



Data Article

Experimental data exploring the effects of intranasal oxytocin on young adult social preference and attachment to romantic partners, parents, friends, and strangers



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ABSTRACT

Experimental studies exploring the effects of intranasal oxytocin are typically underpowered due to small samples. Open access to experimental data and procedures and the use of previously employed measures is critical to building more robust and replicable findings, especially in less studied areas of oxytocin research. In this paper, data is provided from a double-blind placebo-controlled crossover study exploring the effects of intranasal oxytocin (IN-OT: 24 IU) on social preference to romantic partners, parents, peers, and strangers. Young adults ($N = 44$; 91% female) in committed dating relationships completed three phases of data collection including a screening survey followed by two cmdkwdnextpage ?>laboratory visits. In addition to romantic

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partner-, and stranger attraction ratings, the data is the first to provide comparisons between attachment and social preference ratings to parents, close friends, and romantic partners under placebo and IN-OT conditions. The data also include differences by situational and life history factors known to moderate oxytocin effects. The detailed protocol, and dataflow can be accessed to verify the analysis and findings or to conduct a replication study. The standardized experimental design and common IN-OT protocol add to the capacity for a meta-analysis exploring oxytocin effects on partner preference and may also be directly ported to existing or future studies with related questions to increase sample size and power.

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Specifications Table

Subject	Psychology
Specific subject area	The influence of oxytocin on romantic attachment formation and social preference to close others and strangers
Type of data	Table
How data were acquired	Survey Interview Computer-scored diagrammatic instrument
Data format	Raw
Parameters for data collection	The data collection parameters are fully described in the supplemental file on the protocol for laboratory visits.
Description of data collection	Data collection involved an online screening survey followed by two laboratory visits collected over a 3 to 5 month period. Data collection included surveys, interviews, and diagrammatic measures.
Data source location	Institution: University of South Dakota City/Town/Region: Vermillion Country: USA
Data accessibility	Data is hosted in repository Repository name: Mendeley Data Data identification number: doi:10.17632/krkt9cwds9.5 Direct URL to data: https://data.mendeley.com/datasets/krkt9cwds9/5
Related research article	Co-submission H. Freeman, J. L. Scholl, M. AnisAbdellatif, E. Gnimpieba, G. L. Forster, & S. Jacob, I only have eyes for you: Oxytocin administration supports romantic attachment formation through diminished interest in close others and strangers. 134 (2021) <i>Psychoneuroendocrinology</i> , 10.1016/j.psyneuen.2021.105415

Value of the Data

- The raw data come from new and existing measures used in previous experimental oxytocin studies thereby providing opportunities for researchers to combine our sample with new or previous work to increase power. A review of human IN-OT research [1] indicates that the majority of OT studies are underpowered, based a median sample size of 46 participants (within-subject design), and an average effect size of 0.28. An adequately powered IN-OT study based on power of 80%, effect size of 0.28, and using a 10-group repeated measure design (G*Power 3) [2] would require a sample size of at least 96 participants. Consequently, appropriate power can be obtained by adding our sample to existing or new studies.

- The data is especially useful for scholars interested in conducting meta-analysis on how exogenous oxytocin effects social preference to strangers, romantic partners, and close others. The experimental data is based on a translational study exploring the role of oxytocin in social preference to romantic partners, strangers, and four additional close relationships. Oxytocin effects on social preference is a growing area of translational research and having open access to data and experimental protocols will greatly aid researchers interested in summarizing this work.
- Given that intranasal oxytocin (IN-OT) is neither manufactured or distributed in the United States, US researchers studying IN-OT effects on human cognition and behavior must first obtain permission from the FDA through an Investigational New Drug (IND) application. We will provide our IND application upon request that can be used as a template for others interested in this process or those seeking to obtain FDA approval for this drug.
- The data on attachment strength to close others comes from a newly validated measure of attachment strength, the Web Based Hierarchical Mapping Technique. The WHMT that provides ratio-scaled data that significantly increases analytic capabilities compared to previous ordinal-scaled measures. This data allows researchers to explore new metrics of attachment networks.
- The data is based on a theoretical model of attachment formation that provides a framework for understanding the developmental process of social preference in both infant-to-parent attachment and romantic attachment. The theoretical framework provides a number of testable hypotheses for how oxytocin may predict more or less social preference within a network of attachment relationships depending on the duration of the primary attachment bond and depending on the individual's life history.
- The dataset, codebook, and protocol provide open access to researchers interested in verifying our findings or conducting a replication study.

