Oxytocin promotes group-serving dishonesty

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To protect and promote the well-being of others, humans may bend the truth and behave unethically. Here we link such tendencies to oxytocin, a neuropeptide known to promote affiliation and cooperation with others. Using a simple coin-toss prediction task in which participants could dishonestly report their performance levels to benefit their group's outcome, we tested the prediction that oxytocin increases group-serving dishonesty. A double-blind, placebo-controlled experiment allowing individuals to lie privately and anonymously to benefit themselves and fellow group members showed that healthy males ($n = 60$) receiving intranasal oxytocin, rather than placebo, lied more to benefit their group, and did so faster, yet did not necessarily do so because they expected reciprocal dishonesty from fellow group members. Treatment effects emerged when lying had financial consequences and money could be gained; when losses were at stake, individuals in placebo and oxytocin conditions lied to similar degrees. In a control condition ($n = 60$) in which dishonesty only benefited participants themselves, but not fellow group members, oxytocin did not influence lying. Together, these findings fit a functional perspective on morality revealing dishonesty to be plastic and rooted in evolved neurobiological circuitries, and align with work showing that oxytocin shifts the decision-maker's focus from self to group interests. These findings highlight the role of bonding and cooperation in shaping dishonesty, providing insight into when and why collaboration turns into corruption.

decision making | behavioral economics | behavioral ethics | lies | honesty

Profit-seeking certainly drives decision-making (1), but humans are also motivated by moral sentiments (2, 3), the interlocking and evolved sets of values, virtues, and norms cooperating to suppress or regulate selfishness (4). Prominent among these values and virtues are honesty and truthfulness (5). With few exceptions, honesty and truthfulness are held in high regard across many cultures and religious orientations (6), whereas deceit and dishonesty have met with punishment and social exclusion throughout human evolution (7). Despite this near-universal emphasis on honesty, however, humans often lie, deceive, omit, and misrepresent (8–10). For example, the estimated costs from tax evasion and from inflated insurance claims, so-called "insurance build-ups," amass to billions of US dollars annually (5). In addition, in tightly controlled laboratory settings, where lies can go undetected and are financially attractive, people strike a compromise between the profit generated by lying and their ability to justify such behavior to themselves and others (11–15).

That humans apply honesty and truthfulness in a flexible manner, being honest most of the time yet lying and deceiving some of the time, fits a functionalist approach to morality (4, 16). Such a perspective suggests that moral behavior enables people to be a part of a group by making personally costly contributions to the group and by creating a reputation of a loyal and trustworthy cooperator that should be included in social exchange, rather than being ostracized and excluded (17, 18). Accordingly, both groups and their members benefit from developing and nurturing moral behavior, including being honest and truthful. Importantly, however, moral behavior that serves one's group may be at odds with moral concerns and behaviors that serve an overarching collective or some universal moral principle (16, 18–19). For example, when a mother from Ohio faked her home address to send her children to a good school outside their residential district, she was sentenced to jail for breaking the law. What was considered unethical at the collective level (faking her home address) can be considered as highly moral (self-sacrificing to benefit one's kin and kith) at the group level of analysis. Indeed, in her testimony, the mother indicated that she deliberately took the risk of punishment to improve her children's chances in life (20). Such motivation to serve others, it stands to reason, is more powerful and makes it easier to generate justification for moral code breaking than a motivation to serve personal interests only (even when holding personal profit constant) (21–24).

The functionalist approach to morality suggests that humans break fundamental moral codes (e.g., "thou shall not lie") when this serves their group's interests more than when this only serves their personal interests, and that such group-serving dishonesty rests on evolved neurobiological circuitries that sustain and motivate group identification, solidarity, and parochial cooperation. If true, the unethical behavior that benefits one's group should be modulated by oxytocin, an evolutionary ancient and structurally highly preserved neuropeptide produced in the mammalian hypothalamus (25–28). Indeed, and consistent with evolutionary theory predicting that trust and cooperation are geared primarily at those considered relevant to survival and prosperity (29), intranasal administration of oxytocin (compared with placebo) promotes trust and cooperation in humans (30), especially with familiar individuals and in-group members (27, 31–35). Thus, next to its well-known role in reproduction and social bond formation (36, 37), oxytocin also functions to "tend-and-defend" the in-group by motivating parochial altruism: self-sacrificing to benefit one's own group and, if needed, to aggress against competing out-groups (32, 38).

