

# Attachment Security and Oxytocin Receptor Gene Polymorphism Interact to Influence Affectionate Communication

Kory Floyd & Amanda Denes

To cite this article: Kory Floyd & Amanda Denes (2015) Attachment Security and Oxytocin Receptor Gene Polymorphism Interact to Influence Affectionate Communication, Communication Quarterly, 63:3, 272-285, DOI: [10.1080/01463373.2015.1039718](https://doi.org/10.1080/01463373.2015.1039718)

To link to this article: <http://dx.doi.org/10.1080/01463373.2015.1039718>



Published online: 11 Jun 2015.



Submit your article to this journal [↗](#)



Article views: 98



View related articles [↗](#)



View Crossmark data [↗](#)

# Attachment Security and Oxytocin Receptor Gene Polymorphism Interact to Influence Affectionate Communication

Kory Floyd & Amanda Denes

*The present study investigated the interaction of attachment security and genotype in the oxytocin receptor gene on affectionate communication. Specifically, we predicted that individuals' genotype for the single-nucleotide polymorphism (SNP) rs53576 on the oxytocin receptor gene would show a stronger influence in individuals with weak attachment security compared to individuals with strong attachment security. One hundred sixty-four participants completed questionnaire measures about their attachment security and affectionate communication and provided saliva samples for genetic analysis. In support of a predicted gene-environment interaction (G x E) interaction, the GG genotype showed a stronger influence on affectionate communication for people low in attachment security than for people high in attachment security. These results support the (G x E) approach to understanding the relationship between genetics and environmental triggers, as the influence of genotype for rs53576 on affectionate communication was moderated by attachment security.*

*Keywords:* Affection; Genetics; Oxytocin

Social scientists have considered the desire to be loved and appreciated a fundamental human need for decades (Baumeister & Leary, 1995; Brown & Levinson, 1987; Maslow, 1970). A robust empirical literature demonstrates the mental and physical health benefits of exchanging expressions of love and appreciation via affectionate

---

Kory Floyd (Ph.D., University of Arizona, 1998) is a professor of human communication at Arizona State University. Amanda Denes (Ph.D., University of California Santa Barbara, 2012) is an assistant professor of communication at the University of Connecticut. *Correspondence:* Kory Floyd, Hugh Downs School of Human Communication, Arizona State University, P.O. Box 871205, Tempe, AZ 85287; E-mail: [kory@asu.edu](mailto:kory@asu.edu)

behavior (Floyd, 2006a). The communication of affection has been linked to mental health and wellness (Floyd, Hess et al., 2005), relationship satisfaction and stability (Huston, Caughlin, Houts, Smith, & George, 2001), cardiovascular health (Floyd, Hesse, & Haynes, 2007), endocrine health (Floyd 2006b; Holt-Lundstad, Birmingham, & Light, 2008), and improvements in blood lipid levels (Floyd, Boren et al., 2009; Floyd, Mikkelson, Hesse, & Pauley, 2007). In comparison, the lack of affectionate expression predicts elevated probabilities for psychological and physical distress (Schwartz & Russek, 1998), psychosomatic illness (Komisaruk & Whipple, 1998), clinical depression (Mackinnon, Henderson, & Andrews, 1993; Oliver, Raftery, Reeb, & Delaney, 1993), loneliness (Downs & Javidi, 1990), and substance abuse (Shuntich, Loh, & Katz, 1998).

Contemporary theory suggests that humans may be biogenetically predisposed to communicate affection. Specifically, Floyd's (2006a) *affection exchange theory* (AET) offers that the tendency for affectionate communication is evolutionarily adaptive, given that it contributes to the development of procreative relationships and promotes individual viability by attenuating physiological reactivity to stressors. As explained recently by Lull and Neiva (2012), communicative behavior has a strong connection to human viability and evolution. A striking example concerns the use of communicative strategies to attract mating partners and elicit reproductive opportunities. As articulated by Darwin (1871), many species display their sexual receptivity and interest through communicative behaviors; chief among these behaviors for humans is flirting (see Frisby, Dillow, Gaughan, & Nordlund, 2011).

Evolutionary success for humans is not marked by reproduction alone but also by the formation of significant pair bonds and the maintenance of individual health and well-being (Simpson & Kenrick, 1997). Multiple studies have supported the claim of AET that affectionate communication contributes significantly to both goals. In line with AET, studies have shown that highly affectionate people are more likely than less affectionate people to have significant romantic relationships and to be satisfied with those relationships (see Floyd, Hess et al., 2005). With respect to stress, research has shown that the propensity to express and receive affection directly predicts differentiation in 24-hr adrenocortical activity (Floyd, 2006b; Floyd & Riforgiate, 2008) and inversely predicts hormonal reactivity to acute stressors (Floyd, Hesse, & Pauley, 2009; Floyd, Mikkelson, Tafoya et al., 2007b). Expressing affection in the wake of elevated stress has also been shown to accelerate endocrine recovery (Floyd, Hesse et al., 2009; Floyd, Mikkelson, Tafoya et al., 2007a). Such findings have particular applied importance, given the range of physical health conditions known to be exacerbated by stress, including hypertension and coronary artery disease (Hotz, 1995; Potempa, 1994), dyslipidemia and cardiovascular disease (Roy, Kirschbaum, & Steptoe, 2001), and immunosuppression (Kiecolt-Glaser et al., 1984).

