Empathy, Target Distress, and Neurohormone Genes Interact to Predict Aggression for Others–Even Without Provocation

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Abstract

Can empathy for others motivate aggression on their behalf? This research examined potential predictors of empathy-linked aggression including the emotional state of empathy, an empathy target's distress state, and the function of the social anxiety-modulating neuropeptides oxytocin and vasopressin. In Study 1 ($N = 69$), self-reported empathy combined with threat to a close other and individual differences in genes for the vasopressin receptor (*AVPR1a* rs3) and oxytocin receptor (*OXTR* rs53576) to predict self-reported aggression against a person who threatened a close other. In Study 2 ($N = 162$), induced empathy for a person combined with *OXTR* variation or with that person's distress and *AVPR1a* variation led to increased amount of hot sauce assigned to that person's competitor. Empathy uniquely predicts aggression and may do so by way of aspects of the human caregiving system in the form of oxytocin and vasopressin.

On June 9, 2012, guided by his little daughter's screams, a Texas father rushed to a gruesome scene—a farmhand sexually assaulting his 5-year-old daughter. Within seconds, the father beat the assaulter to death. The father was not naturally an aggressive man; in fact, nearly immediately, upon realizing that the man seemed critically injured, the father called 911 on behalf of the man he had beaten, hoping to save his life. The father can even be heard crying on the tape of the 911 call. In court, the father was found not guilty of homicide as attorneys and prosecutors found that the father was remorseful, did not mean to kill his daughter's attacker, and even attempted to save his life (Valencia, Savidge, & Maddox, 2012). What might have led this apparently normal, even sensitive man to brutally beat his child's attacker to death? What may have led him to set aside his aversion to such violence? For that matter, why do people in general aggress on behalf of others, whether parents moved to defend their children, policemen and soldiers fighting on behalf of comrades, or ordinary people taking stands for colleagues and loved ones?

To a large degree, asking why individuals aggress on behalf of others is merely a more specific way of asking why people do *anything* on behalf of others—that is, why people engage in any form of prosocial behavior. In the present article, we examine the possibility that the caregiving behavioral system (Bell & Richard, 2000; Bowlby, 1969; Brown & Brown, 2006; Preston, 2013; Shaver, Mikulincer, & Shemesh-Iron, 2009) may facilitate aggression even as it can elicit gentle, nurturing behaviors. We also present evidence that certain features of the caregiving system, including the experience of empathy and the function of the caregiving-linked hormones vasopressin and oxytocin, can predict aggression, thereby helping to explain why aggression on behalf of others may occur under certain circumstances.

The Caregiving System

Several researchers have argued that prosocial behavior is regulated in part by a caregiving behavioral system that evolved alongside the well-researched attachment system (Bell & Richard, 2000; Bowlby, 1969; Brown & Brown, 2006; Preston, 2013; Shaver et al., 2009). The primary feature of this system is a motivation to reduce the suffering and/or increase the well-being of a valued individual perceived as being in

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need, perhaps especially when suffering is perceived as undeserved (Goetz, Keltner, & Simon-Thomas, 2010). Many accounts of the functioning of the caregiving system focus on the role of the emotions people tend to have when viewing another person in a state of distress or vulnerability. These emotions include feelings of warmth, tenderness, and sympathy—collectively referred to variously as *empathy, compassion*, or *empathic concern* (e.g., Batson, 1991; Goetz et al., 2010; Mikulincer, Shaver, Bar-On, & Ein-Dor, 2010; Sober & Wilson, 1998). Experimental manipulations and assessments of these emotions (henceforth "empathy") have shown them to predict a wide array of prosocial behaviors, including laboratory assessments of willingness to help others (Batson, 1991), real-world volunteering (Gillath et al., 2005; Stuermer, Snyder, & Omoto, 2005), and responsiveness in close relationships (Collins & Ford, 2010).

Although it is still unknown precisely how empathy motivates helping behavior, biological models of the caregiving system have focused on the role of the hormones and neurotransmitters oxytocin and vasopressin (Feldman, 2012; Goetz et al., 2010; Kemp & Guastella, 2011; Poulin, Holman, & Buffone, 2012; Preston, 2013). Although these neurohormones have many divergent effects—for example, vasopressin is frequently anxiogenic whereas oxytocin can be anxiolytic—in non-human mammals, these neurohormones both regulate pair-bonding and the provision of parental care (Carter, 1998), and are thus may facilitate caregiving and empathy more broadly.