1. Data Description

1.1. Background

Oxytocin (OT) is a neuropeptide produced in the hypothalamus and oxytocin receptors are distributed across cortical and subcortical brain regions implicated in executive function, learning and memory, emotional regulation, reward, and social behaviors [3,4]. One of the most promising areas in human subjects has focused on single dose intranasal oxytocin (IN-OT) effects on social cognition and social attraction among adults. This work implicates exogenous OT in a range of social behavior, including increased accuracy in facial recognition [5], greater tendency to interpret others behavior as prosocial and trustworthy [6], and improved implicit and explicit memory of positive social interactions [7]. While main effects are typically small to moderate, the effects are more robust when viewed in conjunction with situational variables such as person familiarity [8]. One important implication for why familiarity is a potent moderator is that OT may act in a relationship-specific manner, favoring closer relationships (hierarchical order), or favoring specific relationship types (e.g., romantic, filial, or affiliative). Somewhat surprisingly, the effect of OT on human social preference or perceptions of closeness between existing close relationships has not been studied.

1.2. The Data

The data is the first to show participant closeness and preference ratings to strangers, romantic partners, and four additional close relationships under placebo and IN-OT conditions. The data show if exogenous OT has a main effect (i.e., generalized) on perceptions of attachment or if effects are moderated by relationship type. In addition, by testing the effect of OT

on social preference to multiple relationship types (stranger, filial, affiliative, and romantic), the data provide information on whether the OT system is implicated in the process of attachment transfer from parent to romantic attachment formation, and whether romantic relationship duration moderates this effect. This question is particularly meaningful to emerging adulthood, a time when filial, affiliative, and romantic relationships are changing positions of status in young adult social networks. The data also allow assessment of whether oxytocin differentially affects relationships based on relative position in one's social order (i.e., hierarchy). For instance, OT may affect primary attachment relationships more strongly than secondary attachments independent of relationship type (i.e., filial, romantic, or affiliative). In addition to person familiarity, the data contain individual differences in life history factors known to moderate IN-OT effects including early attachment experiences and the experience of parental divorce or separation.

2. Experimental Design, Procedure, Materials

2.1. Design

We employed a randomized, double-blind, placebo-controlled, crossover single-dose challenge study to examine the effects of IN-OT challenge on attachment preference, social discrimination, and episodic memories of attachment related experiences. After the online pre-screening procedure, the intranasal challenge (IN-C) was given on two visits separated by a four-week drug-free period. Participants who meet protocol criteria were randomly allocated to receive either OT or placebo in a 1:1 ratio at the first visit. Participants who receive OT at the first visit will receive placebo at the second visit and subjects that received placebo at the first visit will receive OT at the second visit. Participant assessments were done by an evaluator who was blinded to the content of the IN-OT challenge. The primary outcome, changes in attachment preference and social discrimination, was measured using four categories of outcome measures, including attachment strength, romantic closeness, sexual attitudes, and attraction; each designed to access general and relationship specific ratings of relationship closeness and social memory in parent and peer relationships.