Humans vary in their propensity to communicate affection, however, and AET suggests that some of the individual variance may be accounted for by inherited rather than acquired characteristics. One pathway for studying variation in acquired characteristics is molecular genetics, which examines differences in gene patterns that may influence the brain's structure or function and therefore affect behavior (Canli,

2008). In this study, we examine one candidate characteristic—genotypic variation on the oxytocin receptor gene—which predicts empathic ability and positive social behavior.

### The Oxytocin Receptor Gene (*OXTR*)

Oxytocin is a peptide hormone consisting of nine amino acids that is produced by the hypothalamus. The hormone is released into the bloodstream and is also projected directly onto various parts of the brain, including the amygdala, striatum, and vagal motor and sensory nuclei (Uvnäs-Moberg, Arn, & Magnusson, 2005). Physiologically, oxytocin produces feelings of calm and suppressed responses to stress (e.g., Adler, Cook, Davidson, West, & Bancroft, 1986; Chiodera et al., 1991; Uvnäs-Moberg, 1996, 2003). Both women and men experience increases in circulating oxytocin at sexual orgasm (Murphy, Seckl, Burton, Checkley, & Lightman, 1990; Richard, Moos, & Freund-Mercier, 1991) and in response to affectionate but nonsexual touch (Turner, Altemus, Enos, Cooper, & McGuinness, 1999).

Like all hormones, oxytocin is chemically active only on cells that contain an oxytocin *receptor*, a molecular protein that receives and interprets instruction from the hormone to affect the metabolism of the cell. The oxytocin receptor is encoded by the oxytocin receptor (*OXTR*) gene, which appears in humans on the third chromosome at location 3p25.

Some genes, including *OXTR*, contain single-nucleotide polymorphisms (SNPs), which are variations in the DNA sequence that occur when one of the four nucleotides—adenine (A), thymine (T), cytosine (C), or guanine (G)—differs between paired chromosomes. On the *OXTR* gene, the SNP known as rs53576 represents variations in the form of the gene (which are called *alleles*) involving the G and A nucleotides. The result is genotypic variation on this SNP from person to person. Specifically, each individual carries either two A alleles (AA), two G alleles (GG), or one of each (AG) on the rs53576 SNP.

### rs53576 and Social Behavior

Several studies have found that an individual's genotype on rs53576—whether AA, GG, or AG—predicts social and emotional behavior that is relevant to affectionate communication. For example, one study found that individuals with an A allele have a higher risk of autism (Wu et al., 2005), suggesting that individuals with an A allele may face social interaction issues. Tost et al. (2010) also found that individuals with the “risk allele” (i.e., the A allele) reported lower levels of sociality. Individuals with an A allele have also been found to have lower levels of optimism, mastery (i.e., the belief that individuals determine their own behaviors and have the ability to bring about desired outcomes), and self-esteem compared to GG individuals (Saphire-Bernstein, Way, Kim, Sherman, & Taylor, 2011). Individuals with an A allele

also show less empathy and become more startled and stressed than individuals with the GG genotype (Rodrigues, Saslow, Garcia, John, & Keltner, 2009).

Conversely, individuals with the GG genotype report more empathy and sociality than individuals with an A allele (Rodrigues et al., 2009; Tost et al., 2010). GG individuals can also be recognized nonverbally. In one study, observers were asked to rate individuals' pro-social behaviors and affiliative cues (Kogan et al., 2011). Specifically, observers watched a video of targets interacting with their romantic partners. In the videos, the partners were sharing an experience about personal suffering and the targets were listening to the story. Participants in the study were asked to rate the targets' pro-social behaviors. Kogan et al. (2011) found that observers judged GG individuals as more pro-social than individuals with an A allele. They also discovered that affiliative nonverbal displays (e.g., head nodding, eye contact, open arm posture, smiling) mediated this relationship. In other words, GG individuals were rated as more pro-social than A allele carriers due to the affiliative nonverbal behaviors they displayed.

The links between rs53576 and sociality, pro-social behavior, empathy, and affiliative cues suggest that the gene may also be directly related to affectionate communication. Affectionate communication includes many verbal (e.g., expressing emotions), nonverbal (e.g., engaging in physical contact or touch, increased eye contact), and support (e.g., helping a partner) behaviors (Floyd & Morman, 1998), many of which have been linked to oxytocin in general and/or rs53576 specifically (e.g., Domes, Heinrichs, Michel, Berger, & Herpertz, 2007; Guastella, Mitchell, & Dadds, 2008; Kogan et al., 2011; Lim & Young, 2006; Rodrigues et al., 2009; Tost et al., 2010). For example, rs53576 has been linked to autism spectrum disorders (ASD; Wu et al., 2005), and individuals with Asperger Syndrome (which is an ASD) have difficulty communicating emotions and feelings of affection (e.g., Beaumont & Sofronoff, 2008). Given such connections between pro-social/anti-social behavior and the oxytocin gene, it is possible that individuals' genotype for rs53576 will also predict affectionate communication. In other words, what may be underlying the associations between rs53576 and various pro-social behaviors may be individuals' propensity for communicating affection to others.

