showed that when participants imagined engaging in a two-person economic problem-solving task with another person, their cognitive performance decreased with increased levels of closeness felt toward their counterpart. Three experiments showed that when participants engaged in the problem-solving task with a close (vs. a distant) other, they tended to recall the correct solutions less (Study 2), used more time to find the solution (Study 3) and gave less accurate responses under time pressure (Study 4). These four studies are the first to jointly demonstrate that closeness influences interpersonal decision processes by being cognitively more costly.

KEYWORDS
cognitive performance, interpersonal closeness, problem-solving, social decisions

1 | INTRODUCTION

Interpersonal closeness has been often addressed in the psychological literature with its positive influences on human behaviour. Past studies have documented a strong and robust positive association between interpersonal closeness and social decisions such as cooperative behaviour and trust (e.g., Binzel & Fehr, 2013, DeBruine, 2002; Foddy et al., 2009; Leider et al., 2009). In typical cooperation studies, participants share on average 28% of their resources with unknown others (see Engel, 2011, for a review), even when there are no obvious costs for not giving anything at all. Importantly, however, the allocated amount significantly increases with closeness: people allocate on average 50% more to their friends than to strangers (e.g., Lieder et al., 2009). The tendency to favour close others over distant others is already prevalent in 10- to 12-year-old children (Goeree et al., 2010). A number of accounts have been offered to explain why people favour close others in social decision-making. The vast majority of arguments that focus primarily on the benefits of closeness in interpersonal interactions (e.g., Cropanzano & Mitchell, 2005; Molm, 2010; Vanyperen & Buunk, 1991) are in line with the central idea of the social exchange approach (Homans, 1958; Thibaut & Kelley, 1959). This account suggests that humans are motivated to obtain a maximum level of rewards with the lowest possible costs (Colquitt et al., 2014; Vanyperen & Buunk, 1991) and thus adopt the type of behaviour that provides the highest benefit to cost ratio. Behaviour is thus influenced by the expectation of returns from close others (Blau, 1964). Considering the typically repetitive and long-lasting nature of close relationships and the likelihood of future reciprocity, humans are likely to benefit more from giving to a close than a distant other in the long term. Note that giving more to close others may offer more than material benefits. Cooperation with close others can also be considered as a strategic tool to fulfil psychological goals such as the satisfaction of belongingness needs (Baumeister & Leary, 1995). What seems to be common in the arguments summarised above is a tendency to relate social decisions to their 'rational' purpose of maximising some sort of benefit, either material or psychological.

Similarly, evolutionary approaches highlight the adaptive advantages of cooperating with close others, thus leading humans to be implicitly inclined to do so (Caporael & Brewer, 1995; Kerr & Levine, 2008). The kin selection theory (Hamilton, 1964) posits that traits that increase the fitness of relatives are favoured through natural selection processes because when a close relative reproduces, this also transfers part of one's own, shared genes to the next generation (Kurzban et al., 2015). Accordingly, cooperation and social bonds with family members (i.e., close others) provide a means of contributing to the reproductive success of one's kin. The group selection hypothesis proposes that members of the same group who cooperate with each other and compete with outgroups have an increased potential for survival (Sober & Wilson, 2011). Hence, cooperation among close others is advantageous (Kerr & Levine, 2008). The reciprocal altruism perspective suggests that the high probability of reciprocity between ingroup members (i.e., the probability that group members will reciprocate altruistic behaviours) decreases the initial costs of altruistic behaviours and increases the individual's chance of survival (see Kurzban et al., 2015). The literature discussed above argues that favouring close others pays off.

Taken together, the literature discussed above views the effect of closeness on social decisions from an instrumental perspective by arguing that personal benefits increase in the long run. Perhaps because of the communal nature of this kind of relationship (Clark & Mills, 2012), the impact of interpersonal closeness on people's decision-making performance has been overlooked in psychological research so far. We aim to fill in this gap by taking a closer look at the cognitive underpinnings of interpersonal closeness and whether and to what extent closeness interferes with the process of evaluating decision choices to meet its purpose (e.g., maximizing outcome).

2 | INTERPERSONAL CLOSENESS AND COGNITIVE PERFORMANCE: THE COGNITIVE COST OF CLOSENESS

Each social decision involves at least two persons, one of which is often the self. Whenever judgements and decisions involve information on both the self and another person, specific cognitive mechanisms are at play. The inclusion of other in the self-approach (Aron & Aron, 1986, 1996; Aron et al., 1991) suggests that the mental representation of the self overlaps with the mental representations of others, and the extent of this overlap increases with closeness. The closer the other person is, the greater the overlap of the two mental representations. According to this view, judgements about the self and close others, at least partially, involve overlapping knowledge structures of close others and the self. Thus, the equivalent of closeness on the level of mental representations is the number of shared cognitive elements (Mashek et al., 2003).

This claim has been substantiated by many findings. Several studies have shown that people are more likely to confuse information about the self with information about a close person compared with information about a distant person. In their original article on the inclusion of others in the self-approach, Aron et al. (1991) demonstrated confusions between the self and close others in memory associations. Specifically, they showed that people recalled fewer nouns when the nouns were previously envisioned together with either the self or a close other than when they were envisioned with either the self or a distant other (Aron et al., 1991). Similarly, people confuse the source of the rating (the self versus a close or a distant other) more often for traits that were previously rated for the self and for close others compared with traits rated for the self and for distant others (Mashek et al., 2003). A similar self-other confusion was observed in a study in which participants were asked to recall past actions; for instance, after only observing an action, people were more likely to think that they had actually performed the action themselves if the actor who performed the action was an ingroup compared with an outgroup member (Linder et al., 2012). Recent research (Uğurlar et al., 2021) showed that interpersonal decisions reflect this theorising: when making cooperative decisions in trust games, individuals who felt close to their counterparts were less accurate in recalling their own decisions. Social neuroscience studies have also shown that mentalising about similar others activates brain regions that are similar to the ones activated by self-referential thinking, whereas mentalising about dissimilar others activates different regions (Mitchell et al., 2005; also see Jenkins & Mitchell, 2011, for a review). All of these findings are in line with the argument that closeness is defined as a greater overlap in the mental representations of the self and the critical other. Taken together, these studies demonstrate that closeness—or in other words, the mental self-other overlap—influences cognition by leading to confusion between the self and the close other.