2.2. Procedure

Respondent participation occurred in three phases, including: (1) an 8 min online screening survey, (2) a 90 min Time 1 IN-OT versus Placebo treatment phase and behavioral assessment and, (3) a 90 min Time 2 IN-OT versus Placebo treatment phase and behavioral assessment. See Fig. 1 for study schematic of respondent participation through each phase of the study. Undergraduate students were initially recruited to the screening survey from social science courses using SONA system scheduling software. The initial pre-screening phase included survey questions about the subject's romantic status, relationship duration, family relationship history, and attachment network. At the end of the survey participants indicated if they were interested in completing a second study involving the intranasal administration of oxytocin and requiring two 90 min laboratory visits. Of the 447 students that completed the screening survey, 258 expressed potential interest in participating in the laboratory portion of the study. Interested students were screened for inclusionary criteria. To be included in the second and third phase of the study, participants were required to be between 18 and 25 years of age and in a current monogamous romantic relationship of at least one month duration. 146 participants met inclusion criteria and were contacted by email with more detail on the laboratory visits and exclusionary criteria. Subjects with any condition, including alcohol and drug abuse, which might interfere with the conduct of the study, confound interpretation of the study results, or endanger their own well being. This included, but was not limited to impairment of renal function, evidence or history of malignancy or any significant hematological, endocrine, respiratory, hepatic,

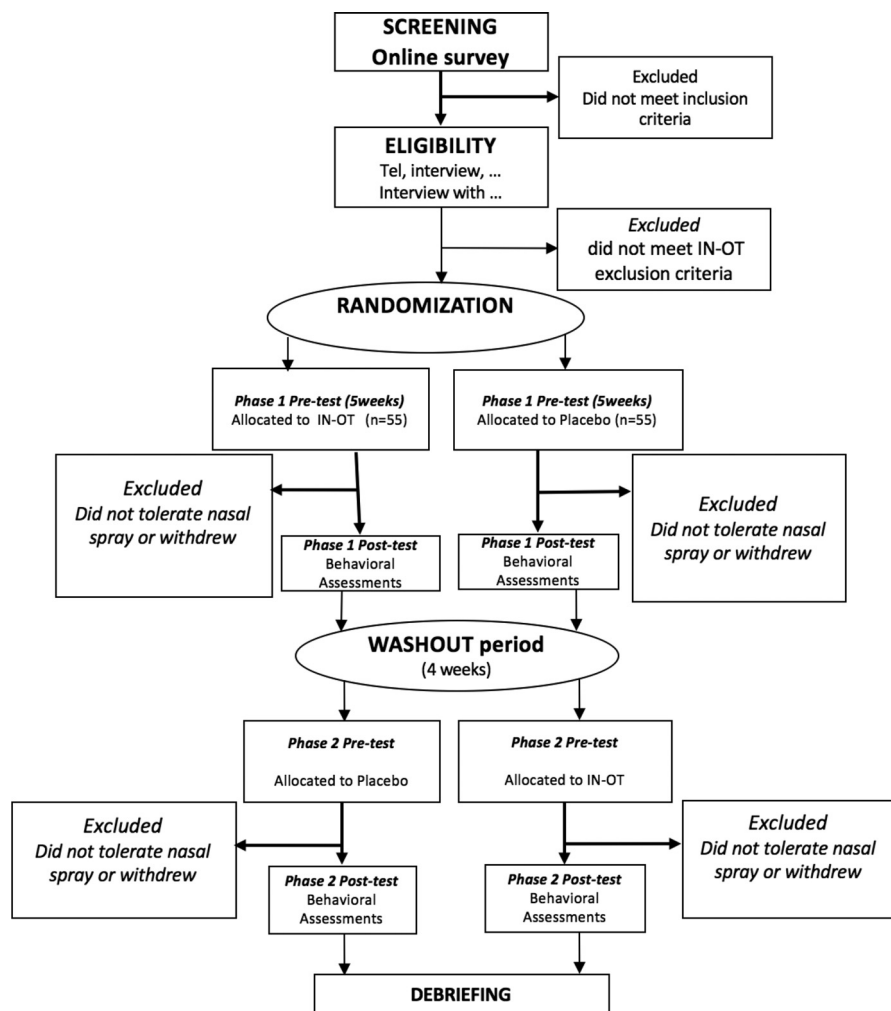


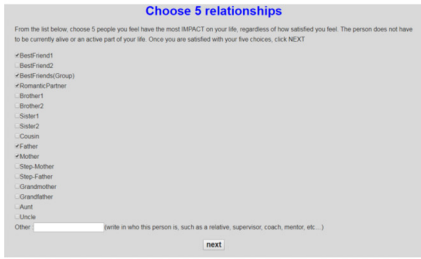
Fig. 1. Study schematic.

cardiovascular or gastrointestinal disease. Interested participants that met the inclusionary and exclusionary criteria were invited to complete phase II and III of the study. Fifty one participants were enrolled in phase II.

