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Brief report

## Oxytocin not only increases trust when money is at stake, but also when confidential information is in the balance

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### ABSTRACT

Past studies have suggested that the neuropeptide oxytocin (OT) could play a crucial role in human trusting behavior. Specifically, people on OT would be more willing to entrust someone with their money than would people on a placebo. Because alternative explanations—which do not involve trust—exist for these studies' findings, the present study aimed to rule out confounds and test how OT influences trust behavior in a totally different context. The variable at stake was not money but confidential information. Sixty participants were randomly assigned to receive either OT or a placebo. Results showed that oxytocin does increase trust, and that its effects extend beyond money. Specifically, participants on OT were 44 times more trusting that their privacy would not be violated than participants on placebo.

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### 1. Introduction

Imagine receiving a \$5000 settlement or bonus. At a friend's party, you meet some extremely skilled investor: He claims to have found a way to make investments triple. If you entrust him with your money, he will make it triple, and equally share the proceeds with you. You would then make a net profit of \$2500. But you have to trust him: He will not sign any contract. He has a job on the side (which you can verify), and he does not want to leave any tracks of this complementary job in order to avoid paying taxes. What do you do?

In normal circumstances, it is unlikely that you would trust him. But if you are on oxytocin, things might be different. Oxytocin (OT) is a neuropeptide naturally secreted by the hypothalamus. It peaks at the end of pregnancy and during sexual intercourse, and is also released during positive social interactions (Campbell, 2008). Originally known for its role in labor and lactation, OT has recently been shown to play a key role in humans' emotional and social lives. In addition to having an anti-stress effect (Uvnas-Mobaerg, 1998), it facilitates social relationships by biasing both cognitions and behaviors in a pro-social way (Taylor, 2006; Unkelbach et al., 2008; Zak et al., 2007; Domes et al., 2007; Feldman et al., 2007; Guastella et al., 2008). Using a laboratory simulation of the

above mentioned dilemma known as the "trust game" (Berg et al., 1995), Kosfeld et al. (2005) and Baumgartner et al. (2008) have shown that people on OT were much more likely to transfer money to a partner—and to transfer larger amounts—than people on a placebo.

The authors' (Kosfeld et al., 2005; Baumgartner et al., 2008) explanation for these results is that oxytocin increases trust and, specifically, reduces the perceived risk of being betrayed. Though their data make a compelling case in favor of this hypothesis, it is noteworthy that both studies involved money; therefore research has yet to demonstrate that the trust increasing effect of OT extends to other, non-monetary, scenarios. This non-monetary research is needed to rule out the alternate explanation that oxytocin does not increase trust, but instead increases generosity (Zak et al., 2007), which may not involve trust. Given that more generous people are known to make higher transfers in the trust game, it is possible that participants made higher transfers not because they were more trusting but because they were simply being more generous.

In order to rule out this alternative explanation, we designed a simple and ecologically valid experiment. In this paradigm, the subject's trust behavior does not benefit the recipient (thereby controlling for the influence of generosity) and no money is at stake. What is at stake is subjects' privacy (i.e., confidential information about them). If OT really increases trusting behaviors, it should increase trust that one's privacy will not be violated and, therefore, decrease protection of confidential information.

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## 2. Materials and methods

### 2.1. Participants

Sixty healthy young adult men ( $M_{age} = 21.2$ ,  $SD = 2.4$ ) were enrolled in the study and randomly assigned to receive either intranasal placebo (PL;  $n = 30$ ) or oxytocin (OT;  $n = 30$ ; 32 IU Syntocinon Spray—4 puffs in each nostril—Novartis, Basel, Switzerland). The biomedical ethics committee of the University of Louvain approved the protocol. Exclusion criteria included medical or psychiatric condition, substance dependence, and female gender (in order to avoid sex differences in OT response). After providing written informed consent, participants were invited to complete measures of demographics, risk taking (Jackson, 1994), self-esteem (Rosenberg, 1979), kindness (Park et al., 2004), agreeableness (Costa and McCrae, 1992), social competence (Petrides, in preparation), emotional dispositions (Petrides and Furnham, 2003), and psychological disorders (Derogatis, 1993), in order to ensure that groups were equal regarding demographics and individual differences relevant to the study.

### 2.2. Procedure

Before substance administration, participants were invited to complete a questionnaire about their sexual practices and fantasies. Questions were purposefully very intimate (e.g., anal sex, sex toys, sado-masochism) to ensure a type of content that one would not divulge to a stranger. Accordingly, participants were told that responses would be read via an optical character recognition device. Participants were given an envelope for their completed questionnaire, though they were instructed not to seal the envelope until the end of the experiment. The substance (OT or PL) was then administered. Owing to the crucial role of social thoughts or experiences in facilitating the effects of oxytocin (Uvnas-Moberg and Petersson, 2005), subjects were then invited to wait for the beginning of the experiment in front of an excerpt of a movie featuring friendship and camaraderie.

Forty-five minutes after product administration, participants were asked to complete a similar questionnaire (in order to rule out the hypothesis that OT rid people of their inhibitions) and return both questionnaires to the experimenter. The experimenter assured participants that he would not look at their answers because participants were protected by confidentiality rules (therefore, participants identified themselves by a code). However, they were free to seal the envelope, and even add sticky tape (which was provided), if they wanted to secure their answers until optical scanning. The degree of the envelope's opening (sealed plus taped, only sealed, or left open) was considered as a measure of the participant's trust in the experimenter.

