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Oxytocin makes inexperienced men more selective in their dating strategy

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ABSTRACT

Oxytocin (OT) is known to be involved in pair-bonding. This, however, does not take the form of an undifferentiated approach behavior but rather a behavior adapted to the current needs. Therefore, in this study, we hypothesized OT to promote adaptive pair-bonding strategies by increasing appropriate selectiveness in the dating context. To test this, 110 participants intranasally self-administered OT or placebo and then conducted a "Tinder" style task in which they rated pictures of medium attractive individuals in terms of their romantic and sexual interest. Two patterns of results revealed: First, we found a less selective dating strategy among males compared to females, both with regard to romantic and sexual dating. Second, this unselective strategy was mostly pronounced among the rather inexperienced males which, however, was restored to the level of experienced males by OT. These findings support previous insights on pair-bonding and add to the understanding of the neuromodulator OT. Specifically, OT seems to adjust behaviors during social interactions to help individuals fit into social environments.

1. Introduction

Dating apps like Tinder have become a worldwide trend [35] benefitting from being quick and effortless [1] to find both sexual and romantic partners. First studies are on the rise that explore the people who use such apps and their strategies. For example, it has been shown that dating app users who score low on agreeableness are more likely to use such tools to make sexual experiences, whereas people scoring high on conscientiousness are more likely to use it to find a romantic partner [2]. Moreover, men are less selective in their dating app strategy in the hope of attaining any match, whereas women are rather selective looking out for the optimal candidate [3,4]. The current study investigates how the neuromodulator and hormone Oxytocin (OT) affects such pair-bonding tendencies.

OT is primarily produced in the hypothalamus from which it is spread within the brain and the circulatory system [5]. Laying the foundations for OT research, early work showed that OT increases trust [6]. Today, OT is known to modulate a much wider range of social cognition and behavior (for an overview, see Refs. [7]. For example, it increases gazing towards novel social but also non-social stimuli [8] and facilitates in-group conformity [9] but also coordinated out-group attacks [10].

OT also seems to be involved in pair-bonding. Among prairie voles which are monogamous mammals and form male-female pair bonds, OT administration induces preferential contact with a familiar partner [11, 12]. This is associated with sexual activity why such partner preference is an index of pair bond formation. Studies with humans also suggest OT effects on pair-bonding. For example, after intranasal administration of OT, people assess both male and female targets as more attractive [13, 37]. In another study, OT made female participants to decrease the social distance between themselves and an unfamiliar attractive and friendly male experimenter [14]. Similarly, under OT, only those men who were in monogamous relationships kept greater distance between themselves and attractive female strangers, but not men who were single [15]. In a most recent study, OT made men to rate faces of women who were described to have acted unfaithfully during a previous relationship as more attractive and to increase their interest in a short-term relationship with those women. In women, however, a different picture emerged: OT made them to rate faces of unfaithful men as less attractive and to increase their interest in long-term relationships with faithful men [16].

All in all, these studies imply an amplifying effect of OT on pair-bonding with somewhat different forms among men and women. This is intriguing because it indicates that OT does not simply boost approach-related tendencies as suggested previously [17]. Instead, it seems to improve adaptation to the social environment [18]. This pattern had been revealed in a range of contexts in the past. For example, OT induced cooperation in safe environments and competition in antagonistic ones

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[19].) OT might even work allostatic by adjusting the individual to changes in the environment to better suit current needs [20]. Transferring this reasoning to dating behavior, it appears plausible that OT does not undifferentiatedly increase (romantic and sexual) interest but rather promotes an adaptive strategy to find a suitable partner. Thus, in the current study, we suggested OT to promote appropriate selectiveness in the dating context. Since appropriateness is dependent on person and context, we aimed to explore the moderating impact of two variables in this relationship: gender and level of experience.

Previous studies have revealed that men and women behave somewhat differently in pair-bonding. Women are more selective in their dating behavior per se [3,4]. This seems consistent with evolutionary approaches according to which intersexual choice (i.e., the discriminative choice of mating partners) is largely based on females choosing mating partners. In other words, females are the more-choosy sex [21]. This might be explained by females (in contrast to males) being commonly less ready for reproductive opportunities because these mean a prolonged burden for them [22]; but see Refs. [23,24]. Against this background, a ceiling effect in selectiveness for women (impeding an OT effect) is likely. The generally lower selectiveness of men in the dating context, on the other hand, might be impacted by OT.

