Short Report

aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Psychological Science
21(8) 1072–1074

DOI: 10.1177/0956797610377343
http://pss.sagepub.com
SAGE

Oxytocin Makes People Trusting, Not Gullible

Moïra Mikolajczak[1], James J. Gross[2], Anthony Lane[1], Olivier Corneille[1], Philippe de Timary[1], and Olivier Luminet[1]
[1]Université catholique de Louvain and [2]Stanford University

Received 10/13/09; Revision accepted 1/31/10

The neuropeptide oxytocin (OT) plays such a key role in social behavior that it has been referred to as "the love hormone" and "liquid trust" (e.g., Domes, Heinrichs, Michel, Berger, & Herpertz, 2007; Ferguson, Young, & Insel, 2002; Guastella, Mitchell, & Mathews, 2008; Morhenn, Park, Piper, & Zak, 2008; Taylor, 2006; Unkelbach, Guastella, & Forgas, 2008). These nicknames have an element of truth: When OT levels are increased, people do in fact seem to become more altruistic, trusting, and generous (Barraza & Zak, 2009; Baumgartner, Heinrichs, Vonlanthen, Fischbacher, & Fehr, 2008; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Pedersen, Ascher, Monroe, & Prange, 1982; Theodoridou, Rowe, Penton-Voak, & Rogers, 2009; Zak, Stanton, & Ahmadi, 2007).

The effect of OT on prosocial behavior—and on trust in particular—is so strong that it has been suggested that OT may make people indiscriminately prosocial (e.g., trusting to a fault). While the press (e.g., Szalavitz, 2008) and researchers (e.g., Damasio, 2005) alike have worried about its potential misuse by politicians, the armed forces, and marketers, OT retailers have flourished by convincing clients that they can close deals with a few whiffs of OT.

But does OT really increase people's trust in anybody, or can contextual cues of unreliability override the effects of OT? Animal studies suggest that OT's social effects may be context dependent (Campbell, 2008). In rodents, a female's OT release after giving birth decreases her aggressiveness toward her offspring but increases her hostility toward potentially aggressive female intruders (Debiec, 2005; Pedersen, 2004). It is not known, however, whether OT's effects are context dependent in humans. To examine this issue, we used a customized version of the trust game (Berg, Dickhaut, & McCabe, 1995; Cesarini et al., 2008; see the Supplemental Material available online). In this game, we manipulated partners' trustworthiness and measured participants' investment in each partner. We predicted higher investment by participants who received a nasal OT spray than by control participants, unless there were cues that a partner might not be trustworthy.

Method

Sixty healthy young adult men (mean age = 21.2 years, $SD = 2.4$) completed measures of demographics, risk taking (Jackson, 1994), self-esteem (Rosenberg, 1979), kindness (Park, Peterson, & Seligman, 2004), agreeableness (Costa & McCrae, 1992), social competence (Petrides, 2009), emotional dispositions (Petrides & Furnham, 2003), and psychological disorders (Derogatis, 1993). Participants were then randomly assigned to receive intranasal OT ($n = 30$; 32 IU Syntocinon Spray, Novartis, Basel, Switzerland) or intranasal placebo ($n = 30$). To avoid gender differences in OT response, we recruited only males.

Forty-five minutes after substance inhalation (the time required for OT to be fully active), participants received instructions for the trust game. Each participant assumed the role of investor and could transfer money to a "trustee," in whose hands the funds would triple. The trustee would then transfer all the money, part of it, or none of it back to the investor. If the investor entrusted the trustee with all of his money, he could maximize his profits if the trustee was reliable and fair. Conversely, he could lose everything if the trustee was not fair. The trust game is perfectly suited to establish the investor's level of trust (i.e., the higher the trust, the higher the transfer). Each participant played with three different types of trustees: seemingly reliable humans, seemingly unreliable humans, and the computer (i.e., a fully neutral device). By manipulating the partners' trustworthiness, we sought to determine the extent to which OT impairs sensitivity to potential signs of dishonesty.

In one part of the game, participants were told that they would play 10 rounds with the computer, which would randomly determine the back transfers; in another part, participants were told that they would play online with real people.

Corresponding Author:
Moïra Mikolajczak, Department of Psychology, Université catholique de Louvain, Place Cardinal Mercier 10, 1348 Louvain-la-Neuve, Belgium
E-mail: moira.mikolajczak@uclouvain.be

