

Oxytocin Promotes Buying

Xing Zhang
Department of Marketing
National University of Singapore
Mochtar Riady Building, 15 Kent Ridge, Singapore 119245
Email: zhangxingis@gmail.com

Mikhail Monakhov
Department of Economics
National University of Singapore
AS2 06-02, 1 Arts Link, Singapore 117570
Email: misha.monahov@gmail.com

Poh San Lai
Department of Paediatrics
National University of Singapore
Lower Kent Ridge Road, Singapore 119074
Email: poh_san_lai@nuhs.edu.sg

Soo Hong Chew
Department of Economics
National University of Singapore
AS2 05-14, 1 Arts Link, Singapore 117570
Email: chew.soo hong@gmail.com

Richard P. Ebstein
Department of Psychology
National University of Singapore
AS4 02-07, 9 Arts Link Singapore 117570
Email: rpebstein@gmail.com

ABSTRACT

Oxytocin, a nonapeptide hormone, is the paramount human social hormone modulating social cognition and affiliative behaviors. Drawing on the extant literature on social aspects of buying behavior, we found that people with higher plasma oxytocin levels, are associated with higher scores in multiple measures of buying tendency, and people with higher plasma oxytocin level spend more on conspicuous goods. All the effects are driven by females. The findings are consistent with the role of oxytocin in enhancing conformity and social affiliation, which potentially increases buying tendency. Our study captures the social aspects of buying behavior at the psychological - neuroendocrinological level and opens a window into the role of this social hormone in consumer buying behavior.

KEYWORDS: Oxytocin, Neuromarketing, Buying Behavior, Conspicuous Consumption

1. INTRODUCTION

One central theme of modern human behavior is the act of buying. We have shifted the focus of buying from satisfying basic physical needs towards signaling our social identity (Dittmar 1992) and gaining social status (Veblen 1899). “I buy, therefore I am”. We are more and more shaped by the products we buy. The prevalence of social media further drives our buying decisions from individual decision making to decisions with an eye on others. We follow the trend and recommendations from others; we care about which social group we belong to if we possess certain products. Towards studying the social dimension of buying, we focus in this first study on a biological factor, oxytocin (OT), which has been extensively demonstrated to play an important role in social cognition and behaviors such as conformity (Stallen et al. 2012), jealousy/gloating (Shamay-Tsoory et al. 2009), and affiliation seeking (Carter 2014). The purpose of this paper is to investigate the biologically-plausible hypothesis that plasma OT is a biomarker of increased buying.

OT is a nonapeptide hormone secreted from the posterior pituitary gland. Early research has found its important peripheral actions such as inducing lactation and uterine contraction. Recently, substantial studies reveal its role as the paramount social hormone in man. It has been suggested that oxytocin played a crucial role in the very evolution of human social behavior (Carter 2014). In the last decade, converging evidence shows that this neuropeptide is important in shaping wide range of social cognition and affiliative behaviors (see Carter (2014), Ebstein et al. (2012) and Meyer-Lindenberg et al. (2011) for reviews).

OT seems to be a promising candidate in promoting buying, which is rendered plausible by the following three sets of empirical findings. First, a considerable literature demonstrates that our buying decisions are largely influenced by those “opinion leaders” or consumers like us (Bass 1969). People tend to buy more of products that are seen to be popular. Consumer’s herding behavior has been vastly exploited to induce impulse buying by retailers such as Amazon.com by offering like-minded consumers’ view (The Economist 2006). An interesting recent investigation found that oxytocin induces group conformity (Stallen et al. 2012). When asked to rate visual symbol on attractiveness, participants administered oxytocin exhibit a biased view leaning towards their own group member’s preference. These results together with the findings by De Dreu et al. (2011,

2012) suggest that OT may affect herding behavior and hence causes people to buy more to trace the trends and fashion.