### Genetic and Environmental (G x E) Interaction

The main effects of genotype reported above notwithstanding, it is critical to acknowledge that genes code for proteins—they do not code for behavior. Although genotypic variation in specific genes *predisposes* people toward particular patterns of behavior, the field of behavioral genetics observes that predispositions require environmental triggers before they manifest themselves in actual behavior (Krueger & Johnson, 2008). The influence of environmental triggers on genetic predispositions comes in two forms: the gene-environment correlation ( $r_{ge}$ ) and the gene-environment interaction (G x E).  $r_{ge}$  occurs when the genetic effect varies according to differential exposure to environmental conditions. Jaffee et al. (2004) reported, for instance, that a quarter of the variance in the amount of corporal punishment children receive from their

parents is attributable to genetic influences on the children's own misbehavior. In comparison, G x E occurs when genetic effects are moderated by environmental characteristics. For instance, Caspi et al. (2002) found that boys with the low-activity variant of the monoamine oxidase A gene were more likely to engage in antisocial behavior as adolescents and young adults but only if they had experienced severe parental maltreatment.

Since genotypic variation on rs53576 predicts interpersonal empathic ability and prosocial behavior, it is a minor theoretic skip to the expectation that it may similarly predict interpersonal affectionate behavior. Given the importance of relationship characteristics—which are environmental influences, not genetic—on affectionate behavior, however (Floyd, 2006a), it is prudent also to consider the type of environmental influence that might moderate or correlate with the genetic effect. In the present study, we proposed that *attachment security* may be an environmental variable with considerable influence on the relationship between genotype and affectionate communication.

### Attachment Security

As articulated by Bowlby (1969), attachment reflects the “lasting psychological connectedness between human beings” (p. 194). Attachment theory provides that a human's initial attachment forms instinctively with his or her primary caregiver during infancy (see Bretherton 1992), making attachment itself an environment—not genetic—characteristic even if the predisposition to form an attachment is genetically prepared. Whereas attachment aids survival of the infant by motivating investment on the part of the caregiver, its psychological function is to create a sense of relational security in the infant that serves as a prototype for how that infant will approach all significant relationships during his or her life (Schaffer, 2007). As first studied by Ainsworth, attachment security is the extent to which individuals perceive they can trust and count on their significant relational bonds (e.g., Ainsworth, Blehar, Waters, & Wall, 1978). Those with high attachment security consider their relationships to be dependable and do not fear abandonment; those with low attachment security perceive that significant relational bonds cannot be counted upon.

Floyd's (2006a) AET provides that the propensity for expressing affection evolved among humans because of its contributions to forming and maintaining significant social bonds. Having a genotypic pattern predictive of empathy and prosocial behavior could certainly be expected to make affectionate behavior more frequent, but it stands to reason that one's attachment security might moderate that effect. Specifically, we offer that the genetic influence on affectionate behavior is stronger under conditions of weak attachment security, when affectionate communication functions to compensate for the lack of genetic drive toward relational development, than under conditions of strong attachment security. Importantly, our expectation is not that weakly attached individuals communicate more affection than strongly attached individuals—indeed, existing empirical evidence suggests otherwise (Floyd,

2006a)—but rather that genetic effects on affectionate behavior are more powerful when attachment security is not already strong. This rationale leads us to hypothesize the following:

*H1: Attachment security moderates the effect of genotype of rs53576 on affectionate communication, such that genotype is a stronger influence under conditions of weak attachment security than strong attachment security.*

In line with existing research on empathy and prosocial behavior, we further predict:

*H2: Carriers of a GG allele on rs53576 are more affectionate than carriers with AA or AG alleles.*

## Method

### *Participants*

Participants ( $N = 164$ ) were undergraduate students recruited from two large universities in the western United States. Ages ranged from 18 to 45 years, with an average of 21.20 years ( $SD = 3.67$ ). There were 37 men and 129 women. To satisfy an inclusion criterion for additional procedures not reported here, all participants were required to be in a sexual relationship with another person at the time of the study.

### *Procedure*

Participants were instructed not to eat or drink for at least two hours prior to their participation and not to consume alcohol, smoke, or exercise on the day of their participation. They were also told not to brush their teeth for at least one hour before reporting to the laboratory and not to visit the dentist for at least 48 hours prior. Laboratory sessions were conducted between 2 and 5 pm. Upon arrival at the communication laboratory, participants were instructed to rinse their mouths out with water. After signing informed consent forms, they then provided 1.0 mL of saliva via passive drool into a small plastic cryovial (Granger, Kivlighan, El-Sheikh, Gordis, & Stroud, 2007). The saliva was immediately frozen prior to being shipped on dry ice to a service laboratory at Johns Hopkins University. Participants then completed an online questionnaire in a private room, which took 30–45 min. Following the questionnaire, participants completed other activities not relevant to the analyses reported here.

### *Measures*

*Self-report measures.* *Affectionate communication* was measured with the 10-item Trait Affection Scale-Given (TAS-G; Floyd, 2002). TAS-G asks participants to assess how demonstrative they generally are of their affection for others by indicating their level of agreement with statements such as “Anyone who knows me would say I’m

pretty affectionate,” and “I am always telling my loved ones how much I love them” ( $\alpha = 0.96$ ). Response anchors were 1 for *strongly disagree* and 5 for *strongly agree*. This measure has been extensively validated (for discussion, see Floyd, 2006a). Observed scores for affectionate communication ranged from 1 to 5, with a mean of 3.83 ( $SD = 0.73$ ).