Oxytocin and Caregiving

In humans, the vast majority of the work on these neurohormones has focused on oxytocin, with a literature emerging to support the view that oxytocin is instrumental in parental bonding with and caring for children (e.g., Bakermans-Kranenburg & van Ijzendoorn, 2008; see Feldman, 2012, for a review). In addition, there is some evidence, though not conclusive, that oxytocin facilitates empathy and prosocial behavior (for reviews, see Gonzalez-Liencres, Shamay-Tsoory, & Brüne, 2013; Norman, Hawkley, Cole, Berntson, & Cacioppo, 2012). Intranasal administration of oxytocin may increase emotional empathy (Hurlemann et al., 2010), and in several studies, intranasal administration of oxytocin has led to increased generosity in economic games (Baumgartner, Heinrichs, Vonlanthen, Fischbacher, & Fehr, 2008; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Mikolajczak et al., 2010), though other studies have failed to find this link (e.g., Singer et al., 2008). In addition, there is some evidence that plasma oxytocin increases following an empathy induction, possibly indicating that oxytocin also helps account for the effects of empathy on subsequent behavior (Barraza & Zak, 2009).

Research on the oxytocin receptor gene (*OXTR*) also provides tentative evidence for a role of oxytocin in empathy. Individuals homozygous for the G allele of *OXTR* variant rs53576, who are hypothesized to be more sensitive to the effects of oxytocin, exhibit less stress and greater empathic accuracy after being directed to attend to others' feelings (Rodrigues, Saslow, Garcia, John, & Keltner, 2009) and engage in more charitable behavior under conditions of perceived social threat (Poulin et al., 2012) than do others. In contrast, however, *OXTR* variants have not been shown to predict social integration in a large community sample (Chang et al., 2014). It is important to note that the role of *OXTR* variant rs53576 may differ by ethnicity, with some evidence indicating that it predicts social behavior in European American (White) individuals but not for members of other ethnic groups (Kim et al., 2010; Poulin et al., 2012).

Vasopressin and Caregiving

Very little if any research has examined vasopressin administration and caregiving, and the links between vasopressin, human caregiving, and empathy are unclear (Gonzalez-Liencres et al., 2013). However, a small amount of research suggests that vasopressin 1a receptor gene (*AVPR1a*) variation may influence social behavior, including generosity. For example, those with greater numbers of "long" versus "short" alleles of the 1a vasopressin receptor (*AVPR1a*) variant rs3, who are believed to be more sensitive to the effects of vasopressin, exhibit more laboratory generosity toward strangers (Knafo et al., 2008) and more stable pair bonds (Walum et al., 2008) than do others. Similarly, those with greater numbers of "long" versus "short" alleles of *AVPR1a* variant rs1 demonstrate more commitment to their civic duties under conditions of perceived social threat (Poulin et al., 2012) than do others.

Caregiving and Aggression

Given that empathy motivates a wide range of prosocial behaviors, it is not difficult to imagine that it could motivate helping another person by way of aggressing against a third party. However, research has not directly tested this hypothesis. Some research has examined links between empathy and anti-social behaviors such as punishment or hostility (Condon & DeSteno, 2011; Keller & Pfattheicher, 2013), but these studies did not examine the context of aggression directed toward helping a third party. Moreover, these studies have yielded inconsistent findings, with Condon and DeSteno (2011) showing that experimentally induced empathy inhibits aggression in the form of punishing a wrongdoer, whereas Keller and Pfattheicher (2013) found that compassion (closely related to empathic concern) predicts increased hostility, albeit solely among prevention-focused individuals. Other prior research indicates that empathy induces partiality toward a empathy target that results in disadvantaging a third party (Batson, Klein, Highberger, & Shaw, 1995). However, this outcome differs from aggression in that, while partiality does result in harm to a third party, it does not

reflect a "proximate . . . *intent* to cause harm" (Anderson & Huesmann, 2003, p. 298, emphasis added) to the third party. Finally, a separate body of research suggests that aggression for the sake of another results from experiencing *anger* on the other's behalf (Hoffman, 1989; Neumann, 2000; Staub, 1978; Stotland, 1969; Vitaglione & Barnett, 2003; Weiner, 1995) but has not examined the possibility that empathy plays a direct role in eliciting aggression. In sum, no research has yet provided evidence for a direct link between empathy and aggression, especially in the absence of provocation or a desire to punish a wrongdoer.