Second, emerging research highlights the communicative value of consumption (Griskevicius et al. 2007; Mead et al. 2011; White and Dahl 2006; Berger and Heath 2007). The products we possess signify our personality, taste and aspired social identity. For instance, Mead et al. (2011) found that social exclusion causes people to spend and consume strategically in the service of affiliation. Owning fashion goods would also serve as a facilitator in social communication ('display behavior' to make one more attractive to certain group). Such motivations have been implicated in greater proneness to buying (Dittmar 1992; Dittmar and Drury 2000). An extensive literature has demonstrated that OT functions as a catalyst in pair bonding and social affiliation (Carter 2014; Ebstein et al. 2012; Taylor et al. 2006; Taylor et al. 2010). Hence, we propose the notion that people with high OT levels would be characterized by even greater proneness to social affiliation and therefore more vulnerable to buying products which signal social identity and enhance group affiliation.

The first two mechanisms are based on the consumers' assimilation or approaching strategy in social interaction. Consumers often engage in social comparison processes, because certain products can be used to judge the success of both others and oneself. In his famous study of consumption during the Gilded Age, Veblen (1899) argued that "Consumption is evidence of wealth, and thus becomes honorific, and . . . failure to consume a mark of demerit." Many people believe that the things they possess signal life success (Richins and Dawson 1992). Interestingly, Shamay-Tsoory et al. (2009) found that intranasal administration of OT increases envy and gloating, which suggests that higher level of OT may enhance the motivation to engage in social comparison and hence increases the likelihood of buying especially of conspicuous goods.

This is the first paper investigating the role of oxytocin and buying behavior. We implemented a peripheral biomarker strategy viz., measurement of plasma OT levels. Previous study suggests that oxytocin is likely to be secreted synchronously in central nervous system and peripheral system (Neumann and Landraf 2012). It appears that oxytocin's widespread influence is due to its sometimes coordinated release in the brain and periphery (Stoop 2012). We offer the interpretation that plasma OT level as an

indicator for neuropeptide “tone”, reflecting both central and peripheral oxytocinergic activity.

Plasma OT level has been shown to be remarkably stable over time. For example, OT levels at early pregnancy and the postpartum period are highly correlated at more than 90% (Feldman et al. 2007). Many investigations have reported intriguing correlations between plasma OT and a wide range of social behaviors, such as trust and trustworthiness (Zak et al. 2004; 2005; Zhong et al. 2012), parent-infant bonding (Feldman et al. 2010; Feldman, Gordon, and Zagoory-Sharon 2010, 2011; Feldman et al. 2007; Gordon et al. 2010a, 2010b; Levine et al. 2007), social anxiety (Hoge et al. 2008), and autism (Green et al. 2001; Modahl et al. 1998) among others (Ebstein et al. 2011).

There are multiple facets to buying behaviour. In this study, to investigate buying tendency, we inventory participants with four well-established scales, impulse buying scale (IBS) (Rook and Fisher 1995), compulsive buying scale (CBS) (Ridgway et al. 2008), Spendthrift-Tightwad scale (ST-TW) (Rick et al. 2008), and materialism value scale (MVS) (Richins 2004). As an external validity check, we asked participants to report the value of the luxury products they own and their yearly expenditure on conspicuous goods.

We found that people with higher plasma OT levels, are associated with higher scores in multiple measures of buying tendency, and people with higher plasma oxytocin level spend more on conspicuous goods. All the effects in our studies are driven by females. The remainder of the paper proceeds as follows: Section 2 describe the methods in our studies; Section 3 present the results; in the last section, we discuss the limitation and identify directions for future research.

2. GENERAL METHODS

Plasma OT

We recruited 1,158 (51.4% females; $M_{age}=21.2$, $SD=1.5$) Han Chinese undergraduate students at a large public university to participate in three waves of online questionnaires. The study was approved by the university’s Institutional Review Board. Participants gave informed written consent prior to participating.

Several days prior to the first wave, participants donated 10 to 20 cc of blood for assaying plasma OT. All identifiable information (names, student ID, and other contact

information) was kept separately from the blood sample and behavioral data, and only can be linked by a unique code number (participant ID) which is kept confidential.

The assay procedure of plasma OT is presented in the Appendix (for a more detailed discussion of the procedure, see Zhong et al. (2012) and Carter (2014)). 58 participants were excluded from the 1158 sample because these participants failed to provide enough blood samples for assaying plasma OT. 16 participants did not provide gender information.

Buying Scales

The IBS, ST-TW, CBS, MVS and actual spending on conspicuous goods (clothes, shoes and jewelry) were administered online with other unrelated questionnaires in wave one, two and three, respectively. The online survey on average lasted about 45 minutes. Participants were reimbursed Singapore Dollar \$25 (around \$20 USD) per hour for participation in the project.