*Attachment security* was measured with The Relationship Questionnaire (RQ) (Bartholomew & Horowitz, 1991). The RQ asks individuals to indicate which of four general relationship styles best describes them. The relationship styles describe the attachment styles secure, fearful-avoidant, preoccupied, and dismissive (Styles A, B, C, and D, respectively). An example of Style A (secure attachment style) is as follows: “It is easy for me to become emotionally close to others. I am comfortable depending on them and having them depend on me. I don’t worry about being alone or having others not accept me.” Individuals were then asked to rate each of the styles on a 5-point Likert scale, with 1 being *strongly disagree that this style describes me* and 5 being *strongly agree that this style describes me*.

In the present study, only individuals’ ratings of the secure attachment style (i.e., Style A) were used in the analyses. In other words, we used each participant’s continuous measure of attachment security, rather than attachment dismissiveness, avoidance, etc. Bowlby’s (1973) theoretical approach to attachment posits that individuals possess internal working models of the self and other. A positive model of self refers to the belief that an individual is worthy of love or is lovable, while a positive model of other captures the belief that others are able to provide love and support (Bowlby, 1973). Based on the intersection of these models of self, Bartholomew (1990) proposed a four-category classification system of adult attachment patterns, which are captured in the RQ (Bartholomew & Horowitz, 1991). Using individuals’ ratings of perceived identification with the secure attachment style (i.e., Style A) description on the RQ indicates the amount of attachment security an individual demonstrates for both internal working models. High identification with Style A suggests that an individual possesses a positive view of self and other (i.e., high security attachment), while low identification with Style A suggests that an individual does not possess a positive view of self and other (i.e., low security attachment). Observed scores for attachment security ranged from 1 to 5, with a mean of 3.73 ( $SD = 1.17$ ). Affectionate communication and attachment security were significantly associated,  $r(159) = 0.41$ ,  $p < 0.001$  (2-tailed).

*Genetic measure.* *OXTR* receptor gene polymorphism rs53576 genotype was measured from DNA extracted from participants’ saliva samples in accordance with procedures described by Saphire-Bernstein et al. (2011). For the oxytocin receptor polymorphism genotypes, 13.2% of participants were coded as having a GG genotype, 46.6% had an AG genotype, and 40.2% had an AA genotype. This distribution does not deviate from the Hardy-Weinberg equilibrium,  $\chi^2(1) = 0.003$ ,  $p = 0.96$ , which suggests that the frequencies of these genotypes are likely to remain constant from one generation to the next in the absence of disturbing factors such as mutations, genetic drift, or non-random mating (Moonesinghe et al., 2010).

## Results

A hierarchical linear regression was conducted to test the effect of the attachment-by-*OXTR* interaction on trait-expressed affection. *OXTR* receptor polymorphism genotype, dummy coded as 0 = GG, 1 = AG/AA, was entered in the first step of the regression, and attachment security was entered in the second step. In accordance with Rodrigues et al. (2009), the AG and AA groups were combined, as the presence or absence of an A allele—rather than the number of A alleles—is hypothesized to be the discriminating factor. A hierarchical model was used in order to control for the main effects when testing the attachment-by-*OXTR* interaction effect in the third step. Predictor variables were centered prior to inclusion in the regression. Trait expressed affection was the criterion variable. Multicollinearity diagnostics were unremarkable. The regression produced a significant main effect for attachment security as well as the interaction between *OXTR* receptor polymorphism rs53576 genotype and attachment security. Regression results appear in Table 1.

To plot the interaction effect, we formulated beta weights for “high attachment security” and “low attachment security” by using one standard deviation above and below the mean for attachment security. These beta weights were used in the regression equation to simulate cells of high- and low-attachment-security participants for the purpose of plotting the interaction visually. The interaction appears in Figure 1. The interaction indicates that genotype has a stronger effect on individuals who are low in attachment security than on those who are high in attachment security. H1 is supported.

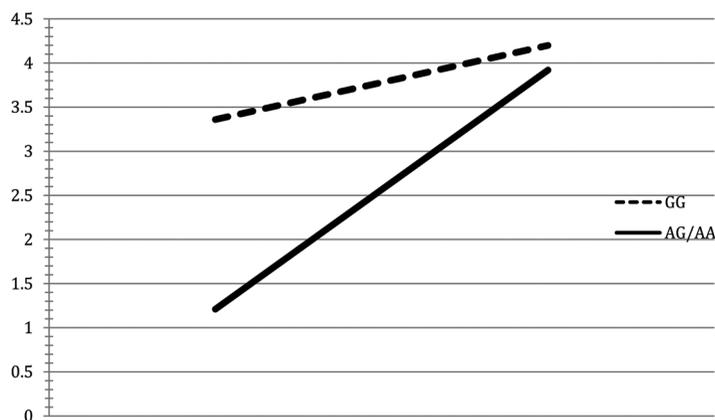
The ordinal nature of the interaction allows for interpretation of main effects as well. Although carriers of the GG genotype appear more affectionate than carriers of the AA or AG genotypes on the plot of the interaction, in line with H2, the beta score was nonsignificant in the first step of the regression, when only the effect of the genotype was examined. In line with previous research (Floyd, 2006a), however, people high in attachment security were more affectionate than were people low in attachment security.