The ease (or difficulty) with which people can dissociate the self from other people should have important consequences for an individual's cognitive performance in making a decision with respect to their efficiency (i.e., accuracy and speediness). On a cognitive level, the closer the individuals are, the more their self-other representation overlaps, and thus, differentiating between overlapping self-other representations is effortful (Aron et al., 1991). On the basis of this theorising and related findings (e.g., Mashek et al, 2003; Uğurlar et al., 2021), we expect interpersonal closeness to interfere with the decision-making process itself. That is, when individuals make a decision in a context where they need to differentiate between information on themselves and a close other, they should be cognitively less efficient than when they need to make the same decision between themselves and a distant other (i.e., the cognitive cost of interpersonal closeness). More specifically, during such social decision-making processes, (a) optimizing a decision should require more time and (b) when there is a cognitive constraint, such as time limit, there should be fewer accurate responses when the process involves interpersonal closeness. Unlike previous literature (e.g., Aron et al., 1991; Binzel & Fehr, 2013; DeBruine, 2002; Foddy et al., 2009), we were not interested in decision outcomes (e.g., whether or not people would behave more generously towards close compared with distant others). The main question at hand is whether and to what extent the decision-making process becomes more cognitively costly as a function of interpersonal closeness. We propose that interpersonal closeness critically influences people's cognition while making social decisions, by reducing their ability to differentiate accurately between information referring to the self and others.

3 | THE PRESENT RESEARCH

The current line of studies tested the cognitive cost of closeness hypothesis, which suggests that the social decision-making process is cognitively more demanding when a decision involves a close other. Importantly, our hypothesis focuses on participants' cognitive performance when making the decision (i.e., response times and accuracy in completing tasks that had clearly correct solutions) rather than the decision outcome. To measure cognitive performance in social decisions, we developed a two-person economic *problem-solving* game (i.e., the me/other game) that requires participants to first identify self- and other-related information and then find a clearly correct answer in a resource allocation frame.

We tested our predictions in one correlational study and three experiments. All studies measured cognitive performance in the me/other game. To assess two critical dimensions of cognitive performance (i.e., accuracy and speed), we created two versions of the me/other game: A search version of the task allowed either response time or response accuracy to freely vary whereas a memory version allowed both performance measures to vary freely. Study 1 examined if interpersonal closeness correlates with cognitive performance. To do so, we tested if closeness relates to the most basic performance measure, namely response accuracy in the search version of the me/other game with restricted response time. Experimental Studies 2–4 employed two different manipulations to alter participants' level of closeness with their interaction partner (i.e., a close vs. a distant other). In this set of experiments, we compared cognitive performance in the me/other game, allowing both performance parameters to vary (Study 2), allowing only the response time parameter (Study 3) or the accuracy parameter (Study 4) to vary freely. In Study 2, we created a memory version of the me/other task which allowed speed and accuracy parameters to freely vary and tested how well participants could recall the correct solutions if they imagined engaging in the me/other game with a close versus a distant other. To focus on the speed component of cognitive performance, Study 3 used a search version of the me/other game without time restriction. Participants' task was to find and state the correct answer in the me/other game when the game incorporated a close versus distant other. Using the same structure of the me/other game as in Study 1, Study 4 again focused on accuracy, this time manipulating interpersonal closeness with a different manipulation. In sum, the four studies systematically tested for the effect of closeness on decision-making processes by measuring and manipulating interpersonal closeness and assessing cognitive performance (i.e., response accuracy and response time) in the me/other game. We designed Studies 1, 2 and 4 in Qualtrics (https://qualtrics.com), and Study 3 in MouselabWeb (https://www.mouselabweb.org/). We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in these studies.

4 | STUDY 1

Study 1 aimed to test the link between the levels of interpersonal closeness and the cognitive cost in a two-person economic problem-solving game (i.e., the me/other game). The task of the participants in the game was to find clearly correct solutions under a time limit based on predefined decision rules. As a classic performance measure, we assessed response accuracy. We expected interpersonal closeness to be negatively linked to response accuracy in the me/other game.

4.1 | Method

4.1.1 | Participants

One hundred ninety-five US-based participants (68 women, M_{age} = 34.50), recruited through Amazon Mechanical Turk (MTurk), completed this study online. We predetermined the sample size $N = 200$, based on a power analysis (G*Power 3.1; Faul et al., 2009) to detect a small effect ($r = .20$) with at least 80% power and a two-tailed alpha level of .05. Design, sample size and planned analysis were preregistered (https://aspredicted.org/233ze.pdf).

4.1.2 | Procedure

We asked participants to imagine that they were going to play a resource allocation game which allocates resources between themselves and someone they know in person, such as a friend. They wrote the initials in a text field. Those initials were presented in the me/other game to represent the other person.

Me/other task—search version

The me/other game consists of a series of problem-solving tasks in a two-person resource allocation frame. Each trial includes several resource allocation options. In Study 1, in each trial the participants saw six different payoff distributions between themselves and the person they had named (see Supplemental Material Section A for the instructions and materials). They were asked to imagine that they and their counterpart could receive one of the resource allocation options in the game. Every option offered a payoff value for the participant and for their counterpart. For example, Option 1 may offer a payoff of 12 to the participant and a payoff of 9 to their counterpart. In a second option, the offer may be a payoff of 15 to the participant and a payoff of 9 their counterpart. Unlike classic resource allocation decision tasks, in this game, participants were not asked to decide what their own preferences were but to find a clearly correct solution according to a predefined decision rule. There were two predefined decision rules: the self-interested rule and the altruistic rule. In the self-interested rule, participants were asked to find the option that maximises their payoff and minimises the other person's payoff. In the altruistic rule, participants were asked to find the option that minimises their payoff and maximises the other person's payoff. The two contrasting rules