IBS is consist of nine items scored on 5-point likert-type scales from strongly disagree to strongly agree. It measures “a consumer’s tendency to buy spontaneously, unreflectively, immediately, and kinetically” (Rook and Fisher 1995). There were 1118 participants participated in the survey.

CBS is composed of six items on 7-point likert-type scales, covering two-dimensional constructs of compulsive buying: an obsessive-compulsive buying dimension and an impulsive buying dimension (Ridgway et al. 2008). ST-TW is a four-item scale assessing “individual differences in the tendency to experience the pain of paying” (Rick et al. 2008). CBS and ST-STW are implemented to the same sample in wave two about 5 months later following wave one. There were 896 participants from the original sample who participated in Wave 2 (53% females).

Material value scale and yearly expenditure on conspicuous goods were administered in wave three (N=618, 52% females), ~10 months later than the first wave. Material value scale is a 15-item measure developed by Richins (2004), which conceptualizes material values in three domains, “the use of possessions to judge the success of others and oneself, the centrality of possessions in a person’s life, and the belief that possessions and their acquisition lead to happiness and life satisfaction.”

Expenditure on Conspicuous Goods

We also administered questions about expenditure on conspicuous goods. To control for income effect, we asked the participants to report the in family monthly income: 1) below \$1000; 2) \$1000-\$3000; 3) \$3000-\$5000; 4) \$5000-\$7000; 5) \$7000-\$10000; 6) \$10000-\$12000; 7) \$12000-\$14000; 8) \$14000-\$16000; 9) \$16000-\$18000; 10) Above \$18000.

Two sets of questions were asked to investigate the expenditure on conspicuous goods. The first set of questions is about the value of participants' own favorite sunglasses, wallet, handbag, and watch. The value for each category is divided into 8 ranges: I do not have one, below \$50, \$50-\$100, \$100-\$200, \$200-\$300, \$300-\$500, \$500-\$1000, and above \$1000. In data analysis phase, we treat the value on each category as 1-8 scale and sum up the numbers to form a single score on luxury goods. We believe this score represents the participants' preference for luxury products, which signals the wealth (Veblen 1899).

The second set of questions is about participants' expenditure on shoes, cloths, and jewelry in the past year. The spending for each category is divided into 7 ranges: below \$50, \$50-\$100, \$100-\$200, \$200-\$300, \$300-\$500, \$500-\$1000, and above \$1000. In data analysis phase, we treat the expenditure on each category as 1-7 scale and sum up the numbers to form a single score. It captures the willingness to follow the fashion and make themselves more appealing to others.

Insert table 1 about here

3. RESULTS

Descriptive Statistics

The descriptive statistics about the plasma OT and measurement of buying tendency are presented in table 1. The average plasma OT level is 214 pg/ml ($SD = 230$), which is representative of the assay procedure used in other investigations (Ebstein et al. 2012). As usually observed (Ebstein et al. 2012), there is no significant gender difference

in plasma OT levels ($M_{male} = 206.39$ vs. $M_{female} = 222.2$, $t < 1.14$, *NS*). We drop 23 observations since these subjects' plasma OT level exceeds three standard deviations (plasma OT > 940.22 pg/ml).

The distribution of the plasma OT for both genders is presented in Figure 1a. As can be seen from the figure, both distributions have are skewed to the right. In Figure 2b, we present the comparison of the distribution in a quantile - quantile plot. The distribution of the plasma OT is approximately similar for males and females.

Insert Figure 1 about here

The buying tendency measures (IBS, CBS, ST-TW, and MVS) all showed good internal consistency in the original studies. In our study, we also observe high internal consistency for IBS (Cronbach's $\alpha = .89$), CBS (Cronbach's $\alpha = .86$), ST-TW (Cronbach's $\alpha = .70$), and MVS (Cronbach's $\alpha = .87$).