Because the sample included substantially more female than male participants, the above analyses were re-conducted using only the female participants to examine

**Table 1** Multiple Regression Predicting Trait Expressed Affection from Attachment Security and *OXTR* Receptor Genotype ( $N = 164$ )

Model	Zero-order $r$	B	SE B	$\beta$	$\Delta R^2$
1. <i>OXTR</i>	−0.002	0.005	0.13	0.004	
2. <i>OXTR</i>		0.011	0.12	0.007	
Attachment	0.41**	0.26	0.05	0.40**	0.16**
3. <i>OXTR</i>		0.90*	0.39	0.60*	
Attachment		0.36**	0.07	0.56**	
<i>OXTR</i> -by-attachment	0.05	−0.24	0.10	−0.64*	0.03*

Note.  $R^2 = 0.19$ ; adjusted  $R^2 = 0.17$ ,  $F(3, 137) = 11.01$ ,  $p < 0.001$ . \* $p < 0.05$ ; \*\* $p < 0.01$ .



**Figure 1** Interaction of OXTR rs53576 genotype and attachment security on affectionate communication ( $N = 164$ ).

whether the inclusion of the small percentage of male participants skewed the results in any way. The beta weights changed slightly but the fundamental results were the same, leading us to retain the male participants in the sample.<sup>1</sup>

## Discussion

Much has been written in recent years about the neurological, immunological, endocrine, cardiovascular, and hematological correlates and substrates of interpersonal communication (for a contemporary review, see Floyd & Afifi, 2012). For perhaps the first time, researchers are identifying how interpersonal behavior affects, and is affected by, biological as well as cultural, social, political, religious, and historic influences. A more complete and better-integrated picture of the human communicator—one that begins to articulate how biological and social effects interact to shape behavior—consequently emerges.

The elegance of that picture is illustrated in the gene-by-environment interaction identified in the present study. Like most communication behavior, affectionate communication is a complex enterprise with multiple causes, correlates, and outcomes (Floyd, 2006a), one that manifests substantial person-to-person variation. Given the complex, multifaceted nature of affectionate communication, it is inconceivable that any single variable—whether innate or acquired—could account completely for that variation. As explained herein, any genetic variation (whether on *OXTR* or any of the other 25,000-some genes in the human genome) could most likely be expected only to predispose an individual toward greater or lesser affectionate communication. When individuals with certain alleles are predisposed toward higher levels of a behavior, they will, on average, manifest greater levels of that behavior when compared to other groups, but the inference cannot be made that the genotype is causing their behavior.

Rather, as we articulated here, a predisposition toward affectionate communication is likely to be enhanced or inhibited under particular conditions of the social environment. In this study, we proposed that attachment security—the extent to which individuals perceive they can trust and count on their significant relational bonds (which, according to attachment theory, arises from initial interactions with one's primary caregiver)—moderates the influence of the rs53576 SNP on how much affection individuals report communicating in their social and personal relationships. Given main effects of rs53576 genotype on related social behaviors such as empathic behavior, we hypothesized not only that individuals homozygotic for a GG genotype would be more affectionate than individuals homozygotic for an AA genotype or heterozygotic for an AG genotype but also that the difference would be moderated by attachment security.

Although the main effect of the genotype was nonsignificant, the hypothesized gene-by-environment interaction was observed. As predicted, the genotype has a greater influence on affectionate communication for people low in attachment security than for people high in attachment security. We reasoned that the genetic influence on affectionate behavior would be stronger under conditions of weak attachment security—rather than under conditions of strong attachment security, which would also be a gene-by-environment interaction—because under weak attachment, affectionate communication would be functioning to compensate for the lack of genetic drive toward relational development. As we pointed out, our expectation was not that weakly attached individuals communicate more affection than strongly attached individuals, but rather that the genetic effects on affectionate behavior are more powerful when attachment security is not already strong. Our data confirmed that prediction.

It behooves us to be clear about what inferences can and cannot be drawn from this finding. We cannot infer that *OXTR*, attachment security, or their interaction, is causing affectionate behavior, only that the interaction accounts for variance in affectionate behavior. With a beta weight of 0.64, the amount of variance accounted for by the interaction is not inconsequential; it does suggest that our reasoning with respect to attachment security and this particular SNP has merit for understanding individual-level variation in affectionate behavior.

Importantly, however, rs53576 is only one of several SNPs on *OXTR*, which is only one of thousands of genes in the human genome. The vast majority of those genes code for proteins that cannot be expected to have any effect whatsoever on social behavior, so an appropriate strategy for understanding genetic main effects, or gene-by-environment interaction effects, on behavior is not to attempt a genome-wide survey. The genetic options alone would number around 25,000, and the number of environmental variables with which they might interact could be virtually limitless. A more strategic approach for continuing this line of inquiry is to identify those genes with the most reasonable potential to code for proteins that will influence social behavior. In that respect, *OXTR* is a prime example for the current study, given multiple associations between oxytocin and affectionate communication (Floyd, Pauley, & Hesse, 2010; Holt-Lundstad et al., 2008). With respect to affectionate communication, particular other SNPs on *OXTR* await investigation, as do SNPs on

receptor genes for related biochemicals such as dopamine and serotonin. Reasoning about the environmental influences—on the basis of theory and/or empirical findings—that are likely to interact with variation in the presentation of that gene is the next step. Again, attachment security is a natural point of departure for a behavior such as affectionate communication; future work might explore such environmental variables as style of attachment, relational security, and even the personality traits of one's relational partners.