Whereas moral violations such as being dishonest are potentially costly, as one may be caught and punished and one's positive self-view may be undermined (5, 39), a functionalist perspective on morality implies that humans are prepared to accept these risks when dishonesty serves their group. Here, we

Significance

Very little is known about the biological foundations of immoral behavior. We report here the results of a double-blind, placebo-controlled experiment showing that the hormone oxytocin promotes group-serving dishonesty. Compared with participants receiving placebo, participants receiving oxytocin lied more to benefit their groups, did so quicker, and did so without expectation of reciprocal dishonesty from their group members. A control setting ruled out that oxytocin drives self-serving dishonesty. These findings support the functional approach to morality and reveal the underlying biological circuitries associated with group-serving dishonesty.

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conjecture that such group-serving dishonesty may be motivated by oxytocin, and we predict that humans violate moral codes (here: lying) more when this serves their group than when this serves their self-interest only; in addition, intranasal oxytocin compared with placebo should amplify lying when it serves group interests more than when it serves self-interest only. We also explored whether compared with self-serving dishonesty, group-serving dishonesty takes less time to deliberate (40), and whether individuals lying for their group expect reciprocal dishonesty from their group members.

Predictions were tested in a double-blind, randomized placebo-controlled experiment. Sixty healthy males self-administered a single intranasal dose of 24 IU oxytocin ($n = 30$) or placebo ($n = 30$) and then, after 30 min, which allowed oxytocin effects to peak (41, 42), received computerized instructions explaining they were randomly assigned to a three-person group, with each group member performing the same task and all earnings being equally shared among group members (*Materials and Methods*). Participants saw a €1 coin on the computer screen and were asked to predict the outcome of a random toss ("heads" vs. "tails"). Participants predicted the outcome, were instructed to memorize it, and after observing the outcome, indicated whether their prediction was correct. This allowed participants to report making correct predictions even when making incorrect ones. We manipulated (within subjects) the group profit generated by correct predictions to be gain (+€0.30), loss (−€0.30), or none (€0). Incorrect predictions always added nothing (€0). After five practice tosses, participants engaged in 30 randomly presented payment tosses (10 of each outcome in an infinite-repetition design). We measured the time taken between seeing the outcome of each toss outcome and responding to whether the prediction was correct. At the end of the experiment, participants predicted the performance of another group member, with accurate predictions incentivized by €0.10.

Results

Participants' performance was truly private. Dishonesty was assessed on the aggregate level by comparing reported performance to the performance predicted by a fair toss (50%) (43, 44). Overall, participants overreported correct predictions on gain trials (73.2%; binominal Z, 11.31; $P < 0.000001$), underreported on loss trials (29.3%; binominal Z, −10.08; $P < 0.000001$), and modestly overreported in no-benefit trials (55.3%; binominal Z, 2.57; $P = 0.01$). Fig. 1 shows that cheating on the gain trials was modulated by treatment: participants under the influence of oxytocin reported more correct predictions (79.7%) than participants receiving the placebo (66.7%; Mann–Whitney Z, −1.99; $P = 0.046$). No treatment effects were identified in the loss trials ($27.0\%_{oxytocin}$ vs. $31.7\%_{placebo}$; Mann–Whitney Z, −0.72; $P = 0.47$) or in trials with no benefit ($52.7\%_{oxytocin}$ vs. $58.0\%_{placebo}$; Mann–Whitney Z, −1.15; $P = 0.25$).