Consistent with previous study on gender difference in buying behavior, females on average have a higher IBS ($M_{female} = 16.5$ vs. $M_{male} = 13.5$, $t(1116) = 7.2$, $p < .001$), higher CBS ($M_{female} = 19.34$ vs. $M_{male} = 14.87$, $t(889) = 9.6$, $p < .001$), higher ST-TW score ($M_{female} = 14.6$ vs. $M_{male} = 14.2$, $t(889) = 2.5$, $p < .01$) and spend more on conspicuous goods ($M_{female} = 8.25$ vs. $M_{male} = 7.29$, $t(604) = 4.38$, $p < .001$). No significant gender difference in MVS was found ($M_{female} = 8.24$ vs. $M_{male} = 7.99$, $t(570) = .26$, *NS*).

OT and Buying Tendency

As we discussed in the introduction, we expect that participants with higher plasma OT level will show higher scores in the measures of buying tendency. Table 2 shows the regression results of plasma OT level on IBS, CBS, ST-TW score, MVS, and the first principle component from component analysis. As can be seen, all the measures are positively correlated with plasma OT level, and the correlations are mainly driven by the female sample.

More specifically, regression reveals that plasma OT level is positively associated with IBS ($\beta_{OT} = .004$, $SE = .001$, $t(1051) = 2.81$, $p < .01$) for pooled sample

with both male and female participants. A closer analysis reveals that the positive relationship between plasma level and IBS is mainly driven by female sample ($\beta_{OT} = .005$, $SE = .002$, $t(539) = 2.58$, $p = .01$). Plasma OT has no effect on IBS in male sample ($\beta_{OT} = .0007$, $SE = .002$, $t(511) = .32$, *NS*).

We found a significant correlation for female participants between plasma OT levels and CBS ($\beta_{OT} = .007$, $SE = .002$, $t(441) = 2.93$, $p < 0.01$), marginal significance between plasma OT and ST-TW ($\beta_{OT} = .001$, $SE = .0007$, $t(450) = 1.87$, $p = .06$), and a significant correlation between plasma OT and MVS ($\beta_{OT} = .0018$, $SE = .0006$, $t(286) = 3.1$, $p < .01$). It is notable that plasma OT explained about 2% of the variance ($R^2 = .019$) for the CBS, 1.3% for the ST-TW, and 3% for the MVS. Again, the effect of OT is only on female, and no significant correlation was observed for male participants.

We plot the correlations among IBS, CBS, ST-TW, MVS and OT for female sample in Figure 1. As can be seen, four measures on buying are highly correlated (Pearson's r is 0.23~0.61), we further conduct principle component analysis to investigate the relationship between plasma OT and the principle components. We will use the principle components, the composite score, to denote the buying tendency in further analysis.

Insert figure 2 about here

Only the eigenvalue for the first component exceeds one (Eigenvalue = 2.23), which accounts for 55% of the variance, and hence we retain it for creating the component score. The whole analysis was done using STATA 12.0. Using the component score we computed as the dependent variable, female subjects' plasma OT level again shows a significant effect on the score of the first principle component ($\beta_{OT} = .0015$, $SE = .0004$, $t(433) = 3.35$, $p = .001$), and explains 3% of the variance ($R^2 = .033$). Not surprisingly, there is no correlation between male's plasma OT and the component score.

Insert table 2 about here

OT and Conspicuous Consumption

As implied by the correlation with buying tendency scales, plasma OT should be also correlated with actual expenditure for conspicuous goods. We first test whether the plasma OT is associated with luxury consumption (sunglasses, handbag, wallet, and watch). Contrary to our prediction, the plasma OT is not correlated with value luxury goods for female sample ($\beta_{OT} = -.0008$, $SE = .0008$, $t(300) = -0.79$, NS).

We next examine the association between plasma OT and yearly spending on conspicuous goods (clothes, shoes and jewelry). We found that plasma OT is positively correlated with the expenditure on conspicuous goods ($\beta_{OT} = .002$, $SE = .0008$, $t(566) = 2.57$, $p = .01$) for pooled sample. Again the relationship between is mainly driven by female sample ($\beta_{OT} = .0029$, $SE = .001$, $t(293) = 2.69$, $p < .01$). The plasma OT explains 2.43% of the variance in conspicuous goods buying ($R^2 = 0.024$). The effect is still significant if we control for age and income ($\beta_{OT} = .0025$, $SE = .001$, $t(289) = 2.47$, $p = .014$). Plasma OT and income together explain 8% of the variance in conspicuous goods buying ($R^2 = 0.081$).