As a preliminary investigation of a gene-by-environment influence on variation in an interpersonal behavior, we submit that the present study reinforces the complexity of the human animal as both a social and a biological being, and illustrates that innate and acquired characteristics are not necessarily orthogonal in their influence on communication behavior.

## Note

- [1] For the OXTR main effect, the beta weight changed from 0.004 to 0.063 (which was still nonsignificant) when comparing the full sample to the women-only subsample. The beta for the attachment security main effect changed from 0.40 to 0.38, and the beta for the OXTR-by-attachment security interaction changed from  $-0.64$  to  $-0.58$ .

## References

- Adler, E. M., Cook, A., Davidson, D., West, C., & Bancroft, J. (1986). Hormones, mood and sexuality in lactating women. *British Journal of Psychiatry*, *748*, 74–79. doi:10.1192/bjp.148.1.74
- Ainsworth, M., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Bartholomew, K. (1990). Avoidance of intimacy: An attachment perspective. *Journal of Social and Personal Relationships*, *71*, 147–178. doi:10.1177/0265407590072001
- Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of a four-category model. *Journal of Personality and Social Psychology*, *61*, 226–244. doi:10.1037/0022-3514.61.2.226
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497–529. doi:10.1037/0033-2909.117.3.497
- Beaumont, R., & Sofronoff, K. (2008). A multi-component social skills intervention for children with Asperger syndrome: The Junior Detective Training Program. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *49*(7), 743–753. doi:10.1111/j.1469-7610.2008.01920.x
- Bowlby, J. (1969). *Attachment and loss* (vol. 1). New York, NY: Basic Books.
- Bowlby, J. (1973). *Attachment and loss: Vol. 2. Separation, anxiety and anger*. New York, NY: Basic Books.
- Bretherton, I. (1992). The origins of attachment theory: John Bowlby and Mary Ainsworth. *Developmental Psychology*, *28*, 759–775. doi:10.1037/0012-1649.28.5.759
- Brown, P., & Levinson, S. C. (1987). *Politeness: Some universals in language usage*. Cambridge, England: Cambridge University Press.
- Canli, T. (2008). Toward a “molecular psychology” of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 311–327). New York, NY: Guilford.

- Caspi, A., McClay, J., Moffitt, T., Mill, J., Martin, J., Craig, I. W., . . . Poulton, R. (2002). Role of genotype in the cycle of violence in maltreated children. *Science*, *297*, 752–754. doi:10.1126/science.1072290
- Chiodera, P., Salvarani, C., Bacchi-Modena, A., Spailanzani, R., Cigarini, C., Alboni, A., . . . Coiro, V. (1991). Relationship between plasma profiles of oxytocin and adrenocorticotrophic hormone during sucking or breast stimulation in women. *Hormone Research*, *35*, 119–123.
- Darwin, C. (1871). *The descent of man, and selection in relation to sex*. London, England: John Murray.
- Domes, G., Heinrichs, M., Michel, A., Berger, C., & Herpertz, S. (2007). Oxytocin improves “mind-reading” in humans. *Biological Psychiatry*, *61*, 731–733. doi:10.1016/j.biopsych.2006.07.015
- Downs, V. C., & Javidi, M. (1990). Linking communication motives to loneliness in the lives of older adults: An empirical test of interpersonal needs and gratifications. *Journal of Applied Communication Research*, *18*, 32–48. doi:10.1080/00909889009360313
- Floyd, K. (2002). Human affection exchange: V. Attributes of the highly affectionate. *Communication Quarterly*, *50*, 135–152. doi:10.1080/01463370209385653
- Floyd, K. (2006a). *Communicating affection: Interpersonal behavior and social context*. Cambridge, England: Cambridge University Press.
- Floyd, K. (2006b). Human affection exchange: XII. Affectionate communication is associated with diurnal variation in salivary free cortisol. *Western Journal of Communication*, *70*, 47–63. doi:10.1080/10570310500506649
- Floyd, K., & Afifi, T. D. (2012). Biological and physiological perspectives on interpersonal communication. In M. L. Knapp & J. A. Daly (Eds.), *The handbook of interpersonal communication* (4th ed., pp. 87–127). Thousand Oaks, CA: SAGE.
- Floyd, K., Boren, J. P., Hannawa, A. F., Hesse, C., McEwan, B., & Veksler, A. E. (2009). Kissing in marital and cohabiting relationships: Effects on blood lipids, stress, and relationship satisfaction. *Western Journal of Communication*, *73*, 113–133. doi:10.1080/10570310902856071
- Floyd, K., Hess, J. A., Miczo, L. A., Halone, K. K., Mikkelson, A. C., & Tusing, K. J. (2005). Human affection exchange: VIII. Further evidence of the benefits of expressed affection. *Communication Quarterly*, *53*, 285–303. doi:10.1080/01463370500101071
- Floyd, K., Hesse, C., & Haynes, M. T. (2007). Human affection exchange: XV. Metabolic and cardiovascular correlates of trait expressed affection. *Communication Quarterly*, *55*, 79–94. doi:10.1080/01463370600998715
- Floyd, K., Hesse, C., & Pauley, P. M. (2009, November). *Writing affectionate letters reduces stress: Replication and extension*. Paper presented at the annual meeting of the National Communication Association, Chicago, IL.
- Floyd, K., Mikkelson, A. C., Hesse, C., & Pauley, P. M. (2007). Affectionate writing reduces total cholesterol: Two randomized, controlled trials. *Human Communication Research*, *33*, 119–142. doi:10.1111/j.1468-2958.2007.00293.x
- Floyd, K., Mikkelson, A. C., Tafoya, M. A., Farinelli, L., La Valley, A. G., Judd, J., . . . Wilson, J. (2007a). Human affection exchange: XIII. Affectionate communication accelerates neuroendocrine stress recovery. *Health Communication*, *22*, 123–132. doi:10.1080/10410230701454015
- Floyd, K., Mikkelson, A. C., Tafoya, M. A., Farinelli, L., La Valley, A. G., Judd, J., . . . Wilson, J. (2007b). Human affection exchange: XIV. Relational affection predicts resting heart rate and free cortisol secretion during acute stress. *Behavioral Medicine*, *32*, 151–156. doi:10.3200/BMED.32.4.151-156
- Floyd, K., & Morman, M. T. (1998). The measurement of affectionate communication. *Communication Quarterly*, *46*, 144–162. doi:10.1080/01463379809370092
- Floyd, K., Pauley, P. M., & Hesse, C. (2010). State and trait affectionate communication buffer adults’ stress reactions. *Communication Monographs*, *77*, 618–636. doi:10.1080/03637751.2010.498792