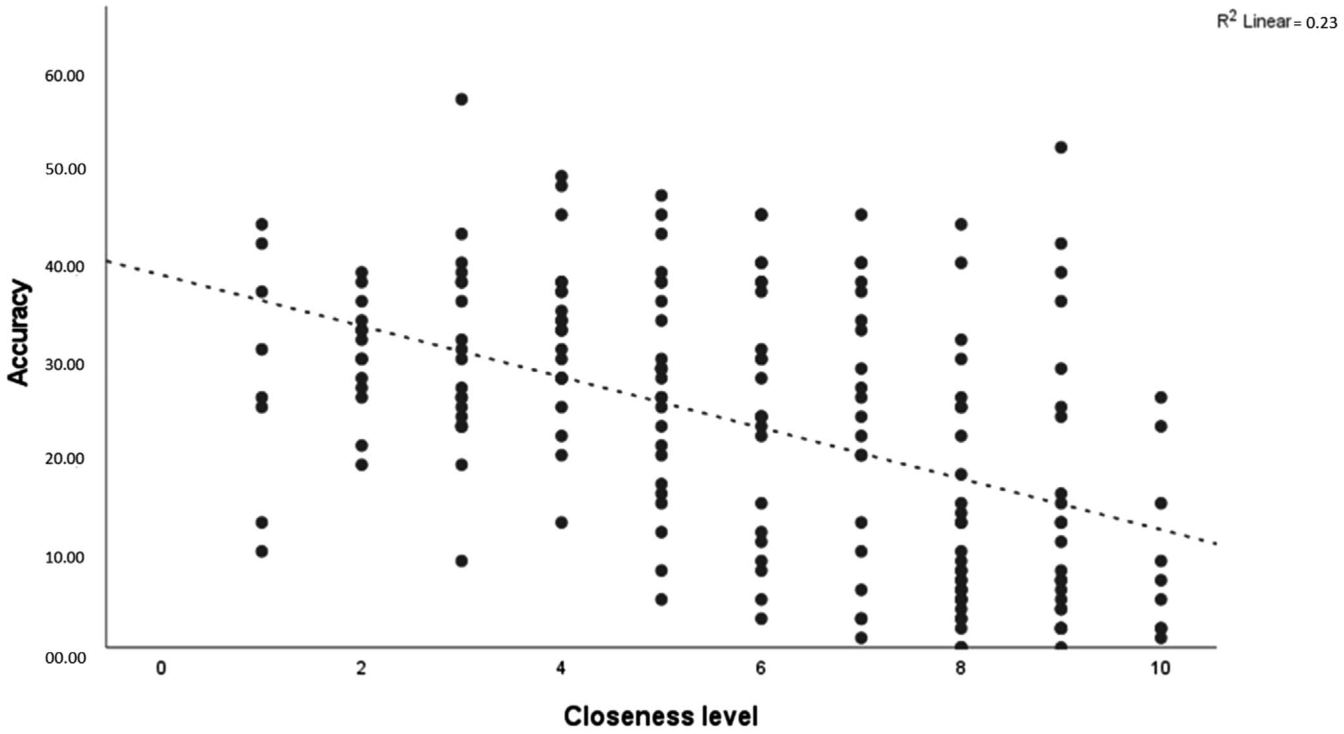

FIGURE 1 The correlation between interpersonal closeness and accuracy in Study 1 is the number of correct responses in the me/other game

(i.e., the self-interested and the altruistic rule) were used to control for the effect of any likely matching between a social context and a relational motivation.

In Study 1, the me/other game consisted of 60 trials. Participants played the trials in two rounds. Half of the trials incorporated the self-interested rule and the other half the altruistic rule. They first completed one round of trials with one of the decision rules and then completed the other round with the other rule. The order of the rounds was counterbalanced. We limited the response time to 5 s per trial. There were 2 s breaks between the trials. Participants were asked to find the correct solutions. We counted the number of correct trials.

Interpersonal closeness

Following the me/other task the participants rated the closeness level between themselves and the person they chose to play with on a 10-point scale ranging from 1 (*not close at all*) to 10 (*very close*).

4.2 | Results and discussion

Accuracy was measured by the sum of correct solutions in the me/other game ($M = 23.30$, $SD = 13.64$). The mean closeness level on the 10-point scale was 5.83 ($SD = 2.49$). Consistent with our predictions, the correlation between the number of accurate responses in the me/other game and the level of closeness was negative and significant, $r = -.48$, $p < .001$. That is, the closer the counterpart in the game was, the less accurate responses in the me/other game the participants gave (Figure 1). The sample size of 195 participants allowed to find an effect of $r = .48$ with a power of 1.00 and a two-tailed alpha level of .05.

Study 1 provided initial support to the cognitive cost of closeness hypothesis: The greater the distance between the self and the other person, the better people performed in the me/other game. Importantly, the me/other game incorporated two opposite decision rules (i.e., self-interested and altruistic). Thus, this negative link between closeness and cognitive performance was not due to a specific decision rule incorporated in the me/other game. However, Study 1 does not speak to the causality of our hypothesis. To address this issue, in the next studies, we tested the effect of closeness on cognitive performance in experimental settings.

5 | STUDY 2

Study 2 manipulated interpersonal closeness and tested the effect of closeness on cognitive performance in a pre-registered experimental study.[1] Unlike Study 1, we used a memory version of the me/other game. The underlying structure (e.g., the resource allocation frame, decision rules, etc.) was the same as in Study 1. However, in Study 2, the task of the participants was to find and then recall a correct payoff distribution. This change in the me/other game allowed us to measure speed and accuracy simultaneously. We expected that solving and recalling the me/other game would be more cognitively demanding when interacting with a close compared with a distant other.

[1] Study 2 is a preregistered, exact replication of an underpowered preliminary study.

5.1 | Method

5.1.1 | Participants

Three hundred fifty-three US-based participants (167 women, M_{age} = 37.42), recruited through MTurk, completed this study online. We predetermined the sample size $N = 352$, based on a power analysis (G*Power 3.1; Faul et al., 2009) to detect a small effect ($d = 0.30$) with a power of 80% and a two-tailed alpha level of .05. Design, sample size and planned analysis were preregistered (https://aspredicted.org/cc3sd.pdf).

5.1.2 | Procedure

Closeness manipulation

We manipulated closeness between participants by adapting the manipulation used by Jones and Rachlin (2006). First, participants were asked to imagine a list of 100 people they knew to varying degrees ranging from 1 (*the closest other*) to 100 (*someone met only once*). Then, they entered the initials of either the closest person or of the person in the 100th place in a text field on the screen. Participants then simulated interacting with the person in the first place (the close-other condition) versus the person in the 100th place (the distant-other condition) on this list in the me/other game.