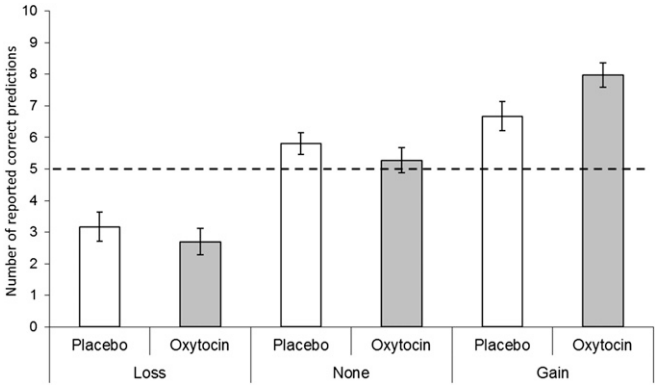

Fig. 1. Mean (±1 SE) reported correct predictions as a function of treatment (oxytocin vs. placebo) and outcome (loss vs. none vs. gain), in the group-serving setting. The dashed line represents the performance predicted by chance (i.e., if participants report honestly; 5/10).

A 2 (oxytocin vs. placebo) × 3 (loss vs. none vs. gain trial block) ANOVA with trial block within subjects revealed faster reporting about whether predictions were correct among participants receiving oxytocin (mean, $2.22_{seconds}$; standard deviation, 0.50) than placebo [mean, $2.86_{seconds}$; standard deviation, 0.78; $F(1,58) = 13.99$; $P < 0.00001$]. The main effect for block was also significant, with participants taking more time in the loss trials (mean, 2.74; standard deviation, 1.09) than in the gain trials (mean, 2.42; standard deviation, 0.89) and no-benefit trials [mean, 2.46; standard deviation, 0.68; $F(1,58) = 3.62$; $P = 0.033$]. The interaction between oxytocin and block was not significant ($F < 1$; $P > 0.65$). ANOVA further revealed that participants expected their group members to overreport correct predictions in gain trials (64.5% correct predictions), underreport correct predictions in loss trials (33.3%), and slightly overreport in no-benefit trials [57.5%; $F(2, 58) = 24.25$; $P < 0.00001$]. Oxytocin neither affected nor moderated expectations ($F < 0.41$), suggesting oxytocin did not boost reciprocal-dishonesty expectations.

Although participants receiving oxytocin lied more to benefit their group than participants receiving placebo, they also boosted their own share of the joint outcome. This raises the possibility that oxytocin increases dishonesty aimed at boosting own, rather than group, outcomes. To address this, we recruited an additional sample of 60 male students, who completed the same task with the exception that the payoff structure was modified to influence only the participants (+€0.10 on gain, −€0.10 on loss, and €0 on no benefit trials) and not their group members. Importantly, personal outcomes in this individual setting (e.g., a correct prediction on a gain trial was worth €0.10/1 person = €0.10 per person) were identical to those in the previously used group-serving setting (e.g., a correct prediction on a gain trial was worth €0.30/3 persons = €0.10 per person). Results revealed similar levels of dishonesty across treatments: Participants over-reported their outcomes on gain trials (68.7%; binominal Z, 9.10; $P < 0.00001$), underreported outcomes on loss trials (41.0%; binominal Z, −4.37; $P = 0.00001$), and did not lie without financial incentive (51.2%; binominal Z, 0.53; $P = 0.59$). Lying was not influenced by oxytocin [gain trials: Z, −1.20 ($P = 0.23$); loss trials: Z, −0.14 ($P = 0.89$); no-benefit trials: Z, −0.92 ($P = 0.36$)]. Finally, ANOVA with trial outcome (loss vs. none vs. gain) within subjects and treatment (oxytocin vs. placebo) between subjects revealed no differences in response time between oxytocin (mean, $2.51_{seconds}$; standard deviation, 0.75) and placebo [mean, $2.65_{seconds}$; standard deviation, 0.86; $F(1,58) = 0.46$; $P = 0.50$]. Similar to the group-serving setting, the main effect for block was significant, with participants taking more time in the loss trials (mean, 2.80; standard deviation, 0.91) than in the gain (mean, 2.44; standard deviation, 0.87) and no-benefit [mean, 2.51; standard deviation, 0.90; $F(1,58) = 8.77$; $P < 0.001$] trials. The interaction between oxytocin and block was not significant ($F = 1.78$; $P = 0.18$). Thus, in contrast to the group-serving setting, oxytocin in the self-serving setting increased neither dishonesty nor the time needed to make decisions.