Although social-psychological literature has not tested a direct role for empathy in helping-linked aggression, decades of research on caregiving behavior in non-human animals have found aggressive acts on behalf of mates and offspring to be a fundamental part of animal caregiving (Gammie & Nelson, 2000; Lonstein & Gammie, 2002; Wolff, 1985). These types of aggression are facilitated, just as are gentler aspects of pair-bonding and parenting, by vasopressin (Bosch, Pfortsch, Beiderbeck, Landgraf, & Neumann, 2010; Carter, 1998) and oxytocin (Bosch, Meddle, Beiderbeck, Douglas, & Neumann, 2005; Campbell, 2010). Moreover, there is preliminary evidence that these neurohormones, especially oxytocin, facilitate aggressive caregiving behaviors in humans.

For example, intranasal oxytocin leads to protective maternal behavior against "enthusiastic strangers" (Mah, Bakermans-Kranenburg, Van IJzendoorn, & Smith, 2014). In addition, breast-feeding human mothers have higher levels of circulating oxytocin and increased aggressive tendencies toward potential intruders compared with formula-feeding mothers (Hahn-Holbrook, Holbrook, & Haselton, 2011; Hahn-Holbrook, Holt-Lunstad, Holbrook, Coyne, & Lawson, 2011). In addition, De Dreu and colleagues have found that oxytocin administration facilitates ingroup favoritism that implicitly disfavors highly threatening outgroups (De Dreu, 2012; De Dreu et al., 2010; Shalvi & De Dreu, 2014). Relatively little research has examined links between vasopressin administration and aggression on another's behalf, but at least one study found that vasopressin administration led to greater negative affect toward unfamiliar faces among males, possibly consistent with more aggressive tendencies toward strangers (Thompson, George, Walton, Orr, & Benson, 2006).

The Present Research

In sum, research on empathy, non-human caregiving, and neurohormonal mechanisms for prosocial behavior suggests that situations that evoke empathy might facilitate aggression on behalf of a vulnerable other. The present research sought to test whether assessed or elicited empathy would lead to situation-specific aggression on behalf of another person, and to explore the potential role of oxytocin and vasopressin in explaining any associations between empathy and aggression. Two studies addressed these goals. The first study used a correlational design exploring the links between self-reported empathy and real-world aggression on behalf of another. The second study used an experimental design to manipulate empathy and assess aggressive behavior on behalf of a distressed other person in a controlled setting. In both studies, the roles of vasopressin and oxytocin in empathy-linked aggression were examined indirectly by way of individual differences in receptor genes for these neurohormones. Specifically, we examined three genetic variants thought to increase the effects of oxytocin and vasopressin and previously shown to predict prosocial behavior: the *AVPR1a* variants rs1 and rs3 (long vs. short genotypes) and the *OXTR* variant rs53576 (GG genotype vs. other).

In addition to empathy and vasopressin/oxytocin receptor genes, both studies also examined the role of the empathy target's distress in predicting aggression. We expected that empathy would only lead to aggression on behalf of clearly distressed targets for two reasons. First, the caregiving system is specifically responsive to distress cues from vulnerable others (Goetz et al., 2010; Preston, 2013). Second, the effects of empathy on aggression should be specific to aggression designed to benefit the empathy target. If the empathy target is not in need of assistance—that is, distressed—aggression should not occur. Examining the effects of empathy in the context of both distressed and non-distressed empathy targets allowed us to test these predictions.

Our primary hypothesis was that manipulated or assessed empathy would predict aggression on behalf of a distressed, but not a non-distressed, empathy target. In addition, our tentative prediction was that empathy's role in predicting aggression for distressed empathy targets would be greater for longer versus shorter genotypes of *AVPR1a* rs1 and rs3 as well as for GG versus other genotypes of *OXTR* rs53576.

Study 1

Method

Participants. Undergraduates ($N = 69$; 35 women, 31 men, 3 declined to answer; age: $M = 19.69$ years) in the introductory psychology subject pool at the State University of New York (SUNY) Buffalo were recruited for this study. Participants' ethnic composition was 1 African or African American, 12 Asian or Asian American, 51 European or European American, 6 Hispanic, 1 Arab or Arab American, and 1 Native American, with 3 individuals being of mixed race/ethnicity. Participating young adults were compensated with research credit for their course research requirement.