Me/other game—Recall version

As for the me/other game in Study 1, we presented resource allocation options to the participants. However, this time the participants' task was to find and recall the correct option. In Study 2, the game consisted of 20 trials presented in two rounds: 10 trials with the self-interested rule and 10 trials with the altruistic rule. The order of rounds was counterbalanced. In each trial of the me/other game, participants saw—screen by screen—several resource allocation options. Each trial consisted of six different payoff distributions on six subsequent screens. We presented every payoff distribution for 2 s on consecutive screens. After the presentation of all six options, we presented three questions to measure cognitive performance. We asked participants to recall the correct option and the amounts offered to each of the two recipients (i.e., themselves and the close other) in that correct option (see Supplemental Material Section B for the instructions and materials). We computed the number of correct recalls and the time taken to recall—recall time was the time to respond all three questions, which were presented on the same page.

5.2 | Results and discussion

We predicted that solving the me/other game would be cognitively more demanding when the game incorporated a close as opposed to a distant other. In principle, cognitive performance could show in more accurate as well as in faster answers. To assess the effects of closeness on accuracy, we calculated independent samples *t*-tests using accuracy as dependent variable. Accuracy was measured by the sum of correctly recalled solutions. In total, there were 60 responses evaluated to measure accuracy: 20 trials * three responses per trial (the correct option, the correct amount offered to the participant and the correct amount offered to the counterpart). In line with the expectations, participants were marginally more accurate in the distant-other condition ($M_{distant} = 23.40$, $SD_{distant} = 6.51$) than in the close-other condition ($M_{close} = 22.07$, $SD_{close} = 7.82$), $t(351) = -1.74$, $p = .082$, $d = 0.19$ (see Figure 2). To assess the effects of closeness on response times, we first calculated the mean of the response times (in s) across all trials ($M_{close} = 13.50$, $SD_{close} = 12.52$; $M_{distant} = 11.83$, $SD_{distant} = 7.00$) and then log-transformed them to account for skewed response times (Ratcliff, 1993). Contrary to our predictions, recall time between the close-other ($M_{close} = 1.05$, $SD_{close} = 0.24$) and distant-other conditions ($M_{distant} = 1.02$, $SD_{distant} = 0.19$) did not differ significantly, $t(350) = 1.08$, $p = .282$, $d = 0.14$.

As a manipulation check, again, we tested whether the closeness manipulation increased perceived closeness on a 10-point scale. Participants in the close-other condition ($M_{close} = 8.80$, $SD_{close} = 1.75$) rated the other person in the game as closer to themselves than participants in the distant-other condition ($M_{distant} = 3.29$, $SD_{distant} = 2.57$) did, $t(350) = 23.69$, $p < .001$, $d = 2.51$.

The findings of Study 2 showed that participants tended to be less accurate when imagining playing the me/other game with a close as compared to a distant other. This marginal effect in Study 2 speaks in favour of our hypothesis. The effect of closeness on recall time was not significant. In principle, both accuracy and response time are a measure of cognitive effort (Vandierendonck, 2018). However, the contributions of accuracy and response times to the compound cognitive performance score are rather complex (Vandierendonck, 2017). The question of the trade-off between two cognitive performance measures (i.e., speed and accuracy) is subject to further discussion. We admit that giving both accuracy and response time room to vary freely in this version of the me/other might not have been ideal to address the question of whether closeness influences cognitive performance. However, as we do not hope to solve the present discussion on the relation of accuracy and response time with the current research (e.g., Vandierendonck, 2017), we opted to design versions of the me/other game that only focus on response time or accuracy by constraining the other factor. Thus, in the following two experiments, we focused on the effect of closeness on the two cognitive performance measure separately. We designed an easier version of the me/other game to compare response time in one experiment (Study 3) and limited the time to compare response accuracy in the other (Study 4).

6 | STUDY 3

Study 3 aimed to test the effect of closeness on response time in the me/other game. We presented an easy version of the me/other game so that all participants should be able to find the correct solution and only response time should vary. In this version of the me/other game allocation information was concealed so that participants needed to actively