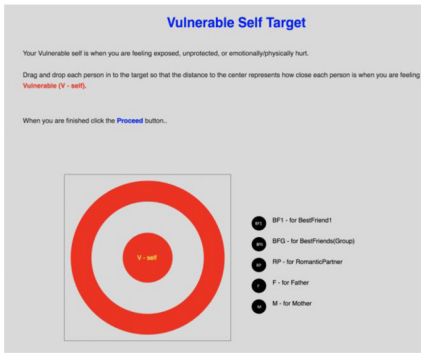
2.3. Laboratory Procedure

The two laboratory visits were separated by four weeks, an interval chosen to minimize practice effects while maintaining stability in attachment network structure and preference. For standardization, all testing occurred between 1 pm and 6 pm after a 1 h fast. Upon arrival participants provided a urine sample. Participants were given verbal instructions and a sterile collection cup (labeled with the participant's specific code, time and date of sample). Each participant took the collection cup into a private bathroom adjacent to the testing room and returned the sample to the investigator when done. All female participants were administered

Screen one.



Screen two.



Screen two - sample of completed diagram.

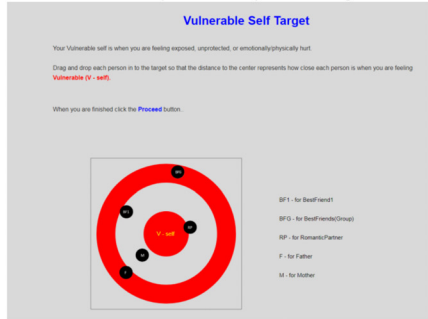


Fig. 2. The WHMT . Screen one. Screen two. Screen two - sample of completed diagram.

urine pregnancy test (no positive results were found). The sample was stored at -80°C and later assayed for baseline oxytocin. During the treatment condition participants received 24 IU of intranasal oxytocin (dosage based on meta-analysis by van IJzendoorn & Bakermans-Kranenburg) [9] or matched placebo administered via nasal spray. Although IN-OT rapidly and reliably increases OT levels within the brain [10], psychological effects are not apparent till 30–40 min post administration and last an additional 90 min [11]. We began behavioral testing 40 min post administration of OT or placebo; participants spent the interim time watching a banal documentary film, which have been shown to improve baseline stability both within and between subjects [12]. The documentary consisted of the first 20 min of the two hour nature film – “Winged Migration”, accessed on YouTube (<https://www.youtube.com/watch?v=5pFiuUUBKoY>). Before the film, participants provided basic demographic information in order to control for recent life events (e.g., romantic status, emotional state) that may impact OT administration or mark a change in network structure (e.g., romantic break-up, death of family member or friend). Next, participants completed an online log of what they ate and drank earlier in the day (e.g., snacks, breakfast), hours of sleep the night before, and a question list of any stressors that occurred prior to the session. The log will help establish baseline between testing sessions and helped control for contextual factors.

Following the 40 min delay, behavioral testing began with two 20 min testing segments. In the first, participants completed computer-based surveys and rating scales, including the WHMT diagrammatic measure of attachment strength (see Fig. 2). In the second segment, subjects will complete a 20 min semi-structured interview specific to the WHMT diagram to capture relevant episodic and autobiographical memories. The interviews were audio taped and transcribed and used to qualitatively validate the WHMT as a measure of attachment strength [13]. The two behavioral assessments segments lasted approximately 40–45 min, thus occurring within the window that IN-OT has been shown to remain active in the brain. At the conclusion of the interview participants provided a second urine sample following the same procedure as the first

Table 1

Laboratory testing procedure and timing.