The results suggest that the role of oxytocin in buying may not be about seeking of status or signaling wealth. The positive correlation with yearly expenditure suggest that the increased buying may be because the consumers are following fashion trends or making themselves more appealing to others.

Alternative Hypotheses

Self-Control and Impulsiveness. Buying is rewarding. As can be seen in Figure 2, the four measures and the conspicuous consumption are correlated. It is possible that a consumer would have higher score and consumption level for fashion products if she is more likely to be tempted by the immediate gratification from buying. Verplanken and Herabadi (2001) found that impulse buying is positively correlated with the Big Five personality dimension of extraversion and inversely correlated with Conscientiousness.

To the best of our knowledge, no prior research has demonstrated the association between plasma OT and impulsiveness. We administrated the “big five” personality inventory in the second wave ($N = 664$). For female sample, the first component score of buying is not correlated with extraversion ($p > .68$), but positively correlated with

impulsiveness under neuroticism ($p < .03$), and negatively correlated with conscientiousness ($p < .001$). We did not find significant correlation between plasma OT and impulsiveness under neuroticism ($p > .9$) and plasma OT and conscientiousness ($p > .19$). Therefore, it is unlikely that impulsivity personality mediates the correlation between plasma OT and buying.

Persuasion and Trust. Buying behavior is highly influenced by the trust attitudes towards salesman and the perception of the reliability of the promotion (“It’s a real bargain - 1/2 price sale”). It is possible that higher plasma OT indexes greater trust directed towards marketing mixes and hence evokes more buying.

We share the same subject pool with a previous study on trust and plasma OT (Zhong et al. 2012). In this game, an individual (the trustor) starts with a pot of money and can either keep the money for herself or pass a fraction of the money to her partner. If she passes \$ x to her partner (the trustee), the amount of money triples to \$ $3x$, and the trustee must then decide how to split the resulting sum of money between the trustor and himself. The trust was induced by trust game (Berg et al. 1995), which is shown to be correlated with trust attitude towards strangers.

With the data in trust game (see Zhong et al. (2012) for a more detailed description of the participants’ response), we test whether the money passed in the trust game, a proxy of trust attitude towards salesman or other marketing mixes, is correlated with buying score. We did not find positive correlation between the money passed and the first principle component of buying scores ($p > .8$).

4. DISCUSSION

In a series of studies we conducted, we found that participants with higher plasma OT level exhibit higher scores in multiple measures of buying tendency and increased conspicuous consumption. The correlations are mainly driven by the female sample. We ruled out two alternative hypotheses that the correlation with plasma OT may be caused by increased impulsivity personality or trust attitude. There is no correlation between plasma OT and the value of the luxury goods. The findings suggest that plasma OT level may enhance conformity and social identity concerns and hence increases buying tendency.

The association between plasma OT and buying tendency is only found in females but not in males. Early research also noted that oxytocin affects males and females differentially in emotional response (Lischke et al. 2012; Theodoridou et al. 2013). They found that females who are administered oxytocin are more sensitive to socially relevant stimuli than males who received oxytocin. These studies suggest that females are more susceptible to the oxytocin level.

Interestingly, Dittmar et al. (1995) studied the gender effect on both the products bought impulsively and the considerations the participants employed in justifying their purchases. They found that women appear to more value their possessions for relationship-oriented reasons compared to men, and women reported more social and relational reasons for their purchases compared to the male participants. This may also explain why the association between plasma OT and buying are only found in females.

The limitation of our research is threefold: first, we draw on the previous findings that the plasma OT is related to conformity, group affiliation seeking, and status concerns. The association between plasma OT and increased expenditure on conspicuous goods suggests that plasma OT may modulate consumers' assimilation and approaching behavior in social interaction. We caution that the data we collected are insufficient to further validate these explanations conclusively. Instead, we present initial evidence and hope that the findings stimulate more research to study the role oxytocin in consumer behavior.

Secondly, all of our results are based on association studies, which is less effective in revealing the causality than experimental methods. To address the limitations of our research, future research should conduct laboratory experiments to manipulate the OT level by intranasal administration (Kosfeld et al. 2005) and test the influence on consumer's buying behavior in various product categories.