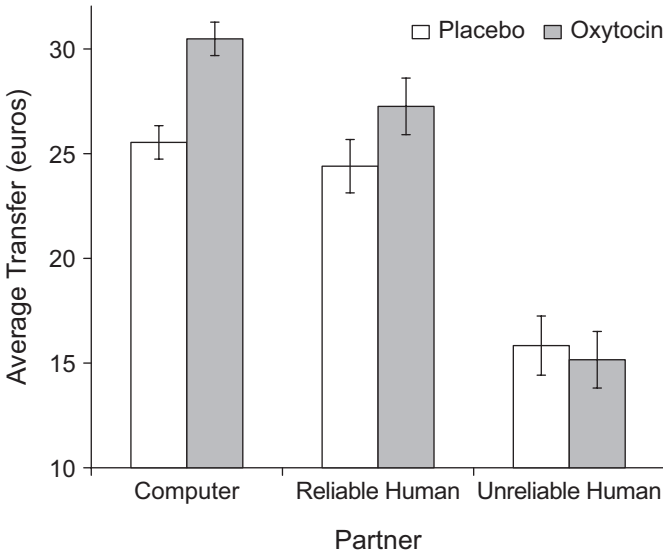

Fig. 1. Average money transfer as a function of group (oxytocin or placebo) and partner (computer, reliable human, or unreliable human). Error bars represent standard errors of the mean.

Following Delgado, Frank, and Phelps (2005), we gave participants a brief description of their partner before each round. Based on a pretest, these descriptions were manipulated to induce high or low trust: We combined trustworthy academic fields (e.g., philosophy) and activities (e.g., practicing first aid) to make some partners seem reliable, and untrustworthy academic fields (e.g., marketing) and activities (e.g., playing violent sports) to make other partners seem unreliable. The main effect of partner type (reported in Results and Discussion) confirms that these descriptions were effective in inducing trust or mistrust in this study. Each participant played 10 rounds with 10 different partners (5 trustworthy, 5 untrustworthy). No back-transfers feedback was provided during the experiment, and presentation order was randomized. Before leaving the laboratory, participants were asked to guess the group (OT or control) to which they had been assigned. (See Supplementary Methods in the Supplemental Material available online for additional details of the experimental method.)

Results and Discussion

The OT and control groups did not differ in demographic and individual difference measures (all ps > .25) or in beliefs about their group assignment ($p > .25$). After removing 1 outlier, we performed a 2 (group: OT or placebo) × 3 (partner type: computer, reliable human, unreliable human) mixed-model analysis on investments, with partner type as a within-subjects factor. Kindness, self-esteem, social competence, emotional dispositions, and psychological disorders were included as covariates because they affected investments (ps ≤ .05). The same pattern of results was obtained with and without inclusion of these covariates. Significant multivariate effects ($p \leq .05$) were followed up with Bonferroni-adjusted t tests.

Analyses yielded a main effect of partner type, $F(2, 1051) = 65.44$, $p \leq .001$; participants made smaller investments, or transfers, with unreliable partners than with the computer, $t(58) = 7.47$, $p \leq .001$, or reliable partners, $t(58) = 5.38$, $p \leq .001$. Transfers to reliable and unreliable partners did not differ, $t(58) = 1.38$, $p = .17$. There was also a main effect of group, $F(1, 1051) = 5.76$, $p < .018$, with the OT group making larger transfers than the placebo group. Crucially, group interacted with partner type, $F(2, 1051) = 3.29$, $p = .038$, such that OT completely lost its trust-enhancing effect when the partner was untrustworthy (see Fig. 1; for more detailed descriptive statistics, see Supplementary Table 1 in the Supplemental Material available online).

This study is the first to demonstrate contextually dependent OT effects on prosocial behaviors in humans. We found evidence—consistent with previous studies—that OT increases prosocial behavior, but we further demonstrated that OT facilitates such behavior only in the absence of cues that a social partner may be untrustworthy.

That OT fosters trust, but not gullibility, is crucial: To survive, people must be able to detect situations in which trust may result in aversive outcomes (Greenspan, Loughlin, & Black, 2001; Teoh & Wong, 2002). Indeed, whereas trust contributes to economic and social success (see, e.g., Kramer, 1999), gullibility fosters social maladaptation and exposes one to financial exploitation and even sexual abuse (Greenspan et al., 2001).

This study has several implications. First, oxytocin is not the magical "trust elixir" described in the news, on the Internet, or even by some influential researchers. Second, the fact that we observed a significant effect of OT when the partner was a computer suggests that OT's effect may be primarily moderated not by the human versus nonhuman nature of the partner, but rather by the perceived risk inherent to the interaction (see Supplementary Discussion in the Supplemental Material for extended discussion).

Acknowledgments

We thank Nathalie Lefèvre, Cécile Husquet, and Noah Forrin for assistance, as well as Markus Heinrichs and Thomas Baumgartner for information and advice.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Funding

The Belgian Fund for Scientific Research (FNRS) supported this research.

Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

References

Barraza, J.A., & Zak, P.J. (2009). Empathy toward strangers triggers oxytocin release and subsequent generosity. *Annals of the New York Academy of Sciences*, *1167*, 182–189.

Baumgartner, T., Heinrichs, M., Vonlanthen, A., Fischbacher, U., & Fehr, E. (2008). Oxytocin shapes the neural circuitry of trust and trust adaptation in humans. *Neuron*, *58*, 639–650.