Procedure	Time	Study Visit	
Screening for exclusionary criteria	3 min	Visit1	Visit2
Consent	5–10 min	X	
Vital signs, Urine sample and pregnancy test for female subjects	10 min	X	X
Administer treatment (IN-OT or Placebo) (10 min)	10 min	X	X
Rating scales for mood, anxiety, and life events	10 min	X	X
Watch documentary – establish baseline	20 min	X	X
WHMT measure of Attachment Network	5 min		
Word Association Test	5 min		
Behavioral rating scales	15 min	X	X
WHMT Interview	20 min	X	X
Urine sample	10 min	X	X
Saliva sample	10 min	X	
Debriefing	5 min	X	X

collection. After collection of a urine sample, participants provided a saliva sample by spitting into a saliva collection tube. Approximately 2 ml (about half a teaspoon in quantity) of saliva was collected and stored at -80°C in a freezer. Urine and saliva samples were processed and stored for future analysis. See Table 1 to view the timeline of procedures during each laboratory visit. In addition, detailed instructions to research coordinators for carrying out each step of the laboratory protocol is provided in the supplementary material, titled “Laboratory Protocol”.

2.4. Materials and Measures

An abbreviated description of the materials and methods is provided here. Please see the co-submission for complete details.

2.4.1. Intranasal Oxytocin

Exogenous oxytocin (OT) is metabolized by chymotrypsin in the GI tract and thus cannot be administered orally. It can be administered in either an intravenous or an intranasal form. Currently, the only form of OT that is available in the US is the intravenous form. Although this formulation has been found to produce positive effects on social cognition, it is invasive to administer and the extent to which this formulation crosses the blood-brain barrier (BBB) is unknown. One alternative is IN-OT, which is absorbed through the highly permeable nasal mucosa and has been shown to pass the BBB [14]. IN-OT remains on the market outside the US and Canada (e.g., Syntocinon®, NOVARTIS, Switzerland). Mean CSF concentrations of peptides like OT begin to rise within 10 min of intranasal administration and last for up to 90 min after intranasal administration [15]. OT is distributed throughout the extracellular fluid, and most is rapidly destroyed in the liver and kidneys. Only small amounts are excreted unchanged in the urine, although in sufficient amounts to identify if subjects experienced a dose-response to the IN-OT. IN-OT and the placebo spray (which is identical to the OT formulation with the exception of the active compound) will be imported from Victoria Pharmacy, Zurich for this project. Researchers in the United States must obtain FDA approval to import IN-OT through an Investigational New Drug (IND) application. Researchers may request a copy of our IND application to use as a template by contacting the corresponding author.

During the treatment condition participants received 24 IU of intranasal oxytocin [5] or matched placebo administered via nasal spray (Laboswiss, Davos Platz, Switzerland).

2.4.2. Attachment Strength

Participants completed the Web Based Hierarchical Mapping Technique. The WHMT is a diagrammatic measure completed in an online format and requiring participants to drag and drop

five icons representing self-selected important people into a target area, with the target center representing the subject's "vulnerable self". Pixel distance between the participant's vulnerable self and each person is recorded as well as distances between each icon.

2.4.3. Romantic Closeness

Closeness to romantic partners was measured using two rating scales: (1) Passionate Love Scale (PLS): The PLS [16] is a widely used 15 item rating scale that assesses cognitive, emotional, and behavioral components of passionate love to romantic partners; and (2) the Triangular Love Scale (TLS) [17]: We include the 15 item commitment subscale of the TTL to examine participant's feelings of dedication and loyalty to their romantic relationship;

2.4.4. Sexual Attitudes

Sexual attitudes were measured using 5 items from the Perceptions of Dating Infidelity Scale and 3 items from Sociosexual Orientation Scale [18]. Together, these items were used to capture permissive attitudes toward one's own possible behaviors of infidelity and general attitudes toward uncommitted sexual relationships.