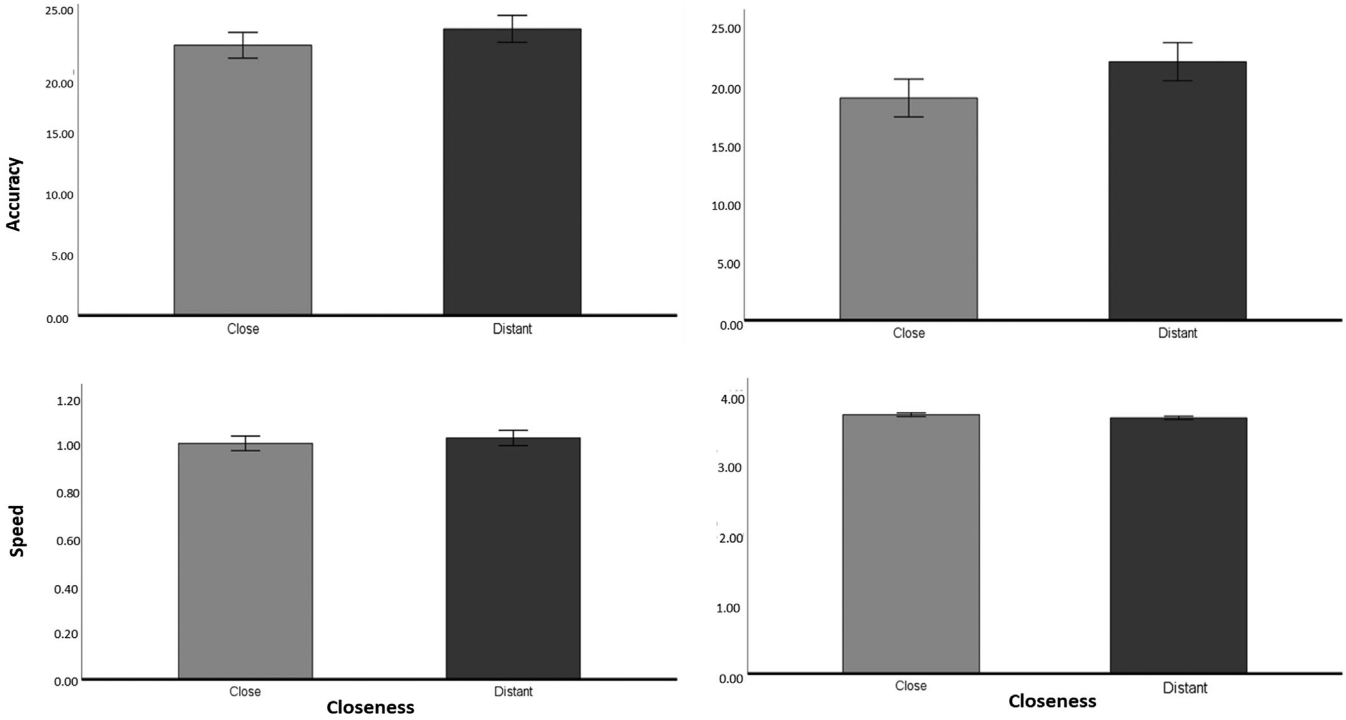

FIGURE 2 Mean ratings for the accuracy in Studies 2 and 4 and speed in Studies 2 and 3. Mean number of correct responses in Study 2 (top left) and Study 4 (top right) and mean response time (log-transformed) in Study 2 (bottom left) and Study 3 (bottom right) as a function of interpersonal closeness. Error bars represent the standard error of the mean

search for and reveal the information to find the correct solution. In Study 3, our critical performance measure was the time that the participants needed to find the correct solution. We predicted that identifying the correct solution on the me/other game would take more time when participants interacted with a close compared with a distant other.

6.1 | Method

6.1.1 | Participants

Two hundred fifty-four US-based participants (116 women[2]) recruited through MTurk completed this study online. Sample size was determined before any data analysis. Based on the sample size of 254, sensitivity analysis using G*Power 3.1 (Faul et al., 2009) indicated a sensitivity to detect an effect size of $d = 0.35$ with 80% power in an independent groups t-test (a two-tailed test of significance and an alpha value of 0.05).

6.1.2 | Procedure

Practice trial

Participants played a practice session to get familiar with the me/other problem-solving task. The practice session explained the me/other game with two examples. Detailed explanations of the correct answers were presented. In order to avoid manipulating interpersonal closeness at the practice stage and to make participants focus on the logic of the game instead of the characteristics of the recipients, the practice trials allocated resources between an unspecified Person A and B instead of the self and a close (vs. a distant) other.

Closeness manipulation

We manipulated closeness in the same way as we did in Study 2. Closeness was a between-subjects factor.

Me/other game—search version

Participants were presented with resource allocation options and asked to find the clearly correct solution according to the predefined decision rules. Instead of six options per trial (see Study 1 and 2), in each trial participants were presented with four allocation options on one screen (see Supplemental Material Section C). The game consisted of 20 trials of the problem-solving game. First, participants played 10 rounds according to the self-interested rule and then 10 rounds according to the altruistic rule. Unlike Study 1 and 2, the payoff numbers were easy to compare; the options incorporated only round numbers from 10 to 90. A fixed column represented each recipient. The first column presented the participant's payoffs (i.e., Me), and the second column presented the other person's payoffs (i.e., #1 vs. #100). In this simple version, people could easily identify the maximum and minimum numbers in each of the columns and solve the game without having to actively search for amounts they and the other person

[2] Age was not assessed.

received. To encourage the participants to pay more attention to the match between the amounts and the receiver, the amounts for the options were embedded in closed boxes. Participants were asked to move the cursor over the closed boxes to reveal the hidden information and stated the correct answer by clicking on the relevant button next to the correct payoff options. We asked the participants to be as fast and accurate as possible while playing the games. The next trial started when the participant was ready to proceed.

6.2 | Results and discussion

We computed an independent samples *t* test to analyse the data. Interpersonal closeness was the between-subjects factor. As in Study 2, all response times in ms (M_{close} = 5386.33, SD_{close} = 3583.20; $M_{distant}$ = 4595.22, $SD_{distant}$ = 1341.44) were aggregated and log-transformed (Ratcliff, 1993). Results showed that, as expected, the time to identify the correct solution in the close-other condition (M_{close} = 3.69, SD_{close} = 0.17) was higher than in the distant-other condition ($M_{distant}$ = 3.64, $SD_{distant}$ = 0.13), $t(252) = 2.52$, $p = .012$, $d = 0.32$[3] (see Figure 2).

Accuracy level was 97% (98% in the close other condition; 96% in the distant other condition), suggesting that participants indeed were able to solve the task correctly. There was no significant difference on accuracy between the close-other condition ($M = 0.98$, $SD = 0.10$) and the distant-other condition ($M = 0.96$, $SD = 0.15$), $t(252) = 0.94$, $p = 0.348$. The difference between close ($M = 3.69$, $SD = 0.17$) and distant ($M = 3.64$, $SD = 0.13$) others on response time hold significant also after controlling for the accuracy in an analysis of covariance, $F(2, 251) = 5.60$, $p = .019$.

The findings of Study 3 provided further support for the hypothesis. The results demonstrated that participants took longer to identify correct solutions when the interaction partner was a close compared with a distant other. Taken together, Study 3 showed the effect of closeness on the response time component of cognitive performance when the task was easy and therefore accuracy was kept relatively constant. In the following study, we aimed to test the effect of closeness on the second component of cognitive performance (i.e., response accuracy) in an experimental setting by restricting response time.

7 | STUDY 4

Study 4 tested the same cognitive cost of closeness hypothesis, this time focusing on response accuracy, instead of using response time, as the measure of cognitive performance. We provided participants with a fixed amount of time to complete as many trials of the me/other game as they could. We counted the number of trials accurately solved as the measure of cognitive performance. Furthermore, in Study 4, we used a different closeness manipulation. In the previous two experiments (Studies 2 and 3), the participants compared two people they knew personally. To account for the effect of complexity of the mental representations and amount of information on close as compared to distant others, in Study 4, we asked participants to imagine playing the game with a stranger who was either similar (close) to them or different (distant) from them (see Liviatan et al., 2008). We conducted Study 4 in the lab with a university student sample in Germany.