Promoting an appropriate form of selectiveness might be particularly adaptive for the inexperienced (men). Experienced and inexperienced individuals vary in their expectations in romantic and sexual relationships and corresponding behaviors [25,36]. Due to fear of failure, inexperienced individuals are especially non-selective in their dating strategy. This, however, is not adaptive to find a suitable partner, particularly in more demanding courtships in which males must discriminate between those to be courted and those to be ignored [21]. Since OT promotes a more adaptive pair-bonding strategy, we hypothesized OT to increase selectivity particularly among the inexperienced men.

To test the hypothesized effect, participants intranasally self-administered OT or placebo and then conducted a "Tinder" style task in which they were presented pictures of medium attractive individuals and asked for their romantic and sexual interest.

2. Method

2.1. Participants

We conducted an a-priori power analysis to test the adequacy of our sample size to detect an interaction with seven predictors in a linear multiple regression analysis using G*Power [26]. We specified an alpha level of 0.05, a 1-β error probability of .80, and an effect size f^2 of 0.08 for an estimated small to medium effect. The results of the analysis suggested a total recommended sample size of 101.

A total of 110 volunteers (mean age = 22.36 years, SD = 3.64; 63 female, 47 male; romantic interest: N_{males} = 43 and $N_{females}$ = 56 heterosexual, N_{males} = 1 and $N_{females}$ = 2 homosexual, N_{males} = 3 and $N_{females}$ = 5 bisexual; sexual interest: N_{males} = 44 and $N_{females}$ = 52 heterosexual, N_{males} = 1 and $N_{females}$ = 1 homosexual, N_{males} = 2 and $N_{females}$ = 10 bisexual) participated in this study. Exclusion criteria were significant medical or psychiatric illness, medication, smoking more than five cigarettes per day, drug or alcohol abuse, hypersensitivity to preservatives in the OT spray, and (for female participants) pregnancy. Moreover, only participants who defined their relationship status as being single (not in a permanent and binding relationship) were allowed to take part to avoid confounding effects with the latter (as investigated in Ref. [15]. Participants were instructed to refrain from smoking or drinking (except for water) for 2 h before arrival. The experiment was approved by the local ethics committee.

2.2. Design

The study followed a 2 (substance: OT vs. placebo) × 2 (gender: male vs. female) between-subjects design with random and double-blind assignment to the former; level of experience served as continuous moderator variable.

2.3. Procedure and materials

After written informed consent was obtained, participants self-administered either 24 I.U. (three puffs per nostril) of OT (Syntocinon Spray, Defiante; N = 53) or a placebo (sodium chloride solution; N = 57) under experimenter supervision. (Each experimental session was supervised by one of five female experimenters of approximately the same age as the participants.) Participants were uninformed about the content of the spray; they were only told that they would receive a hormone or placebo in low dosage. To ensure a nose-to-brain transport, we implemented a latency of 45 min in which all participants watched a movie about the universe (we chose this movie to prevent them from having any kind of social interaction that might had interfered with the study design). Notably, we used the standard dose and time frame which is known to be most effective [27].

After that, the "Tinder" task was started in which participants indicated their romantic and sexual interest. To check for group differences in mood, participants then responded to a measure of affect. Subsequently, they completed items to measure their level of experience. To check for potential confounds, female participants were asked about hormonal contraceptive use and ovarian cycle stage at the end of the survey. Then, all participants were debriefed.