Taken together, our findings suggest that oxytocin drives group-serving, but not self-serving, dishonesty. Although this fits the proposed theoretical framework, one possible caveat is that the conclusion that oxytocin drives group-serving dishonesty appeared to be limited to gain trials and rests on two independent tests (i.e., one in the group-serving and one in the self-serving task). Thus, to further explore the robustness and form of the obtained results, we performed a log-linear analysis that directly tested for the interaction of treatment (oxytocin vs. placebo) and setting (group-serving vs. self-serving) on dishonesty in gain trials.

Because people use more extreme lies when dishonesty serves group- rather than self-interest (22), we grouped together participants who, on gain trials, underreported being correct (i.e., 0–4 predictions), reported at around chance level (5–6 predictions), moderately overreported being correct (7–8 predictions), or extremely overreported being correct (9–10 predictions). Note that correctly predicting 9 or 10 correct predictions should occur only in 1% of the cases if participants are honest.

As can be seen in Fig. 2, however, the proportion of extreme overreporting correct predictions occurred much more than the predicted 1% if participants were honest. Moreover, extreme overreporting of correct predictions varied as a function of treatment (oxytocin vs. placebo) and setting [group-serving vs. self-serving; χ^2 (4) = 9.08; $P = 0.059$ (marginal)]. Fig. 2 shows that participants in the group-serving setting reported predicting correctly 9 or 10 times in 53% of the cases (16/30) when given oxytocin, which was more than twice as high as reported by participants given placebo [23% (7/30); χ^2 (1) = 5.71; $P = 0.017$]. In the self-serving setting, the difference was far less pronounced and was not significant. Here, participants receiving oxytocin extremely overreported in only 33% of the cases (10/30) vs. 20% in the placebo group [6/30; χ^2 (1) = 1.36; $P = 0.24$]. These additional analyses confirm that oxytocin drives dishonesty when it serves one's group, but not when it only serves personal self-interest. Moreover, and as seen in other work (22), these additional analyses show that this oxytocin-motivated group-serving dishonesty manifests itself especially in extreme lies.

With regard to time needed to make decisions, a treatment (oxytocin vs. placebo) × setting (group vs. self) between-subject ANOVA revealed no significant effect for setting [$F(1,116) = 0.09$; $P = 0.76$] but did reveal significant effects for treatment [$F(1,116) = 8.32$; $P = 0.005$] and for the treatment × setting interaction [$F(1,116) = 3.34$; $P = 0.07$ (marginal)]. Fig. 3 shows that the significant treatment effect in the group-serving setting [$F(1,116) = 11.19$; $P = 0.001$] was absent in the self-serving setting [$F(1,116) = 0.56$; $P = 0.45$].

Discussion

Morality, and its universality, has been subject to centuries of philosophical debate (2, 4, 16), with one possible solution being a functional perspective suggesting that rules such as "thou shall not lie" may be universal and accepted across groups and cultures, and that humans actually condition the application of such rules on the ultimate consequences for the groups they belong to (4, 16). Indeed, to gain profit, humans are tempted to act dishonestly and to violate moral codes. As shown here, such unethical behavior is particularly likely when it serves group interests and humans were given oxytocin rather than placebo. Specifically, when dishonesty serves group interests, oxytocin increased lying as well as extreme lying. Compared with placebo, oxytocin also increased the speed of dishonest decision making. These effects were particularly prominent when lying generated profits and were absent when lying served to avoid loss or had no financial consequences.