- Floyd, K., & Riforgiate, S. (2008). Affectionate communication received from spouses predicts stress hormone levels in healthy adults. *Communication Monographs*, *75*, 351–368. doi:10.1080/03637750802512371
- Frisby, B. N., Dillow, M. R., Gaughan, S., & Nordlund, J. (2011). Flirtatious communication: An experimental examination of perceptions of social-sexual communication motivated by evolutionary forces. *Sex Roles*, *64*, 682–694. doi:10.1007/s11199-010-9864-5
- Granger, D. A., Kivlighan, K. T., El-Sheikh, M., Gordis, E., & Stroud, L. R. (2007). Salivary alpha-amylase in biobehavioral research: Recent developments and applications. *Annals of the New York Academy of Sciences*, *1098*, 122–144. doi:10.1196/annals.1384.008
- Guastella, A. J., Mitchell, P. B., & Dadds, M. R. (2008). Oxytocin increases gaze to the eye region of human faces. *Biological Psychiatry*, *63*, 3–5. doi:10.1016/j.biopsych.2007.06.026
- Holt-Lunstad, J., Birmingham, W. A., & Light, K. C. (2008). Influence of a “warm touch” support enhancement intervention among married couples on ambulatory blood pressure, oxytocin, alpha amylase, and cortisol. *Psychosomatic Medicine*, *70*, 976–985. doi:10.1097/PSY.0b013e318187aef7
- Hotz, S. B. (1995). Stress and cardiovascular disease risk behaviors: Implications for health behavioral change. *Canadian Journal of Cardiology*, *11*, 8A–11A.
- Huston, T. L., Caughlin, J. P., Houts, R. M., Smith, S. E., & George, L. J. (2001). The connubial crucible: Newlywed years as predictors of marital delight, distress, and divorce. *Journal of Personality and Social Psychology*, *80*, 237–252. doi:10.1037/0022-3514.80.2.237
- Jaffee, S. R., Caspi, A., Moffit, T., Polo-Thomas, M., Price, T. S., & Taylor, A. (2004). The limits of child effects: Evidence for genetically mediated child effects on corporal punishment but not on physical maltreatment. *Developmental Psychology*, *40*, 1047–1058. doi:10.1037/0012-1649.40.6.1047
- Kiecolt-Glaser, J. K., Garner, W., Speicher, C., Penn, G. M., Holliday, J., & Glaser, R. (1984). Psychosocial modifiers of immunocompetence in medical students. *Psychosomatic Medicine*, *46*, 7–14.
- Kogan, A., Saslow, L. R., Impett, E. A., Oveis, C., Keltner, D., & Saturn, S. R. (2011). Thin-slicing study of the oxytocin receptor (OXTR) gene and the evaluation and expression of the prosocial disposition. *Proceedings of the National Academy of Sciences (PNAS)*, *108*, 19189–19192. doi:10.1073/pnas.1112658108
- Komisaruk, B. R., & Whipple, B. (1998). Love as sensory stimulation: Physiological consequences of its deprivation and expression. *Psychoneuroendocrinology*, *23*, 927–944. doi:10.1016/S0306-4530(98)00062-6
- Krueger, R. F., & Johnson, W. (2008). Behavioral genetics and personality: A new look at the integration of nature and nurture. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 287–310). New York, NY: Guilford.
- Lim, M. M., & Young, L. J. (2006). Neuropeptidergic regulation of affiliative behavior and social bonding in animals. *Hormones and Behavior*, *50*, 506–517. doi:10.1016/j.yhbeh.2006.06.028
- Lull, J., & Neiva, E. (2012). *The language of life: How communication drives human evolution*. Amherst, NY: Prometheus Books.
- Mackinnon, A., Henderson, A. S., & Andrews, G. (1993). Parental “affectionless control” as an antecedent to adult depression: A risk factor refined. *Psychological Medicine*, *23*, 135–141. doi:10.1001/archpsyc.1983.01790080038005
- Maslow, A. H. (1970). *Motivation and personality* (2nd ed.). New York, NY: Harper & Row.
- Moonesinghe, R., Yesupriya, A., Chang, M.-H., Dowling, N. F., Khoury, M. J., & Scott, A. J. (2010). A Hardy-Weinberg equilibrium test for analyzing population genetic surveys with complex sample designs. *American Journal of Epidemiology*, *171*, 932–941. doi:10.1093/aje/kwq002
- Murphy, M. R., Seckl, J. R., Burton, S., Checkley, S. A., & Lightman, S. L. (1990). Changes in oxytocin and vasopressin secretion during sexual activity in men. *Journal of Clinical Endocrinology and Metabolism*, *65*, 738–741. doi:10.1210/jcem-65-4-738