2.4.5. Attraction to Romantic Partner and Strangers

Participants rated their current level of attraction to their romantic partner and their attraction to strangers based on three images (two same sex and one opposite sex). Ratings were scored on a visual analog scale ranging from 0, unattractive, to 10, highly attractive). The sequence of the photographs was randomized.

2.4.6. Life History

Two life history factors were measured, including the Parental Love Withdrawal scale [19], and questions that ascertained the occurrence and timing of parental divorce or separation.

3. Data Processing, Flow and Analysis

Fig. 3 describes the dataflow from the subject(participant) to the processed dataset submitted in this paper. The raw dataset from Qualtrics (in csv format) and WHMT (in JSON format) surveys were aggregated in SPSS, and then enriched with participant metadata. The merged dataset was filtered to remove any compromising metadata as per our IRB and IND compliance requirements. Participant data from the WHMT and Qualtrics surveys were merged within each lab visit (Lab Visit Time 1, Lab Visit Time 2), and then merged with the Screening survey data into a single SPSS data file. Screening WHMT data, biological data, and interview data are not included in this data file. A subset of the interview transcripts are available through another publication [20] and the biological data are currently being processed and analyzed. The resulting datafile contains 21 raw variables from the demographics portion of the screening survey, and 95 computed variables from across the three phases of data collection. All variable names from the screening survey are appended with "..._S". All laboratory testing variables are labeled according to the corresponding treatment condition in which they were measured. For example, scale scores for the Passionate Love Scale were renamed "Passion_OT and Passion_PL" for each participant corresponding to oxytocin and placebo conditions respectively. In order to control for procedural order a variable was computed to denote the order in which the respondent received IN-OT or Placebo (named *Treatment Condition*). WHMT variables derived from the Web Based Hierarchical Mapping Technique (WHMT), taken at each laboratory visit, include WHMT in the variable label. The Codebook (see Data file/Codebook) provides detail on each variable including the variable name, variable labels, value labels, and measurement scale, as shown for a partial list of variables in Table 2. Descriptive statistics are also provided (see Data file/Descriptive statistics), as shown for a partial list of variables in Table 3.

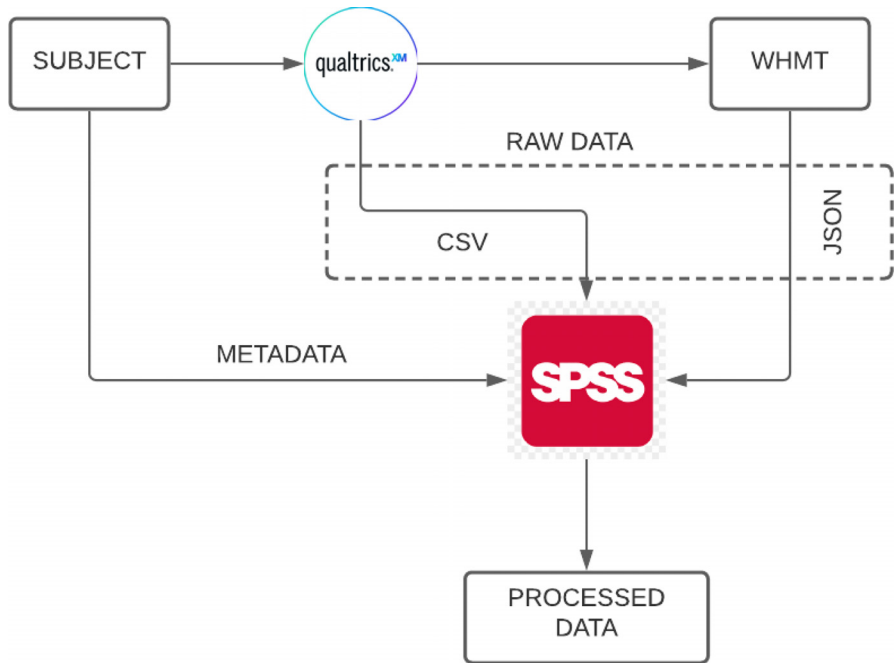


Fig. 3. Data flow and analysis

Outline the data flow diagram from subject recruitment to the SPSS output and data processing in SPSS.