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior*, *10*, 122–142.

Campbell, A. (2008). Attachment, aggression and affiliation: The role of oxytocin in female social behavior. *Biological Psychology*, *77*, 1–10.

Cesarini, D., Dawes, C.T., Fowler, J.H., Johannesson, M., Lichtenstein, P., & Wallace, B. (2008). Heritability of cooperative behavior in the trust game. *Proceedings of the National Academy of Sciences, USA*, *105*, 3721.

Costa, P.T., & McCrae, R.R. (1992). *Neo PI-R professional manual*. Odessa, FL: Psychological Assessment Resources.

Damasio, A. (2005). Brain trust. *Nature*, *435*, 571.

Debiec, J. (2005). Peptides of love and fear: Vasopressin and oxytocin modulate the integration of information in the amygdala. *BioEssays*, *27*, 869–873.

Delgado, M.R., Frank, R.H., & Phelps, E.A. (2005). Perceptions of moral character modulate the neural systems of reward during the trust game. *Nature Neuroscience*, *8*, 1611–1618.

Derogatis, L.R. (1993). *BSI: Brief Symptom Inventory*. Minneapolis, MN: National Computer Systems.

Domes, G., Heinrichs, M., Michel, A., Berger, C., & Herpertz, S.C. (2007). Oxytocin improves "mind-reading" in humans. *Biological Psychiatry*, *61*, 731–733.

Ferguson, J.N., Young, L.J., & Insel, T.R. (2002). The neuroendocrine basis of social recognition. *Frontiers in Neuroendocrinology*, *23*, 200–224.

Greenspan, S., Loughlin, G., & Black, R.S. (2001). Credulity and gullibility in persons with mental retardation: A framework for future research. *International Review of Research in Mental Retardation*, *24*, 101–135.

Guastella, A.J., Mitchell, P.B., & Mathews, F. (2008). Oxytocin enhances the encoding of positive social memories in humans. *Biological Psychiatry*, *64*, 256–258.

Jackson, D.N. (1994). *Jackson Personality Inventory–Revised*. Port Huron, MI: Sigma Assessment Systems.

Kosfeld, M., Heinrichs, M., Zak, P.J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature*, *435*, 673–676.

Kramer, R.M. (1999). Trust and distrust in organizations: Emerging perspectives, enduring questions. *Annual Review of Psychology*, *50*, 569–598.

Morhenn, V.B., Park, J.W., Piper, E., & Zak, P. (2008). Monetary sacrifice among strangers is mediated by endogenous oxytocin release after physical contact. *Evolution and Human Behavior*, *29*, 375–383.

Park, N., Peterson, C., & Seligman, M.E.P. (2004). Strengths of character and well-being. *Journal of Social and Clinical Psychology*, *23*, 603–619.

Pedersen, C.A. (2004). Biological aspects of social bonding and the roots of human violence. *Annals of the New York Academy of Sciences*, *1036*, 106–127.

Pedersen, C.A., Ascher, J.A., Monroe, Y.L., & Prange, A.J. (1982). Oxytocin induces maternal behavior in virgin female rats. *Science*, *216*, 648–650.

Petrides, K.V. (2009, July). *Trait social intelligence: Continuing the incorporation of faux intelligences into mainstream personality hierarchies*. Paper presented at the biennial meeting of the International Society for the Study of Individual Differences, Evanston, IL.

Petrides, K.V., & Furnham, A. (2003). Trait emotional intelligence: Behavioural validation in two studies of emotion recognition and reactivity to mood induction. *European Journal of Personality*, *17*, 39–57.

Rosenberg, M. (1979). *Rosenberg Self-Esteem Scale*. New York: Basic Books.

Szalavitz, M. (2008). Cuddle chemical could treat mental illness. *New Scientist*, *2656*, 34–37.

Taylor, S.E. (2006). Tend and befriend: Biobehavioral bases of affiliation under stress. *Current Directions in Psychological Science*, *15*, 273–277.

Teoh, S.H., & Wong, T.J. (2002). Why new issues and high-accrual firms underperform: The role of analysts' credulity. *Review of Financial Studies*, *15*, 869–900.

Theodoridou, A., Rowe, A.C., Penton-Voak, I.S., & Rogers, P.J. (2009). Oxytocin and social perception: Oxytocin increases perceived facial trustworthiness and attractiveness. *Hormones and Behavior*, *56*, 128–132.

Unkelbach, C., Guastella, A.J., & Forgas, J.P. (2008). Oxytocin selectively facilitates recognition of positive sex and relationship words. *Psychological Science*, *19*, 1092–1094.

Zak, P.J., Stanton, A.A., & Ahmadi, S. (2007). Oxytocin increases generosity in humans. *PLoS ONE*, *2*(11), e1128. Retrieved June 10, 2010, from http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0001128