2.3.1. Romantic and sexual interest

In the framework of the "Tinder" task, participants indicated their romantic and sexual interest in a first step. Therefore, they were asked in which gender they are primarily interested in (opposite gender: N_{males} = 45 and $N_{females}$ = 61; same gender: N_{males} = 2 and $N_{females}$ = 2; notably, we avoided the terms hetero-, homo- and bisexual at this point since this item was to determine whether pictures of men or women were shown subsequently). Depending on their answer, they were then shown pictures of either 40 female or 40 male medium attractive faces. On 20 pictures, participants indicated their romantic interest. This involved three items to be answered on a 1 = *not at all* to 6 = *very much* response scale ("I would like to take up contact with this person to get to know her/him romantically", "I would like to arrange a romantic date with this person", "I would like to meet this person on a romantic date"; α = 0.95). On the other 20 pictures, participants indicated their sexual interest. Therefore, they responded to the same three items as before; however, the word "romantic" was replaced with the word "sexual" (α = 0.97). Which of the 40 pictures were shown for the romantic and sexual category was randomized across participants, as well as the order in which they were shown.

The stimulus materials for the "Tinder" task was created as follows: A total of 271 pictures of friendly-looking faces was pretested for their level of attractivity. These pictures were obtained from a social media platform to appear as naturally as possible. Thirty-one participants indicated how attractive they experienced each of the depicted persons on a 1 = *not at all* to 8 = *very much* response scale. Those 80 pictures which ranged most closely around the mean were chosen for the OT study (male: M = 2.91, SD = 0.90, Min = 1.33, Max = 5.40; female: M = 3.63, SD = 0.90, Min = 1.81, Max = 5.63).

2.3.2. Experience index

Participants were asked how many partner relationships (M = 1.48, SD = 1.38) and how many sexual partners (M = 5.92, SD = 1.38) they had in their lives, out of which we created an experience index by multiplying both numbers.

2.3.3. Control variables

Participants completed the 10 positive (α = 0.85) and 10 negative affect items of the PANAS (α = 0.79 [28] on 1 = *not at all* to 5 = *very much* response scales. Moreover, female participants were asked about

hormonal contraceptive use ($N = 41$ no contraceptive use, $N = 22$ contraceptive use) and, if no, ovarian cycle stage (mean day of cycle = 13.85, $SD = 8.23$).

2.4. Statistical analyses

To investigate whether OT (vs. placebo) affected the dating strategy of male (vs. female) participants low (vs. high) in experience, we conducted moderated multiple regressions and plotted the interaction at 1 *SD* above/below the mean by using the Process tool [29]. In these simple slope tests, a variation of the original multiple regression analysis is repeated two additional times. In doing so, all data is analyzed and it is possible to capitalize on the power of the entire sample size (but weight some observations more heavily in one simple slopes test and the other observations more heavily in the other simple slopes test). We entered substance (coded as +1 = OT and −1 = placebo), gender (coded as +1 = female and −1 = male) and the experience index (standardized) as independent variables; romantic and sexual interest served as dependent variables.

To check for differences in mood, *t*-tests for independent samples were conducted on the affect variables. Moreover, to check for potential confounds in the form of female hormonal variations, we re-performed the regression analyses adding hormonal contraceptive use and ovarian cycle stage as covariates.

3. Results

See Table 1 for descriptive statistics.

3.1. Romantic dating

For romantic dating, the regression model revealed a significant main effect of gender, $b = -0.20$, $SE = 0.07$, $t\,(102) = -2.85$, $p = .01$, 95%CI = [-0.34, −0.06], indicating more romantic interest among men than women. Notably, this effect was qualified by a significant three-way interaction, $b = -0.22$, $SE = 0.09$, $t\,(102) = -2.45$, $p = .02$ 95%CI = [-0.39, −0.04], R^2 increase due to interaction = 0.05. The model showed no other effects, $ps \geq .14$.