7.1 | Method

7.1.1 | Participants

One hundred thirty-one participants from a university in Germany (89 women, M_{age} = 23.65) completed this study in the laboratory in return for course credit. As in previous lab studies (Steinmetz & Posten, 2017), we predetermined a sample size of at least 60 participants per condition. Sample size was determined before any data analysis. Based on a sample size of 131, sensitivity analysis (G*Power 3.1; Faul et al., 2009) indicated a sensitivity to detect an effect size of $d = 0.49$ with 80% power in an independent groups *t*-test (a two-tailed test of significance and an alpha value of .05).

7.1.2 | Procedure

Closeness manipulation

We asked participants to imagine that they were going to play a game with an unknown person whose initials were A.K. Half of the participants wrote five ‘things’ that would make them consider A.K. to be someone similar (close) to them, whereas the other half wrote five ‘things’ that would make them consider A.K. to be someone different (distant) from them. Similarity was used as a proxy for interpersonal closeness. Closeness was a between-subjects factor.

Me/other task—Search version

The game was similar to the one used in Study 3 with some exceptions. First, all information about the options was displayed in an open format (see Supplemental Material Section D). This allowed us to ensure that the time needed to move the cursor would not affect the results. Second, there were six instead of four options in each trial, ensuring that the game was difficult enough, given the openly visible payoff options. Third, payoff numbers were different from the ones in Study 3. This time, the options incorporated a wider range of numbers to produce more confusion—thus errors—in responses. Fourth, to increase complexity, the position where the information regarding the self and the other person (i.e., A.K.) was presented altered. Finally, there were one or more correct answers in accordance with the predefined decision rules. Both responses were coded as accurate. The decision rules remained the same as in the previous studies maximising (minimising)

[3] An exploratory test on the current data set demonstrated that the participants who used a touchpad ($M = 3.72$, $SD = 0.13$) were slower at solving the me/other game trials as compared to the participants who used a mouse ($M = 3.65$, $SD = 0.15$), $t(252) = 3.01$, $p = .003$. Importantly, the difference between close ($M = 3.69$, $SD = 0.17$) and distant ($M = 3.64$, $SD = 0.13$) other conditions on response time remains significant also after controlling for the type of tool in an analysis of covariance, $F(2, 251) = 6.87$, $p = .009$, $\eta 2 = 0.03$. These results suggest that the difference on RT between closeness conditions were not driven by the speed of cursor movements.

the benefits to the self versus minimising (maximising) the benefits to the other. Participants were asked to find as many correct solutions as possible within 3 min in each of the two rounds (i.e., self-interested and altruistic rounds). Each round involved many more trials (i.e., 45 trials per round) than could be completed in 3 min. The order of the rounds was counterbalanced. To boost participants' attention to the recipient-payoff matching, there were trials in which one of the (incorrect) options included random initials that were different from 'Me' and 'A.K.'.

The inclusion of other in the self scale

As a manipulation check question, the participants rated The Inclusion of Other in the Self Scale (IOS; Aron et al., 1992), which assessed perceived closeness to the stranger in the game (i.e., A.K.). The IOS scale involves seven pairs of circles that intersect to varying degrees, each representing different levels of mental overlap between the self and the other person.

7.2 | Results and discussion

We computed an independent samples *t*-test to test our main prediction that people would give more accurate responses in the me/other game when the interaction partner was a distant versus a close person. In line with this prediction, participants completed fewer tasks accurately in the close-other condition ($M_{close} = 18.82$, $SD_{close} = 5.85$) than in the distant-other condition ($M_{distant} = 21.89$, $SD_{distant} = 7.26$), $t(129) = 2.67$, $p = .009$, $d = 0.47$ (see Figure 2).

The similarity manipulation was successful in differentiating the perceived closeness levels (measured with the IOS scale) between close and distant other conditions. Participants in the close-other condition ($M_{close} = 3.12$, $SD_{close} = 1.74$) perceived the stranger in the game as closer to themselves than participants in the distant-other condition ($M_{distant} = 1.98$, $SD_{distant} = 1.05$) did, $t(129) = 4.51$, $p < .001$, $d = 0.79$.

In this study, the cognitive cost of interpersonal closeness was identified when accuracy was used as the measure of cognitive performance when time was held constant. Importantly, in Study 4, instead of asking participants to imagine real people, we experimentally manipulated perceived closeness by asking them to imagine a stranger, which they had similarly little information about. Thus, the current findings provide further support for the claim that the effect of closeness on cognitive performance is not driven by the amount of information one has about a known person or by the number of shared experiences one has with a close other.

8 | GENERAL DISCUSSION

In this article, we discuss the cognitive cost of closeness in social decision-making, which is linked to the cognitive representation of interpersonal closeness. According to the inclusion of other in the self-approach (Aron et al., 1991) the mental representation of a close other greatly overlaps with the mental representation of the self. The mental representation of a distant other overlaps less with the mental representation of the self. This makes it harder to differentiate between the concept of the self and the concept of a close other compared with the concept of a distant other. We claim that interpersonal closeness impairs cognitive performance in social decisions that involve information about both the self and a close person, and therefore imposes an increased cognitive computational cost on the decision-maker.

We tested our hypotheses with one correlational study and three experiments in which we examined the effect of closeness on cognitive processes by administering the me/other game to measure cognitive performance. Study 1 demonstrated that the less the perceived closeness to the counterpart is, the better the person's cognitive performance in problem-solving games involving the self and another person (i.e., the me/other game). Studies 2–4 used two different manipulations to experimentally vary closeness to another person in the me/other game. All of the three experiments demonstrate that solving a self-involving two-person decision problem (i.e., the me/other game) is cognitively more demanding when the interaction partner is a close other compared with distant other. Study 2 showed that participants tended to recall solutions in the me/other game better when they played the game with a distant compared with a close person.[4] Study 3 showed that the participants who played the me/other game with close others required more time to identify correct solutions. Study 4 showed that when a time limit was imposed, participants completed fewer of the me/other games correctly, when the interaction partner was a close (vs. distant) other. Our findings demonstrated that interacting with close others impairs cognitive performance (i.e., response times and accuracy) in two-person problem-solving tasks. We found the same effect in the samples from the United States (Studies 1–3) and from Germany (Study 4); in a student sample in the laboratory (Study 4) and in online samples that represented a wider range of age and educational level (Studies 1–3).