Third, in the current paper we interpret base-line plasma OT as a partial indicator or biomarker for neuropeptide "tone" that reflects long-term chronic oxytocin activity. The contours of the relationship between plasma OT and central neural system oxytocin, however, need to be fully resolved (Landgraf and Neumann 2004).

The emerging field of consumer neuroscience aims at combining consumer psychology with the methodologies and insights from the toolbox of neuroscience (Plassmann et al. 2012; Reimann et al. 2011; Smidts et al. 2014). Plassmann et al and

Smidts et al underscore the importance of going one level deeper to the neurotransmitter level towards explaining consumer behavior. Our findings highlight the social dimension of buying behavior for females at a neuroendocrinological level. We demonstrate for the first time an effect of OT on purchasing behavior and open a window into the role of this hormone in consumer buying behavior.

APPENDIX

Plasma OT assay

Blood samples for oxytocin assay were collected from the antecubital vein into pre-chilled 5 ml EDTA tubes with 250 KIU of aprotinin, and refrigerated until processing. Plasma was isolated by centrifugation at 1800g, 15 minutes, 4°C, and stored in aliquots at -70°C. Oxytocin immunoreactivity levels were quantified in duplicates using a commercial oxytocin ELISA kit (Enzo Life Sciences, NY, USA, formerly Assays Designs, MI, USA), as recommended in previous publications (Carter et al. 2008; Taylor 2010). Thawed samples on ice were diluted 1:2 times in assay buffer and assayed according to manufacturer's instructions. The oxytocin assay had a sensitivity of 11.7 pg/ml, and inter- and intra-assay coefficient of variations below 15%.

REFERENCE

- Bass, F., (1969). A new product growth for model consumer durables. *Management Science* 15 (5): p215–227
- Carter, C Sue. 2014. Oxytocin pathways and the evolution of human behavior. *Annual Review of Psychology* 65: 1146.
- De Dreu, C. K., L. L. Greer, M. J. Handgraaf, S. Shalvi, and G. A. Van Kleef. (2012). Oxytocin modulates selection of allies in intergroup conflict. *Proceedings. Biological sciences: The Royal Society* 279 (1731): 1150-4.
- De Dreu, C. K., L. L. Greer, G. A. Van Kleef, S. Shalvi, and M. J. Handgraaf. (2011). Oxytocin promotes human ethnocentrism. *Proceedings of the National Academy of Sciences of the United States of America* 108 (4): 1262-6.
- Dittmar, H., Beattie, J., & Friese, S. (1995). Gender identity and material symbols: Objects and decision considerations in impulse purchases. *Journal of Economic Psychology*, 16, 491-511.
- Dittmar, H. and Drury, J. (2000) Self-image - is it in the bag? A qualitative comparison between "ordinary" and "excessive" consumers, *Journal of Economic Psychology*. 21., 109-142
- Dittmar, H. (1992). The social psychology of material possessions: To have is to be. Hemel Hempstead: Harvester Wheatsheaf & New York: St. Martin's Press
- Ebstein, R. P., Knafo, A., Mankuta, D., Chew, S. H., & Lai, P. S. (2012). The contributions of oxytocin and vasopressin pathway genes to human behavior. *Hormones and behavior*, 61, 359-379.
- Gordon, I., Zagoory-Sharon, O., Schneiderman, I., Leckman, J. F., Weller, A., & Feldman, R. (2008). Oxytocin and cortisol in romantically unattached young adults: Associations with bonding and psychological distress. *Psychophysiology*
- Green, L., Fein, D., Modahl, C., Feinstein, C., Waterhouse, L., & Morris, M. (2001). Oxytocin and autistic disorder: alterations in peptide forms. *Biological psychiatry*, 50, 609-613.