To probe the interaction effect, we analyzed the conditional effect of substance × sexual experience at different values of the factor gender. In female participants, OT (vs. placebo) did not affect romantic interest, either among the rather inexperienced (i.e., 1 standard deviation below the mean), $b = 0.11$, $SE = 0.10$, $t\,(102) = 1.07$, $p = .29$, 95%CI = [-0.09, 0.31], or among the rather experienced (i.e., 1 standard deviation above the mean), $b = -0.12$, $SE = 0.12$, $t\,(102) = -1.05$, $p = .30$, 95%CI = [-0.36, 0.11]. Also, rather inexperienced and rather experienced women did not differ in their romantic interest, either under placebo, $b = -0.10$, $SE = 0.12$, $t\,(102) = 0.81$, $p = .42$, 95%CI = [-0.14, 0.33], or under OT, $b = -0.39$, $SE = 0.23$, $t\,(102) = -1.71$, $p = .09$, 95%CI = [-0.84, 0.06]. However, among male participants, OT (vs. placebo) decreased the indicated romantic interest among the rather inexperienced, $b = -0.29$, $SE = 0.12$, $t\,(102) = -2.30$, $p = .02$, 95%CI = [-0.53, −0.04], whereas it did not among the rather experienced, $b = -0.11$, $SE = 0.11$, $t\,(102) = -0.94$, $p = .35$, 95%CI = [-0.33, 0.12]. More specifically, under placebo, the rather inexperienced men indicated more romantic interest than the rather experienced men, $b = -0.23$, $SE = 0.10$, $t\,(102) = -2.28$, $p = .02$, 95%CI = [-0.43, −0.03], whereas OT eliminated this difference, $b = 0.15$, $SE = 0.22$, $t\,(102) = 0.68$, $p = .50$, 95%CI = [-0.29, 0.59], see Fig. 1.

Table 1
Means and standard deviations split for substance and gender (left side) as well as correlations (right side) for the main study variables.

	OT		Placebo		*r*
	Male (*n* = 23)	Female (*n* = 30)	Male (*n* = 24)	Female (*n* = 33)	1
1. Romantic interest	2.84 (0.68)	2.69 (0.61)	3.15 (0.94)	2.65 (0.67)	–
2. Sexual interest	2.92 (0.74)	2.05 (0.63)	3.11 (0.95)	2.13 (0.55)	.69***

Note. ***$p < .001$.

3.2. Sexual dating

For sexual dating, the regression model revealed a significant main effect of gender, $b = -0.49$, $SE = 0.07$, $t\,(102) = -7.23$, $p < .001$, 95%CI = [-0.63, −0.36], indicating more sexual interest among men than women, analogous to romantic interest. Moreover, a significant three-way interaction effect emerged, $b = -0.27$, $SE = 0.09$, $t\,(102) = -3.12$, $p = .002$, 95%CI = [-0.44, −0.10], R^2 increase due to interaction = 0.06. The model showed no other effect, $ps \geq .13$.

To probe the interaction effect, we analyzed the conditional effect of substance × sexual experience at different values of the factor gender. In female participants, OT (vs. placebo) did not affect sexual interest, either among the rather inexperienced (i.e., 1 standard deviation below the mean), $b = 0.04$, $SE = 0.10$, $t\,(102) = 0.41$, $p = .69$, 95%CI = [-0.15, 0.23], or among the rather experienced (i.e., 1 standard deviation above the mean), $b = -0.17$, $SE = 0.11$, $t\,(102) = -1.51$, $p = .13$, 95%CI = [-0.40, 0.05]. Rather inexperienced and rather experienced women did not differ in their sexual interest, either under placebo, $b = 0.16$, $SE = 0.12$, $t\,(102) = 1.37$, $p = .17$, 95%CI = [-0.07, 0.39], or under OT, $b = -0.29$, $SE = 0.22$, $t\,(102) = -1.30$, $p = .20$, 95%CI = [-0.72, 0.15]. However, among male participants, OT (vs. placebo) decreased the indicated sexual interest among the rather inexperienced, $b = -0.29$, $SE = 0.12$, $t\,(102) = -2.43$, $p = .02$, 95%CI = [-0.53, −0.05], whereas it did not among the rather experienced, $b = 0.003$, $SE = 0.11$, $t\,(102) = 0.02$, $p = .98$, 95%CI = [-0.22, 0.22]. More specifically, under placebo, the rather inexperienced men indicated more sexual interest than the rather experienced men, $b = -0.22$, $SE = 0.10$, $t\,(102) = -2.27$, $p = .03$, 95%CI = [-0.41, −0.03], whereas OT eliminated this difference, $b = 0.41$, $SE = 0.22$, $t\,(102) = 1.89$, $p = .06$, 95%CI = [-0.02, 0.83], see Fig. 2.