## 3. Results

No differences emerged between groups in demographic and individual difference measures (all  $p > .25$ ), nor in beliefs about group assignment ( $p > .25$ ). There was no significant difference either between groups regarding sexual practices and fantasies, neither before substance administration ( $p > .25$ ) nor after ( $p > .20$ ). As expected, repeated measure ANOVAs performed on sexual fantasies yielded no significant effect ( $p > .25$ ), indicating that OT has no general effect on people's inhibitions. However, the ordinal regression performed on the degree of envelope's opening suggested that OT substantially increased trust ( $-2$  Log-Likelihood = 11.57,  $p \leq .001$ ). As shown in Fig. 1, 80% participants in the PL group sealed the envelope and added tape, whereas only 7% in the OT group did. Conversely, 60% participants in the OT group left the envelope open, while only 3% of the PL group did. These differences resulted in a large effect size (Cohen's  $d = 2.41$ ). Odds ratios revealed that OT subjects were 44 times more likely to leave their envelope open than PL subjects.

## 4. Discussion

Beyond confirming that oxytocin can have a large effect on behavior (see Unkelbach et al., 2008; Zak et al., 2007; Domes et al., 2007; Baumgartner et al., 2008 for effect sizes—Cohen's  $d$ —larger than .70), these findings extend OT literature in several important ways. First, they show that oxytocin decreases the perceived risk of betrayal, as hypothesized by Baumgartner et al. (2008). Second, our findings suggest that oxytocin not only increases trust when money is at stake but also when immaterial things—such as intimate and confidential information—are in the balance. This is crucial because

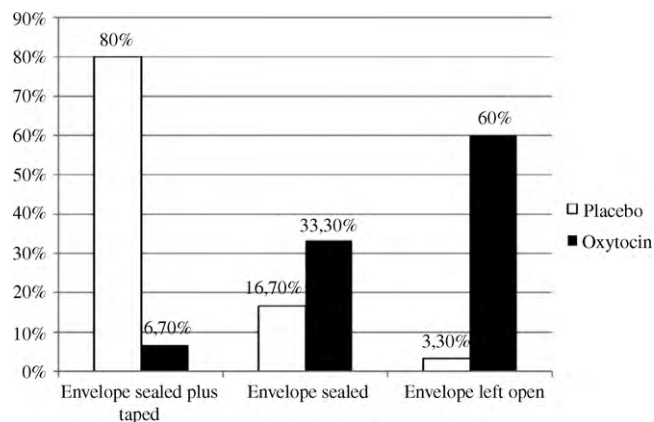


Fig. 1. Percentage of participants displaying each behavior in the placebo and oxytocin condition.

trust is not only essential for transactions and market efficiency but also for politics, friendship, and love (Fehr and Zehnder, 2009).

These results dovetail with the finding that oxytocin increases the readiness to engage in emotional disclosure (Mikolajczak et al., submitted for publication).<sup>1</sup> Taken together, these findings further explain the benefits of OT for bonding and relationships. Indeed, the construction of intimacy, whether in friendship or marital interactions, involves a disclosure–counter–disclosure cycle: Each partner must disclose, in turn, private facts (i.e., secrets known to very few people) (Van den Broucke et al., 1995). Intimacy grows as cycles develop, with an increment in self-disclosure at each new cycle (Reis, 2001). In light of this, it is likely that OT and self-disclosure feed each other into a positive loop: OT would increase trust, thereby decreasing privacy protection and facilitating self-disclosure. This would result in an increase in reciprocal trust (Rimé, 2009), which would in turn prompt OT release (Zak et al., 2005). A new cycle would then go on, resulting in increased attachment and intimacy.

Although this study fits well in the oxytocin and interpersonal processes literatures, several limitations have to be acknowledged. First, the fact that substance administration was single-blind (the experimenter knew about group appartenance but the participants did not) does not allow to firmly rule out the possibility that the experimenter involuntarily influenced the findings. This is, however, unlikely given that (a) the verbal contact with the experimenter was limited (most instructions were given by the computer), (b) instructions were fully standardized, and (c) the trust increasing effect of OT has already been observed in double-blind studies (Kosfeld et al., 2005; Baumgartner et al., 2008).<sup>2</sup> Second, it is possible that the movie may have facilitated the effects of oxytocin, similar to the effect of social support in facilitating the anxiolytic effects of oxytocin (Heinrichs et al., 2003). Thus, although the movie cannot account for the observed effects (participants view the movie in both conditions), it may have enhanced the effect of OT. Third, differences between first and second assessments of sexual fantasies might not be the most valid indicator of inhibition,

<sup>1</sup> These results were obtained using another paradigm, but on the same sample as in the current study and within the same laboratory session.

<sup>2</sup> Although it seems unlikely that the experimenter induced the effect, we cannot firmly dismiss the point made by one anonymous reviewer. According to him/her, it cannot be excluded that the experimenter (who knew whether the subjects received OT or PL) involuntarily affected the subjects' decision, for example by facial cues. Because we do not have complete voluntary control over our facial muscles (in particular in emotional situation) and because it is well known that subtle or even unconsciously experienced stimuli (verbal or facial) can modify behavior, it is possible that subjects have unconsciously responded to an unconscious experimenter bias.

because of the well-known tendency towards consistent responding. Thus, it cannot fully be excluded that the present effects result from disinhibition effects, and future research should determine the part played by disinhibition (if any) in OT pro-social effects.

## 5. Conclusion

This study nicely complements previous studies on oxytocin and trust (Kosfeld et al., 2005; Baumgartner et al., 2008; Theodoridou et al., 2009). First, it indicates that the effect of OT on trust is independent from its effect on generosity. Second, it shows that OT also increases trust when non-material things (i.e., privacy, feelings) are at stake. Taken together, findings suggest that future studies would highly benefit from investigating the relationship between oxytocin and psychological disorders involving trust deficits (Bartz and Hollander, 2006). Paranoia, in particular, may be a good candidate for exploration (Dethlefs, 2007).

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