Commentary on: A neurobehavioral model of affliative bonding: implications for conceptualizing a human trait of affiliation, by R.A. Depue and J.V. Morrone-Strupinsky in *Behavioral and Brain Sciences*

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Trust : A Temporary Human Attachment Facilitated by Oxytocin

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Abstract

Trust is a temporary attachment between humans that pervades our daily lives. Recent research has shown that the affiliative hormone oxytocin rises with a social signal of interpersonal trust and is associated with trustworthy behavior (the reciprocation of trust). This commentary reports these results and relates them to the target article's findings for variations in affiliative-related behaviors.

Depue and Morrone-Strupinsky's remarkable review of the neurobiology of affiliation lacks only in the paucity of direct human evidence. This commentary reports new findings supporting the Morrone-Strupinsky's primary contention that affiliation is an essential human trait.

My lab has been studying the physiology of a temporary human attachment, interpersonal trust. Trust is so frequent in quotidian activities that we hardly notice it. Trust among family members and friends is unsurprising due to the value of repeat bidirectional cooperation. What is surprising is that humans trust unrelated strangers quite easily and often with substantial resources. Consider how many strangers you trust to fly an airplane safely, to prepare your food, and to invest your hard-earned money. A conditional psychology supporting interpersonal trust is essential for humans to live among large numbers of unrelated others in modern societies (Pedersen, 2004; Zak, 2003; Zak & Knack, 2001).

Zak and colleagues hypothesized that this conditional psychology would utilize the neuroendocrine architecture for affiliation and social recognition (Zak, Kurzban & Matzner, in press). In this study, trust and trustworthiness were operationalized using a paradigm from experimental economics using monetary transfers. Money is used so that participants' decisions to trust others or to be trustworthy have personal costs and benefits, seeking to mimic why humans trust others outside the laboratory. In each experimental session, twelve to 16 subjects from a large California public university earned $10 for showing up at the lab, were randomly assigned to the role of decision-maker 1 (DM1) or decision-maker 2 (DM2), and were placed in DM1-DM2 dyads through proprietary software. Subjects were informed that their own decisions and those of the other DM in the dyad affected how much money they earned during the experiment, but they were unable to communicate directly with the other DMs. There was no deception of any kind.

During the experiment, DM1s were queried by the software to send an integer amount of their $10 show-up compensation, including zero, to the DM2 in their dyad. Both DMs were advised that whatever DM1 sent to DM2 would be tripled in DM2's account. After DM1s' decisions, the software reported to DM2s the tripled amount that the DM1 in their dyad sent them and the total in their accounts. DM2s were then prompted to send some integer amount, including zero, to the DM1 in their dyad. Researchers in experimental economics agree that the transfer from DM1 to DM2 is a signal of trust; relatedly, the amount DM2 returns to DM1 is an index of trustworthiness (Smith, 1998). Here's the logic: DM1 sacrifices some of his or her show-up earnings by transferring them to an unknown DM2 to signal that the "pie" just got bigger and that the DM1 trusts DM2 to share some of this largess. DM1 can send a stronger trust signal only by sacrificing more of the show-up amount. Similarly, DM2 can only reciprocate trust by taking money out of his or her account — every dollar transferred to a DM1 reduces DM2's earnings one-to-one (and is not tripled).

Each participant was told that he or she would make a single decision and would do so serially. Immediately following each DM's decision, 28ml of blood was drawn from an antecubital vein. After all decisions, subjects were privately paid their earnings in cash. Each experimental session began at 1:00 PM, a time of minimum diurnal hormone

variation. We conducted two experimental conditions. In the Intention condition, the trust social dilemma described above was implemented; in the Random Draw condition, a separate group of DM1s publicly pulled a numbered ball from an urn. The urn contained 11 balls numbered 0, 1, ... 10, corresponding to the set of choices DM1s could make in the Intention condition. The Random Draw condition removes the intentional signaling element from DM1's decision while maintaining the other aspects of the experiment. This allows an identification of the behavioral and endocrine effects of the trust signal.