3.3. Control variables

The effect of OT was not simply based on a changed affective state. Participants under OT ($M = 2.80$, $SD = 0.68$) and placebo ($M = 2.78$, $SD = 0.64$) did not differ in their positive affect, $t\,(108) = 0.17$, $p = .87$, $d = 0.03$, 95%CI = [-0.34, 0.41]. Similarly, participants under OT ($M = 1.38$, $SD = 0.43$) and placebo ($M = 1.39$, $SD = 0.43$) did not differ in their negative affect, $t\,(108) = -0.19$, $p = .85$, $d = 0.04$, 95%CI = [-0.34, 0.41].

When including hormonal contraceptive use and ovarian cycle stage as covariates in the regression models, the same pattern of results emerged (three-way interaction for romantic interest: $b = -0.20$, $SE = 0.09$, $t\,(100) = -2.27$, $p = .03$ 95%CI = [-0.38, −0.03], R^2 increase due to interaction = 0.04; three-way interaction for sexual interest: $b = -0.25$, $SE = 0.09$, $t\,(100) = -2.89$, $p = .005$ 95%CI = [-0.42, −0.08], R^2 increase due to interaction = 0.05).

4. Discussion

The current study revealed two insights: First, in our "Tinder" style task, male participants always indicated more interest in their vis-à-vis than female participants, both with regard to romantic and sexual goals. This is consistent with previous research which repeatedly found a less selective dating strategy among men (e.g., Refs. [3,4]. Notably, this difference was particularly obvious with regard to sexual dating which supports findings on males being more likely to engage in casual sex compared to females [30]. Second, this unselective strategy was mostly pronounced among the rather inexperienced men which, however, was restored to the level of the experienced males by OT. These findings were neither influenced by simple affective states nor by hormonal contraceptive use and ovarian cycle stage.

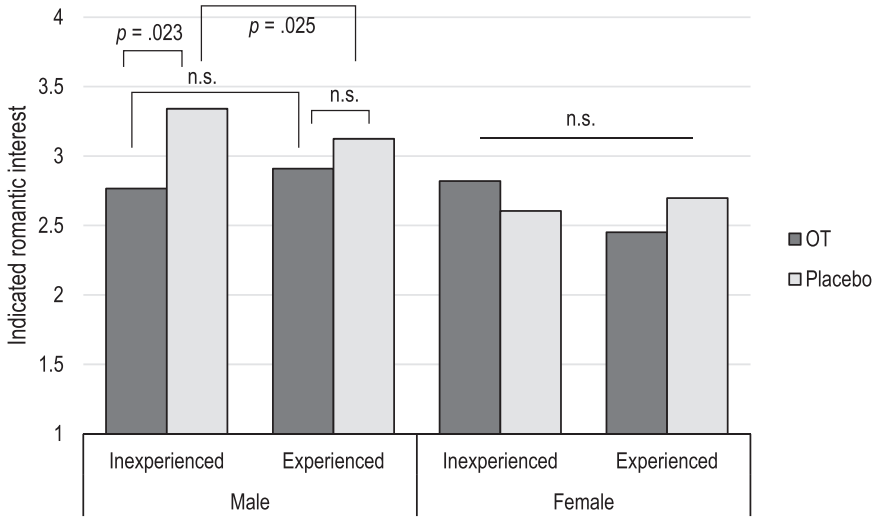

Fig. 1. Degree of indicated romantic interest in dependence of substance, gender and level of experience (plotted at 1 *SD* above/below the mean).