8.1 | Theoretical implications

The current line of studies shows that interpersonal closeness influences social decision-making processes when the decision process requires a differentiation between information on the self and others. In previous research, the link between interpersonal closeness and social decisions has been often examined from motivational and evolutionary perspectives, and the emphasis has been on the positive aspects of closeness in the outcome of social decisions (e.g., Binzel & Fehr, 2013; Kerr & Levine, 2008). The current work focuses on a neglected aspect on interpersonal closeness by demonstrating a potentially negative effect of interpersonal closeness on cognitive performance in the processing of social decisions.

All of our studies incorporated the novel me/other game, a series of two-person resource allocation problem-solving tasks, to measure cognitive performance in solving social problems according to objective decision goals/rules. A person's performance in finding/recalling

[4] This finding was marginally significant.

the correct solution in the me/other game depends on the ability to disentangle the outcome information regarding the self and another person (a close or a distant other) and to subsequently detect the outcomes of the self and the other person according to the decision rule. Importantly, this game incorporates two different predefined, objective decision rules that people need to follow to find the correct solution. These rules are the self-interested rule (finding the option that maximises the outcome for the self and minimises the outcome for the other) and the altruistic rule (finding the option that minimises the outcome for the self and maximises the outcome for the other). In line with our hypothesis, the results demonstrate the effect of closeness on cognitive processing on both the self-interested and altruistic decision tasks. In Study 1, the negative link between closeness and accuracy was significant for both rules in the me/other game (self-interested rule: $r = -.48$, $p < .001$; and the altruistic rule: $r = -.46$, $p < .001$). In line with our reasoning, there was no significant interaction between decision rule and closeness level on accuracy in Study 2, $F(1, 350) = 0.41$, $p = .524$, and on response time in Study 3, $F(1, 252) = 0.10$, $p = .922$, and the interaction on accuracy was just significant in Study 4, $F(1, 129) = 4.17$, $p = .043$. In Study 4, the effect of closeness was stronger in the altruistic rule: participants were less accurate in close ($M = 9.53$, $SD = 3.47$) compared with distant ($M = 11.80$, $SD = 4.01$) other conditions, $p = .001$. In the self-interested rule the difference between close ($M = 9.29$, $SD = 3.50$) and distant ($M = 10.09$, $SD = 9.29$) other conditions did not reach significance, $p = .253$. Given that decision rules had no effect in three studies and only a small—but not contradictory—effect in one study, we conclude that the effect of closeness on cognitive processing shows in both the self-interested and altruistic decision tasks. That is, independent of the criteria required in the decision rule, interpersonal closeness (i.e., mental self-other overlap) is likely to act as a source that imposes a cognitive computational cost on the processing of easily observable self- and other-relevant data. The structure of the me/other game incorporated in the current studies allows us to argue that the effect of closeness on cognitive processes goes beyond the explanation provided by certain relational schemes of the corresponding social roles or preferences.

The degree of the cognitive cost of closeness may differ among individuals. Importantly, on an intrapersonal level, individuals differ in the extent to which they include others in the self (e.g., Cross et al., 2011; Markus & Kitayama, 1991). The more individuals construe themselves as independent, the less they include others in their self-construct (Markus & Kitayama, 1991). The less they include others in their self-construct, the less cognitive effort they should need to differentiate between their mental representation of themselves and their representations of other individuals. Thus, independent self-construal may positively correlate with cognitive performance in the me/other game. On a societal level, a prevalent interdependent self-construal type might lead societies to be more or less prone to the cognitive computational bias in social decisions. More research on the links between self-constructs, interpersonal closeness and cognitive capacity could shed light on the interpersonal variations in the cognitive cost of closeness.

The size of the effect of the cognitive cost on decision outcomes may also differ among individuals. A well-established body of research discussed interpersonal differences in social preferences (e.g., Messick & McClintock, 1968), particularly in the domain of the social value orientation (SVO; Van Lange, 1999). SVO literature documents interpersonal variances in the patterns in distributing resources between the self and others. According to that, people can portray a preference towards individualism (a motivation to maximise outcomes for the self without considering others' outcomes), cooperation (a motivation to maximise outcomes for both the self and others) or competition (a motivation to maximise the relative advantage of the self over others' outcomes). The effect of the closeness on cognitive performance as well as on decision outcome may be different, for example, for people with individualistic preferences as compared to people with cooperative preferences. Future studies could elaborate on the combined effects of the preferences in social decisions and cognitive costs on decision outcome.

Our results support the hypothesis that interpersonal closeness reduces cognitive computational performance in processing the costs and benefits of social decisions involving information on the self and another person. When people are not able to put enough time and effort into decision processes, closeness may limit rational choices. Thus, the cognitive cost of closeness might be pronounced under circumstances that foster intuitive processing, such as when people lack the time to ponder their decisions or when they forego thinking and instead make decisions according to their gut feelings. If most people are capable of differentiating between the self and others when they are allowed to expend effort processing information reflectively, then deliberation should eliminate or at least weaken the effect of closeness on computational capacity. In line with this reasoning, recent studies have indeed demonstrated that closeness leads to cooperation, particularly on an automatic level. Two studies (Acar-Burkay et al., 2014; Cornelissen et al., 2011) provided evidence supporting the automaticity hypothesis. In a dictator game, people allocate more to a close compared to a distant other only when the decisions are based on automatic judgements (Cornelissen et al., 2011). Moreover, people transfer more money to the close other in an investment game only when the decision time is limited, or when they are asked to go with their initial gut decisions instead of carefully considering all possible aspects of the issue (Acar-Burkay et al., 2014). This positive effect of interpersonal closeness on the amount sent to the other person disappears when people are given a chance to deliberate on their decisions. While these findings have been interpreted from the perspectives of needs and motivations, they also imply that closeness might have a stronger effect on prosocial decisions on an automatic level. Studies 1 and 4 in the current article examined and demonstrated the effect of closeness on response behaviour (i.e., accuracy) under time limit. However, if those limits were resolved (Studies 2 and 4), no effects on behaviour, but rather on response time (Study 3), appeared. While none of the studies in the current article directly tested the automaticity argument, it seems to be an interesting implication for future research.