- Griskevicius, V., Tybur, J. M., Sundie, J. M., Cialdini, R. B., Miller, G. F., & Kenrick, D. T. (2007). Blatant benevolence and conspicuous consumption: When romantic motives elicit strategic costly signals. *Journal of Personality and Social Psychology, 93*, 85-102.
- Hoge, E. A., Pollack, M. H., Kaufman, R. E., Zak, P. J., & Simon, N. M. (2008). Oxytocin levels in social anxiety disorder. *CNS neuroscience & therapeutics, 14*, 165-170
- Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature, 435*, 673-676.
- Landgraf, R., & Neumann, I. D. (2004). Vasopressin and oxytocin release within the brain: a dynamic concept of multiple and variable modes of neuropeptide communication. *Frontiers in Neuroendocrinology, 25*, 150-176.
- Mead, N. L., Baumeister, R. F., Stillman, T. F., Rawn, C. D., & Vohs, K. D. (2011). Social exclusion causes people to spend and consume strategically in the service of affiliation. *Journal of Consumer Research, 37*, 902-919.
- Meyer-Lindenberg, A., Domes, G., Kirsch, P., & Heinrichs, M. (2011). Oxytocin and vasopressin in the human brain: social neuropeptides for translational medicine. *Nature Reviews Neuroscience, 12*, 524-538.
- Modahl, C., Green, L., Fein, D., Morris, M., Waterhouse, L., Feinstein, C., & Levin, H. (1998). Plasma oxytocin levels in autistic children. *Biological psychiatry, 43*, 270-277.
- Plassmann, H., Ramsøy, T. Z., & Milosavljevic, M. (2012). Branding the brain: A critical review and outlook. *Journal of Consumer Psychology, 22*, 18-36.
- Reimann, M., O. Schilke, B. Weber, C. Neuhaus and J.L. Zaichkowsky (2011) "Functional magnetic resonance imaging in consumer research: A review and application", *Psychology and Marketing. 28*(6) 608-637.
- Richins, M., & Dawson, S. (1992). Materialism as a consumer value: Measure development and validation. *Journal of Consumer Research, 19*, 303-316.

- Richins, M., (2004). The material values scale: measurement properties and development of a short form. *The Journal of Consumer Research*. 31. 209-219.
- Rick, S., Cryder, C. and Loewenstein, G. (2008). Tightwads and spendthrifts. *Journal of Consumer Research*, 34 (6), 767-782.
- Ridgway, N., Kukar-Kinney, M., and Monroe, K., An expanded conceptualization and new measure of compulsive buying, *Journal of Consumer Research*, 2008, 622-639
- Rook, D. W., & Fisher, R. J. (1995). Normative influences on impulsive buying behavior. *Journal of Consumer Research*, 22, 305-313.
- Shamay-Tsoory, S. G., Fischer, M., Dvash, J., Harari, H., Perach-Bloom, N., & Levkovitz, Y. (2009). Intranasal administration of oxytocin increases envy and schadenfreude (gloating). *Biological Psychiatry*, 66(9), 864-870.
- Smidts, A., Hsu, M., Sanfey, A.G., Boksem, M.A.S., Ebstein, R.B., Huettel, S.A., Kable, J.W., Karmarkar, U.M., Kitayama, S., Liberzon, I., Knutson, B., Lohrenz, T., Stallen, M. & Yoon, C (2014). Advancing consumer neuroscience. *Marketing Letters*, 25(3), 257-267
- Stallen, M., De Dreu, C. K., Shalvi, S., Smidts, A., & Sanfey, A. G. (2012). The herding hormone: oxytocin stimulates in-group conformity. *Psychological Science*, 23(11), 1288-1292.
- Stoop, R. (2012). Neuromodulation by oxytocin and vasopressin. *Neuron*, 76(1), 142-159
- Taylor, S. E., Gonzaga, G. C., Klein, L. C., Hu, P., Greendale, G. A., & Seeman, T. E. (2006). Relation of oxytocin to psychological stress responses and hypothalamic-pituitary adrenocortical axis activity in older women. *Psychosomatic Medicine*, 68, 238-245.
- Taylor, S. E., Saphire-Bernstein, S., & Seeman, T. E. (2010). Are plasma oxytocin in women and plasma vasopressin in men biomarkers of distressed pair-bond relationships? *Psychological Science*, 21, 3-7.