Table 2

Codebook of variables – partial list (see Datafile/Codebook for a full list of variables).

Variable Name	Scale	Variable Label	Value Labels
Mother_primary_PL	Numeric	WHMT: Mother Primary or not PL	1= Primary, 2= Not Primary
Mother_primary_OT	Numeric	WHMT: Mother Primary or not OT	1= Primary, 2= Not Primary
Father_primary_PL	Numeric	WHMT: Father Primary or not PL	1= Primary, 2= Not Primary
Father_primary_OT	Numeric	WHMT: Father Primary or not PL	1= Primary, 2= Not Primary
Peer_primary_PL	Numeric	WHMT: Peer primary or not PL	1= Primary, 2= Not Primary
Peer_primary_OT	Numeric	WHMT: Peer primary or not OT	1= Primary, 2= Not Primary

3.1. Analysis

Repeated measure MANOVAs were employed to test IN–OT effects on perceptions of closeness, attachment, and attraction with specific relationships (e.g., attraction to same sex and opposite sex strangers, and romantic partners). In all analysis, parental separation (parents_together), gender, and procedural order (Treatment Condition) were entered as between subject factors. Continuous factors, including the Parental Love Withdrawal scale (Love_W_centered) and romantic relationship duration (Relationship_Duration) were entered as covariates. Analyses run to examine if IN–OT effects varied by relationship type in terms of attraction to romantic partners versus strangers, as well as attachment to romantic partners, friends, siblings, and parents included a between subject factor (bond) in the repeated measure MANCOVA.

Table 3

Descriptive statistics - partial list (see Datafile/Descriptive Statistics for a full list of variables).

Variable	Count	Mean	SD	min	25%	50%	75%	max
Infidelity_OT	44.00	3.63	0.51	2.50	3.31	3.51	4.01	4.64
Infidelity_PL	44.00	3.61	0.59	1.00	3.39	3.63	3.93	4.64
IOS_RP_OT	44.00	3.75	0.49	2.00	4.00	4.00	4.00	4.00
IOS_RP_PL	44.00	3.70	0.63	1.00	4.00	4.00	4.00	4.00
Commit_OT	44.00	7.96	1.26	2.13	7.72	8.33	8.75	9.00
Commit_PL	44.00	8.01	1.28	2.20	7.77	8.47	8.73	9.00
Attractive_Stranger_OT	44.00	4.67	1.83	1.33	3.25	4.83	6.08	8.67
Attractive_Stranger_PL	44.00	4.71	1.78	1.00	3.50	5.00	5.75	8.33

Ethics Statement

All experimental procedures received approval from the Institutional Review Board of the University of South Dakota, and authors have complied with APA ethical standards in the treatment of their participants and obtained informed consent from all participants.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

Data Availability

Experimental data exploring the effects of intranasal oxytocin on young adult social preference and attachment to romantic partners, parents, friends, and strangers (Original data) (Mendeley Data).

CRediT Author Statement

Harry Freeman: Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization; **Jamie L. Scholl:** Data curation, Writing – review & editing, Investigation; **Musheera AnisAbdellatif:** Data curation, Visualization, Writing – review & editing; **Gina L. Forster:** Methodology, Project administration, Investigation; **Suma Jacob:** Methodology, Writing – review & editing; **Sabi Kafay:** Visualization, Data curation; **Rajeev Bam:** Methodology; **Tuyen Do:** Software; **Etienne Z. Gnimpieba:** Software, Visualization, Validation, Data curation, Writing – review & editing.

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Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:[10.1016/j.dib.2022.108283](https://doi.org/10.1016/j.dib.2022.108283).

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