DM2s who received an intentional trust signal had nearly twice the OT levels as DM2s in the Random Draw condition (Intention mean OT=340.87, SD=130.50 pg/ml; Random Draw mean OT =197.75, SD=165.23 pg/ml; F-test, one-tailed, N=38, $p<.004$) even though the monetary transfer received by DM2s in both conditions are on average identical (F-test, two-tailed, $p>0.87$). The two conditions also resulted in different behaviors. DM2s who received an intentional trust signal returned an average of 53% of the amount they received from the DM1 in their dyad. In the Random Draw condition the mean DM2 return to DM1 is zero (t-test, two-tailed, $p>.45$).

OT levels in DM2s were also related to their behavior in the Intention condition. Using a multiple regression model, the percent DM2s returned to DM1s (relative trustworthiness), was statistically related to OT(+) and OT^2(-) (one-tailed t-test, $p<0.035$), and an indicator of ovulation (progesterone > 3 ng/ml; one-tailed t-test, $p<.036$), including age, gender, and a fainting indicator (N=3) as covariates. Our finding that ovulating women were statistically less trustworthy is consistent with evidence that progesterone inhibits OT receptor binding (Grazzini et al, 1998). It provides evidence that oxytocin facilitates trustworthiness directly, rather than indirectly. None of eight other hormones assayed were related to DM2s' behaviors directly or indirectly through their effect on OT.

These results support the role of affliative hormones in responding to an experimental state. We have also have evidence supporting Depue and Morrone-Strupinsky's assertion that affiliation is a human trait using an extensive social and affect survey. Trustworthy behavior by DM2s was related with three measures of calm affect ($p<.04$), but not robustly with any of the other 189 survey questions. Fig. 1 shows a positive relationship between OT and trustworthy behavior in the Intention condition (N=77), with five DM2s who had high OT (> 400 pg/ml) after a trust signal, but were not very trustworthy (return transfer $\leq$ 7). We investigated traits that differentiated these five "usual" participants from the others and found that they exhibited labile affect on four self-report measures, were unusually sexually active, said that they thought others were trustworthy and evaluated themselves as very trustworthy. They also stated that accumulating wealth while others lived in poverty was acceptable. Though these results are based on a small sample and should be taken with caution, they suggest that a lack of trustworthiness after receiving a signal of trust is associated with identifiable personality traits.

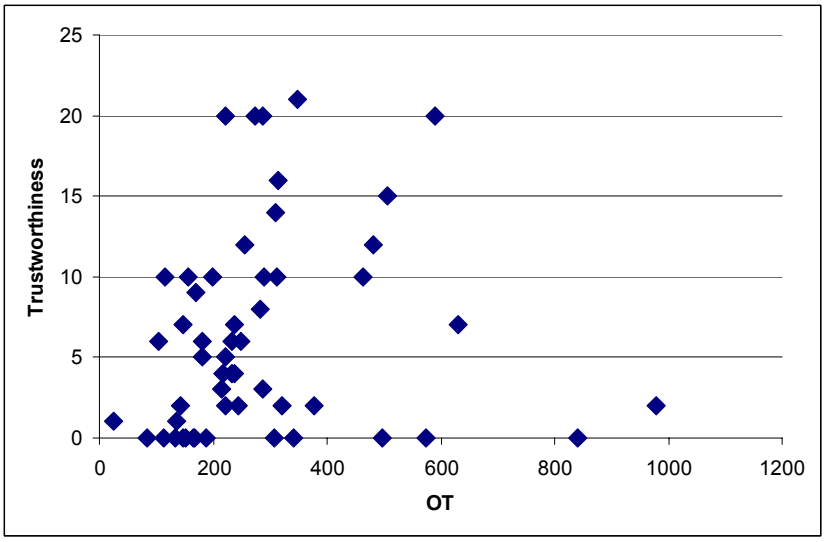

Figure 1: OT levels and trustworthy behavior (dollars returned by DM2 to DM1 after tripled transfer from DM1 to DM2) for DM2s receiving an intentional signal trust.

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