- Oliver, J. M., Raftery, M., Reeb, A., & Delaney, P. (1993). Perceptions of parent-offspring relationships as functions of depression in offspring: "Affectionless control," "negative bias," and "depressive realism." *Journal of Social Behavior and Personality*, 8, 405–424.
- Potempa, K. (1994). An overview of the role of cardiovascular reactivity to stressful challenges in the etiology of hypertension. *Journal of Cardiovascular Nursing*, 8, 27–38.
- Richard, P., Moos, F., & Freund-Mercier, M. J. (1991). Central effects of oxytocin. *Physiological Review*, 71, 331–370.
- Rodrigues, S. M., Saslow, L. R., Garcia, N., John, O. P., & Keltner, D. (2009). Oxytocin receptor genetic variation relates to empathy and stress reactivity in humans. *Proceedings of the National Academy of Sciences*, 106, 21437–21441. doi:10.1073/pnas.0909579106
- Roy, M. P., Kirschbaum, C., & Steptoe, A. (2001). Psychological, cardiovascular, and metabolic correlates of individual differences in cortisol stress recovery in young men. *Psychoneuroendocrinology*, 26, 375–391. doi:10.1016/S0306-4530(00)00061-5
- Saphire-Bernstein, S., Way, B. M., Kim, H. S., Sherman, D. K., & Taylor, S. E. (2011). Oxytocin receptor gene (OXTR) is related to psychological resources. *Proceedings of the National Academy of Sciences*, 108, 15118–15122. doi:10.1073/pnas.1113137108
- Schaffer, R. (2007). *Introducing child psychology*. Oxford, England: Blackwell.
- Schwartz, G. E., & Russek, L. G. (1998). Family love and lifelong health? A challenge for clinical psychology. In D. K. Routh & R. J. DeRubeis (Eds.), *The science of clinical psychology: Accomplishments and future directions* (pp. 121–146). Washington, DC: American Psychological Association.
- Shuntich, R. J., Loh, D., & Katz, D. (1998). Some relationships among affection, aggression, and alcohol abuse in the family setting. *Perceptual and Motor Skills*, 86, 1051–1060. doi:10.2466/pms.1998.86.3.1051
- Simpson, J. A., & Kenrick, D. (Eds.). (1997). *Evolutionary social psychology*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Tost, H., Kolachana, B., Hakimi, S., Lemaitre, H., Verchinski, B. A., Mattay, V. S., . . . Meyer-Lindenberg, A. (2010). A common allele in the oxytocin receptor gene (OXTR) impacts prosocial temperament and human hypothalamic-limbic structure and function. *Proceedings of the National Academy of Sciences*, 103, 13936–13941. doi:10.1073/pnas.1003296107
- Turner, R. A., Altemus, M., Enos, T., Cooper, B., & McGuinness, T. (1999). Preliminary research on plasma oxytocin in normal cycling women: Investigation emotion and interpersonal distress. *Psychiatry*, 62, 97–113.
- Uvnäs-Moberg, K. (1996). Neuroendocrinology of the mother-child interaction. *Trends in Endocrinology and Metabolism*, 7, 126–131. doi:10.1016/1043-2760(96)00036-7
- Uvnäs-Moberg, K. (2003). *The oxytocin factor*. Cambridge, MA: Perseus.
- Uvnäs-Moberg, K., Arn, I., & Magnusson, D. (2005). The psychobiology of emotion: The role of the oxytocinergic system. *International Journal of Behavioral Medicine*, 12, 59–65. doi:10.1207/s15327558ijbm1202\_3
- Wu, S., Jia, M., Ruan, Y., Liu, J., Guo, Y., Shuang, M., . . . Zhang, D. (2005). Positive association of the oxytocin receptor gene (OXTR) with autism in the Chinese Han population. *Biological Psychiatry*, 58, 74–77. doi:10.1016/j.biopsych.2005.03.013