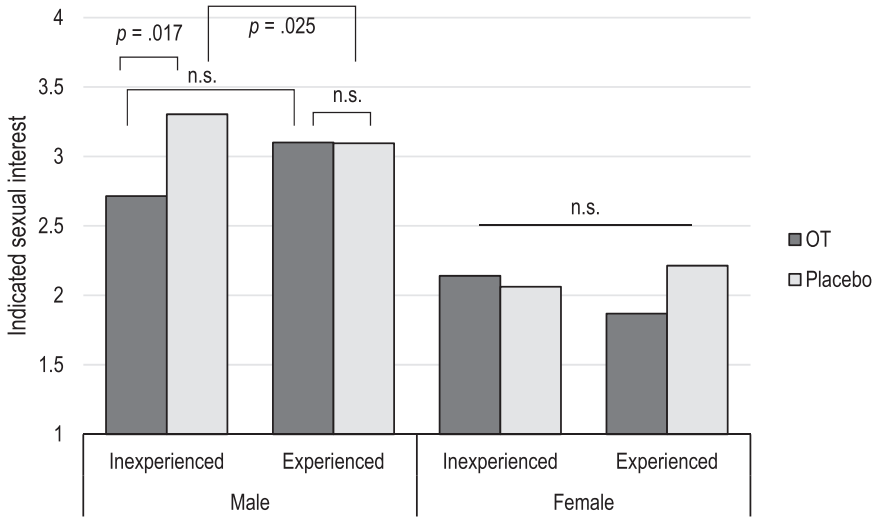

Fig. 2. Degree of indicated sexual interest in dependence of substance, gender and level of experience (plotted at 1 *SD* above/below the mean).

A certain level of selectiveness among males is adaptive, particularly in more demanding courtships [21]. Consistently, a relatively non-selective strategy in online dating leads to more frustration as it does not guarantee more matches and makes post-filtering of incompatible matches necessary [3,4]. Nevertheless, such strategy still seems least risky as no opportunity is passed up. That inexperienced men primarily choose this strategy appears plausible against the background of a possible fear of failure. Adult (sexual) inexperience is not uncommon (e.g., Refs. [31]. Inexperienced individuals often only had rare experiences with precursors to sexual involvement like kissing or holding hands as adolescents and find it increasingly difficult to "catch up" later [32]. Therefore, they choose the least risky, though not necessarily most reasonable, strategy. Importantly, under OT, inexperienced men dare to move away from this to a more adaptive dating strategy similar to that of experienced men.

Notably, OT did not affect the dating strategy of women. This might be since women are more selective in their dating behavior per se (see Ref. [21]. For example, in general, men are more likely to initiate first contact and ask for a date, whereas women are more likely to be waiting for the latter [33]. This is consistent with their typical dating app behavior: Men are driven to attain any match, while women usually follow a pre-filtering strategy [3,4]. This might have induced a ceiling effect unaffected by OT in the current study.

All in all, this work showed that OT promotes an adaptive pair-bonding strategy. This indicates that it is not valid to reduce OT's effectiveness to a pure approach motivation. Instead, it supports frameworks that propose social adaption as OT's fundamental function. According to these, OT modulates emotional responses and adjusts behaviors during social interactions to help individuals fit into social environments [18]. This might be rooted in its evolutionary origin as a system to promote survival [20]. That OT induced a more beneficial dating strategy in our participants matches this function.

Some limitations of the current study should be considered. First, we designed our "Tinder" style task similar to the famous dating app by presenting only limited information. However, in transferring it to a standardized experimental paradigm, it is still different from the app (e.g., due to its interval-scaled response fields or a lack of opportunity to search for more information). Second, in this study, dating strategy was operationalized by self-reports of romantic and sexual interest in pictures. Naturally, this can only depict dating intentions, not, however, real

behaviors like going out for a drink or kissing another person. Thus, whether or not people would actually behave in accordance with their responses or not is a question left to future research. Third, according to G*Power [26], our main effect (the three-way interaction) revealed a statistical power of 64–72%. This is much more satisfying than the power of 16% observed in average OT studies [34]. Still, it does not reach the standard power of 80% why we cannot exclude the possibility that the effects are overestimated.

Revealing a promoting effect of OT on adaptive pair-bonding strategies, our findings add to the understanding of the neuromodulator OT. It does not seem to be a simple amplifier of prosociality but rather supports individuals to adapt to their social environment.

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Contributors

Both authors contributed to the study concept and design. Testing and data collection were performed by V. Berthold. M. Pfundmair performed the data analysis and interpretation. M. Pfundmair drafted the manuscript, and V. Berthold provided critical revisions. Both authors approved the final version of the manuscript for submission.

Declaration of competing interest

None.

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