When lying served personal self-interests only, oxytocin had no effects. Apparently, oxytocin boosts group-serving behavior, rather than adherence to general moral codes, a conclusion that fits work showing that oxytocin sustains and enables social bonding as well as trust and cooperation, especially toward those belonging to one's own group (33). Thus, rather than being a neurohormonal modulator of moral tendencies and universal cooperation, oxytocin appears to function to serve group interests, whether it is through parochial cooperation and self-sacrifice (32, 35, 45), through lashing out against those who threaten group members (46), or as shown here, through dishonesty and moral code breaking.

The finding that oxytocin motivated group-serving dishonesty resonates with recent findings (47) demonstrating that oxytocin increases responses in brain reward regions when pictures of their romantic partners were presented to participants. Possibly, the reward circuitry also may be involved in group-serving behavior and recruited when making decisions that affect not only self-interests but also those of other group members (48). Indeed, people care about the consequence of their lies for

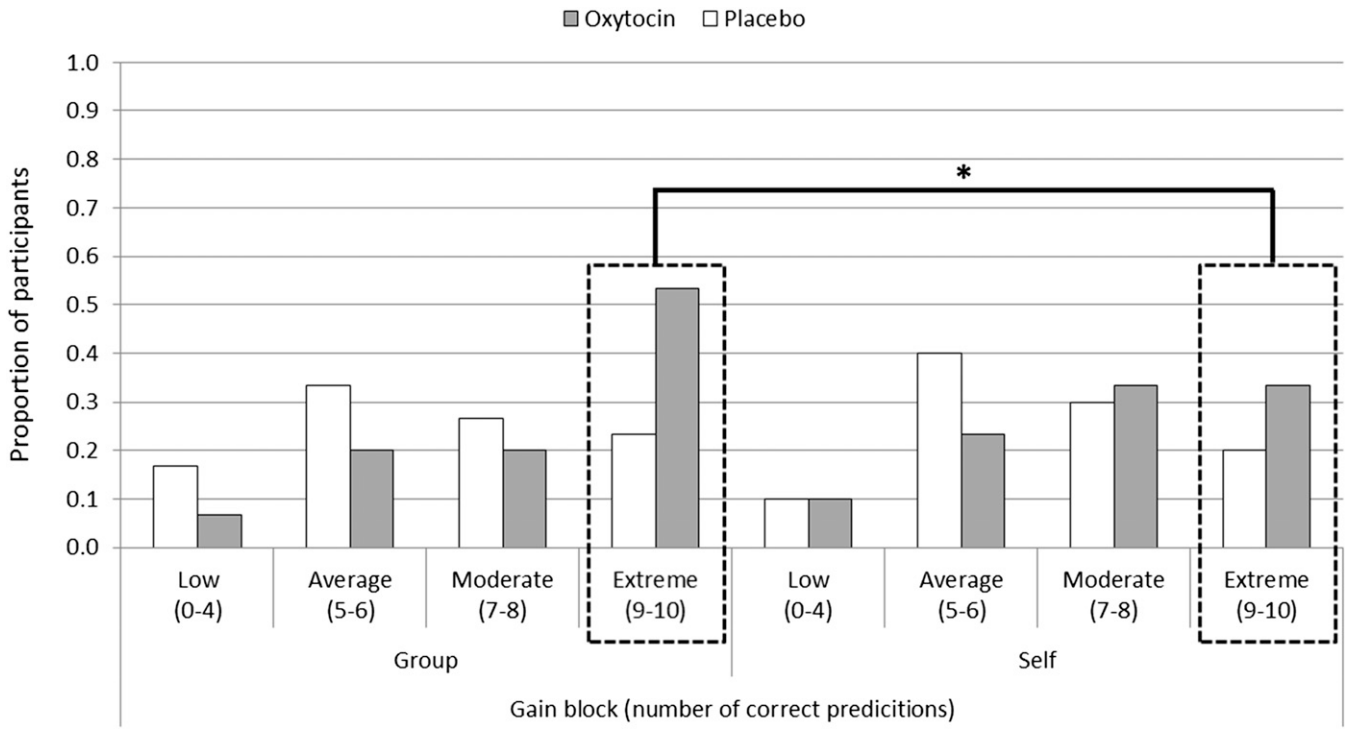

Fig. 2. Proportion of reported correct gain predictions as a function of treatment (oxytocin vs. placebo) and setting (self-serving vs. group-serving). The oxytocin effect (marked by an asterisk) on extreme lies in the group-serving, but not self-serving, setting is highlighted in a dashed frame.

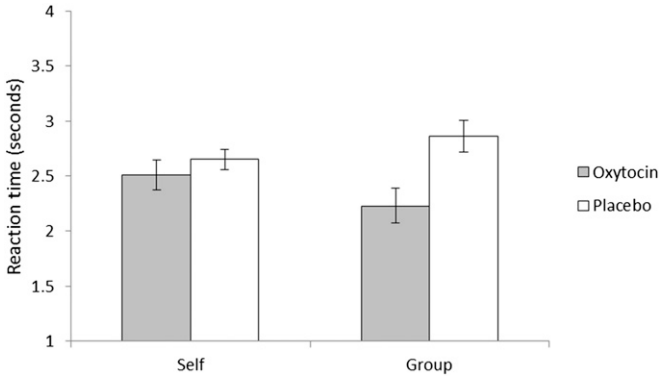

Fig. 3. Mean (±1 SE) response time taken (in seconds) when indicating whether predictions were correct or not as a function of treatment (oxytocin vs. placebo) and setting (self-serving vs. group-serving).

others' outcomes (49), they find it easier to justify their own lies when they are not the only ones benefiting from them (23), and they are willing to engage in more extreme lying when doing so serves their group (22). Fitting this, we observed that oxytocin-driven group-serving lies were relatively fast, suggesting group-serving lying requires little deliberation (40, 50) and that oxytocin enables this more automatic responding.