From a broader perspective, the automaticity hypothesis of this cognitive cost fits well with and corroborates studies suggesting that intuitive processes generally promote prosocial behaviour (Righetti et al., 2013; also see Rand et al., 2014, for a review). Prosocial behaviours, in turn, show characteristics of automaticity such as fast response times and robustness to distraction (Zaki & Mitchell, 2013). This is a finding that has been observed also in real-life examples (Rand & Epstein, 2015). By contrast, reflection and deliberation during the decision-making process lead to more selfishness (Rand & Nowak, 2013). Our article demonstrates that it is more cognitively demanding to make social decisions when self-other overlap is high. On the level of automatic processing, there could be a problem with this differentiation process, and therefore closeness could result in strong impairments of cognitive processing. Effects might then even show in case of low levels of self-other overlap. Therefore, the automaticity of prosocial behaviour could also be linked to cognitive difficulties in differentiating the self from others. Of course, this point remains speculative at the present moment, but it would be promising for future work to investigate how the cognitive process of disassociating the self from others explains the automaticity of prosocial behaviour.

8.2 | Limitations and implications for further research

We acknowledge several limitations of the current line of studies. We have neither claimed nor demonstrated that closeness will impose a cognitive cost in all types of decision processes. Notice that we developed the me/other game to test cognitive performance when people are required to disassociate information related to the self and another person. Our current argument that interpersonal closeness imposes a cognitive cost is limited to situations in which (a) the decision process involves information on both the self and another person, and (b) the performance is linked to the disassociation of that information. Whether or not the cognitive cost of closeness would be at play in other interpersonal decision processes that do not meet the two points mentioned above (e.g., when the decision involves information on a close person and a distant person but not on the self) cannot be inferred from the current data. There are social contexts in which accurately disassociating self-other related information is not at the focus of a decision. For example, egocentric comparison research showed that people think of themselves as they evaluate others and use this knowledge for their assessment (Dunning & Hayes, 1996). People may find it easier to develop judgements about another person's preferences when the other person is close to the self and feel more satisfied with their relationships (Murray et al., 2002). However, egocentric projection does not necessarily come with accuracy as information on the self is used to make inferences about another person and accuracy depends on how the other person's characteristics relate to the projected characteristics of the self. While, in principle, it might be less cognitively demanding to project one's own preferences on close others, this may also result in false estimates of the other one's preference—in case the other's preferences do not match the own preferences. A social decision-making should be more cognitively demanding in a closeness context when there is a need to accurately differentiate between own and other's outcomes.

The current studies focused on the basic cognitive mechanism in a two-person economic problem-solving task. A natural next step is to examine how closeness influences decision-making in various social decisions such as joint decision-making, that is, when two people interact to give a decision together. A prior study showed that when dyads comprised of a mother and an adult child were asked to make a joint decision, these pairs usually arrived at their decision on the basis of automatic and intuitive responses instead of through logical evaluations (Cicirelli, 2006). That is, in close pairs, decisions are less likely to be based on a rational analysis, which is strongly linked to the elaborate assessment of the costs and benefits of a decision. Testing whether joint decision processes themselves are influenced by the cognitive cost of closeness, and whether the effect is robust in different social relational contexts, seems to be important for many areas in which joint decisions are made, such as group decision-making. To extend this idea, a study could potentially test how groups with different closeness levels and different variations in closeness levels reach decisions and whether interventions on the level of closeness influence the effectiveness of the decision process.

Closeness can also be induced in typically neutral contexts, such as in buyer–seller interactions. Given that the cognitive cost of closeness can influence the computation of the costs and benefits of a decision, induced closeness can lead to negative outcomes for the self, particularly when interaction partners wish to take advantage of closeness. A study found that a long-term relationship with a particular dentist increased out-of-pocket expenses for patients who received routine procedures, and that this relationship was independent of the quality of the treatment (Schwartz et al., 2011). The closer patients are to their dentists, as presumably they would be in long-term relationships, the more they are willing to pay for more expensive, but not necessarily better, treatment. What we argue is that closeness may impair decision-making processes, and as a consequence, decisions can be partially driven by an ineffective cognitive process in a context of interpersonal closeness. Future studies could investigate whether consumers buy more from sellers who present themselves as being close to them because they are less efficient at calculating the costs and benefits of the transactions. Buyer-seller interactions are only one example. For example, is it cognitively more demanding for voters to judge a politician's arguments when they portray themselves as close and use 'we' language? The cognitive processes that underlie social decision-making have been a neglected field of research (see Joel et al., 2012) and the cognitive cost of closeness hypothesis can contribute to our understanding of various social decisions such as decision-making in politics, economics or intimate relationships.

9 | CONCLUSIONS

Close relationships fundamentally benefit human lives by providing a social context characterised by trust and collaboration, typically leading to positive outcomes for the individual as well as for the group (e.g., Cook et al., 2005; Knack & Keefer, 1997; Simpson, 2007). We are not arguing that favouring close others more or giving more to close than to distant others is good or bad per se. Yet, navigating through social life requires a capacity to detect and analyse the costs and benefits associated with interpersonal decisions. In this article, the focus exceeds a normative position, which might emphasise that either self-interested or altruistic choices are the most efficient basis of decisions. The current studies are the first to demonstrate that self-interested and altruistic decision processes are influenced by a cognitive computational cost that results from interpersonal closeness. We showed a cognitive influence of closeness on the most basic level of information processing, which should, as a result, influence all higher order decision-making. It seems that close relationships may come with a cognitive cost.

ACKNOWLEDGEMENTS

This research was supported by the Center for Social and Economic Behaviour of the University of Cologne through a Junior-Start-Up grant awarded to the first author and the third author, by Deutsche Forschungsgemeinschaft (DFG; German Science Foundation) through an Individual Research Grant (Grant Number: PO 1850-3/1) awarded to the third author, and by The Scientific and Technological Research Council of Turkey (TÜBİTAK) through an International Research Fellowship Programme awarded to the first author.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

The authors confirm that the manuscript adheres to ethical guidelines specified in the APA Code of Conduct as well as the Association of German Professional Psychologists and the German Psychological Association (BDP & DPGs, 2016). None of the experimental sessions caused any unusual physical or psychological stress for the participants. All participants were adults. Their participation was completely voluntary and it was compensated.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

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SUPPORTING INFORMATION

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How to cite this article: Uğurlar, P., Sümer, N., & Posten, A.-C. (2021). The cognitive cost of closeness: Interpersonal closeness reduces accuracy and slows down decision-making. *European Journal of Social Psychology*, *51*, 1007–1018. https://doi.org/10.1002/ejsp.2803