- The Economist*, (2006). Swarming the shelves: How shops can exploit people's herd mentality to increase sales. 2006.11.11. p. 90.
- Veblen, T. (2005). *The theory of the leisure class; an economic study of institutions*. Aakar Books.
- White, K., & Dahl, D. W. (2006). To be or not be? The influence of dissociative reference groups on consumer preferences. *Journal of Consumer Psychology*, 16, 404-414.
- Zak, P. J.; Kurzban, R.; Matzner, W. T. (2004). The neurobiology of trust. *Annals of the New York Academy of Sciences* 1032: 224–227.
- Zak, P. J., Kurzban, R., & Matzner, W. T. (2005). Oxytocin is associated with human trustworthiness. *Hormones and behavior*, 48, 522-527.
- Zhong S, Monakhov M, Mok HP, Tong T, Lai PS, et al. (2012) U-shaped relation between plasma oxytocin levels and behavior in the trust game. *PLoS ONE* 7(12)

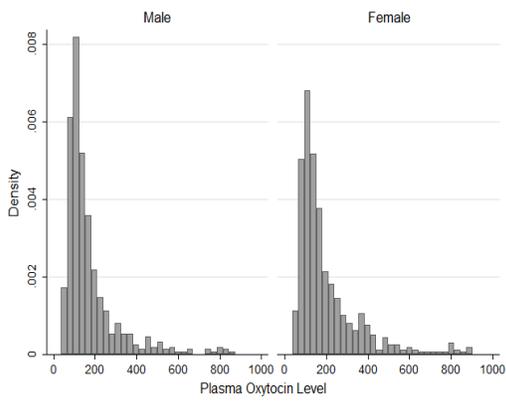


Figure 1a The Distribution of Plasma OT (pg/ml)

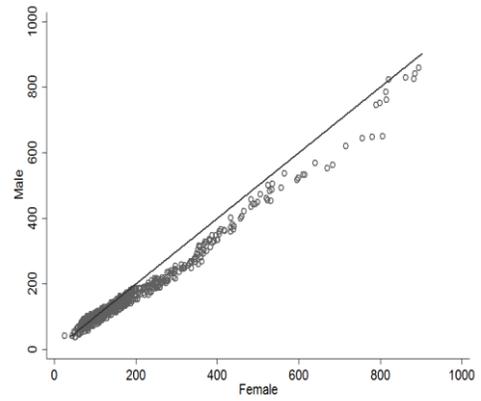


Figure 2b Comparison of Plasma OT Distribution

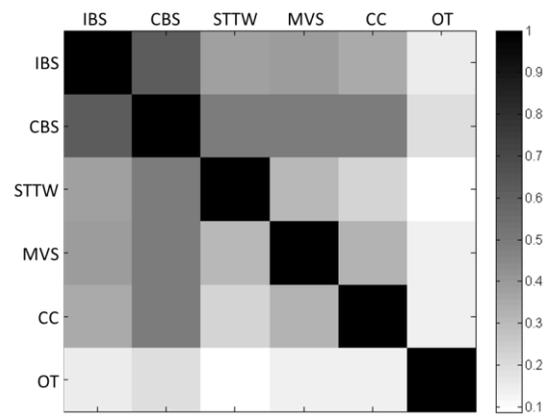


Figure 2 Correlations among Variables (Female)

Variable	Obs	Mean	Std. Dev.	Min	Max
OT (pg/ml)	1100	214.01	230.11	37.68	3115.69
IBS	1118	15.05	7.19	3	39
CBS	896	17.28	7.30	6	42
ST-TW	896	14.38	2.44	8	22
MVS	618	8.14	9.76	-29	34
Luxury Goods	618	8.51	2.97	4	25
Fashion Goods	609	7.78	2.73	3	18
Family Monthly Income	618	3.29	1.67	1	10

Note: The descriptive statistics reported in the table are for pooled sample. Some of the items in MVS are reversely coded (Richins 1992), which results in negative values.

Table 1 Descriptive Statistics of the Variables

Dependent Variables	Pooled	Male	Female
IBS	0.004***	0.0007	0.005**
CBS	0.007***	0.0035	0.0065***
ST-TW	0.00096*	0.00008	0.0013*
MVS	0.005*	-0.00002	0.0084**
Prin. Comp. One	0.0015***	0.00016	0.0018***
Luxury Goods	.00003	.0016	-.0009
Fashion Goods	.0021**	-.00008	.0029***

Note: we report the coefficients from the regression. The independent variable is plasma OT level. *p < .1 **p < .05 ***p < .01

Table 2 Plasma OT and Measures of Buying Tendency