Research is needed to conclusively determine what brain circuitries oxytocin modulates when engaging in group-serving dishonesty. Such new research should also examine why dishonesty aimed at preventing (group- or self-serving) losses appeared insensitive to oxytocin administration. In general, people are more loss-averse than gain-seeking, as preventing loss is more fundamental to survival than achieving gain (51). Perhaps the human brain is more sensitive to neurohormonal modulation when gains, rather than losses, are at stake, and the goal is (group) prosperity, rather than survival. Such a conclusion would fit work suggesting that oxytocin motivates (social) approach tendencies more than it modulates withdrawal (47, 52, 53).

That oxytocin boosted group-serving dishonesty cannot be attributed to people's expectation for reciprocal dishonesty from their fellow group members, as participants receiving oxytocin did not expect group members to lie for the group more often than those receiving placebo. Together with the fact that oxytocin led to faster and putatively less-deliberated decision making in the group-serving setting, this suggests that the oxytonergic circuitry is involved in biologically preparing humans to learn and adhere to ethical codes, as well as to violate moral standards. What matters, it seems, is whether such moral code-breaking serves those one cares about and the group one belongs to.

Materials and Methods

Male participants were recruited via an online recruiting system and offered €10 (approximately 13 USD) for participating in a study on the effects of medication on test scores and decision-making. They filled out an online medical screening form, and participants were included in the study only if they confirmed they were not suffering from significant medical or psychiatric illness, using medication, and/or smoking more than five cigarettes per day. Participants were instructed to refrain from smoking or drinking (except water) for 2 h before the experiment. The experiments received Ethics Approval from the University of Amsterdam Ethics Board, and complied with the Helsinki Protocol for studies involving human subjects. In keeping with departmental ethics guidelines and contemporary practice in experimental research with human subjects, participants read and signed an informed consent before the experiment, the experiments did not involve deception, and participant's pay was based on the sum of their show-up fee and their earnings during the decision tasks. Participants received full debriefing on completion of the experiment.

On arrival in the laboratory, participants were seated in individual cubicles, preventing them from seeing each other and communicating. Closely following the procedures in earlier work (32), participants were randomly assigned to the oxytocin or placebo group (double-blind, placebo-controlled study design). Participants self-administered either a single intranasal dose of 24 IU oxytocin (Syntocinon-Spray, Novartis), 3 puffs per nostril, each with 4 IU oxytocin, or placebo 30 min before engaging in the experimental tasks. The placebo contained all of the active ingredients as the oxytocin, with the exception of the neuropeptide, and was manufactured by Stichting Apothekers Haarlemse Ziekenhuizen in coordination with the pharmacy at the Amsterdam Medical Centre, adhering to the guidelines on good manufacturing practice and good clinical practice.

After self-administration of the medication (placebo or oxytocin), the experimenter left and participants completed a series of unrelated questionnaires and tests that were presented on their computer screen, using the keyboard to answer questions. These tasks were self-paced. Conforming to prior research showing that effects of oxytocin peek after ∼30 min (41, 42), after 30 min, the computer automatically switched to the instructions for the experimental task. The main experimental task began by informing participants that they would engage in a task involving a three-person group. Participants were informed that groups were composed on the basis of the order in which they had signed up for the experiments, and it was noted that most, but not necessarily all, group members were currently present in the laboratory. Accordingly, participants learned that they and two other participants were assigned to be in one group. They were also told that they would not know who was in their group at any time.

Hereafter, participants were introduced to the experimental tasks (see following), made decisions, and answered a questionnaire. The experimental tasks took about 15 min to complete. On finishing the questionnaire, participants were thanked and dismissed. Within 8 weeks after the experiment, all participants received a sealed envelope containing their earnings and went through a full debriefing. We used a time lag between experimental session and debriefing to prevent any insight on the methods and materials used from becoming known before the entire experiment was completed. All participants agreed to this procedure.

Group Setting. Sixty healthy male undergraduate students at a large university in the Netherlands participated in the group-setting experiment. Participants' age did not vary between the oxytocin (mean, 21.60; standard deviation, 2.47) and placebo (mean, 21.47; standard deviation, 2.80) groups [$t(58) = 0.20$; $P = 0.85$] groups. After the general introductions and assignment to a group, computer instructions stated that for the group task, each individual group member would predict the outcome of multiple coin-tosses, earning money for the group according to his performance. Participants read that all three group members would perform the task and that the final earnings of each group member would be a third of the sum earnings generated by the three-person group. Participants learned that before each coin toss, they should predict whether the outcome will be "heads" or "tails," keep the prediction in their mind, and press the "toss coin" button. Once they saw the outcome, they had to click whether their prediction was correct or not (refs. 43–44, similar to ref. 54). To familiarize themselves with the task, each participant engaged in 5 practice coin tosses not meant to determine pay.

After being fully briefed about the task, participants were reminded that their predictions, and those of the others, had financial implications. Participants knew they would engage in a series of coin-tosses receiving (anonymized) feedback about the performance of the other group members only at the very end of the experiment. After their predictions, participants responded to a set of questions assessing how well they expected their group members to perform on the coin-tossing task. Specifically, they were asked to guess how many correct predictions (of a maximum of 10) one of their randomly chosen group members had on each of the three blocks (with correct guesses leading to a loss to the group's outcome, no financial consequence, or a gain to the group's outcome).

Individual Setting. Another group of sixty healthy males participated in the individual-setting control experiment. Participants' age did not vary between the oxytocin (mean, 22.07; standard deviation, 2.82) and placebo (mean, 21.80; standard deviation, 3.25) groups [$t(58) = 0.34$; $P = 0.74$]. The procedures, materials, and measures were identical to those of the group setting, except that participants' earning from predicting each coin toss correctly influenced only their own, not the group's, outcome.

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