Procedure. Students signed up online for a two-part study with the first part consisting of saliva donation in the laboratory and the second part consisting of an online survey. In the first session, all participants completed informed consent materials and then donated their saliva sample for DNA

extraction via Oragene DNA collection kits (http://www. dnagenotek.com). In the survey, participants were asked to write and answer questions about a time in the past 12 months when they witnessed a close other (friend, family member, significant other, child) being hurt physically or emotionally by a third party other than themselves. Participants were instructed to think of only one such event and to refer to this one event for all subsequent questions. All participants were able to recall such an event. Participants were then fully debriefed and thanked for their participation.

Measures

Empathy. Participants rated to what degree they felt emotions associated with empathy, specifically empathic concern, when witnessing the conflict (Batson et al., 1997; Batson, Shaw, & Oleson, 1992). Specifically, participants rated to what degree they felt "compassionate," "softhearted," "sympathetic," "moved," "tender," or "warm" toward their close other at the time of the close other's conflict (1 = "not at all"; 7 = "extremely"), with the mean of these items used as an index of empathy (α = .88).

Aggression. Participants indicated whether they confronted the other party physically, verbally, or by other means in the conflict via three dichotomous items: "When this conflict was going on, did you confront the other person (i.e., the person who was in conflict with the person you cared about) using *physical force*?" and "When this conflict was going on, did you confront the other person (i.e., the person who was in conflict with the person you cared about) *verbally*?" as well as "When this conflict was going on, did you confront the other person (i.e., the person who was in conflict with the person you cared about) *by other means*?" A composite score was created reflecting the total number of physical and verbal confrontation, and confrontation by other means (range = 0-3). A score of 0 reflected that the individual did not intervene.

Close other's distress. Participants rated perceived distress of the close other by indicating to what degree they felt their close other was emotionally harmed by the conflict with the item, "To what extent do you think this conflict was emotionally harmful to the person you cared about?" (1 = "not at all"; 7 = "extremely"), which served as the measure of how much they perceived their close other as in distress.

AVPR1a *and* OXTR *variables*. DNA from participants' saliva samples was examined for two variants in the gene for the 1a vasopressin receptor (*AVPR1a*) and one variant in the gene for the oxytocin receptor (*OXTR*). Details of the genetic analysis are available via supplementary materials (http://pspb.sagepub.com/supplemental). The *AVPR1a* polymorphisms investigated (rs1 and rs3) were regions of DNA in which a section of nucleobases repeats multiple times, with the number of repetitions varying among

individuals. Following prior research (Knafo et al., 2008; Poulin et al., 2012), the number of repetitions for each polymorphism was dichotomized at the median to categorize variants as "long" or "short." Because all individuals have a version, or *allele*, from each parent, individual genotypes can be long/long, short/long, and short/short. This information was used to create an ordinal variable representing the number of "long" alleles (0-2) each individual possessed, consistent with analyses in previous research (Poulin et al., 2012).

The *OXTR* variant (rs53576) is a single-nucleotide polymorphism (SNP) consisting of a locus in the genetic code at which either the nucleobase adenine (A) or guanine (G) may be present. Because every individual receives one allele from each parent, this results in three possible genotypes: AA, AG, or GG. After these genotypes were identified (see supplementary materials), a dichotomous variable was created for our analyses representing *OXTR* rs53576 GG status (AA/AG = 1, GG = 0). This procedure of contrasting GG with AA/AG status parallels what has been done in previous research (Kogan et al., 2011; Rodrigues et al., 2009).

Control variables. In addition to the primary variables of interest, we also assessed several variables for the purpose of ruling out alternate explanations for our findings. We assessed how much subjects personally felt emotionally harmed by the close other's conflict situation, using an item similar to that used to assess the close other's degree of distress. In addition, the kind of relationship to the close other was assessed (e.g., same-sex friend, parent, romantic partner) as well as the sex and age of the close other. We also assessed trait aggression with the Buss–Perry Aggression Questionnaire (Buss & Perry, 1992) and impulsiveness with the 16-item version of the Barratt Impulsiveness Scale (Patton, Stanford, & Barratt, 1995). In addition, to measure the degree of participants' perceived overlap between their own self-concept and that of the close other, participants completed the Inclusion of the Other in the Self (IOS) scale (Aron, Aron, & Smollan, 1992). The IOS scale consists of a set of seven numbered pictures depicting increasing literal overlap between two circles, one labeled "self" and the other labeled "other" (1 = *no overlap between self and other*; 7 = *nearly complete overlap*).

Results

Descriptive statistics

Confrontation. A total of 26 participants reported confronting their close other's perpetrator in one or more of the three possible ways: physical (*n* = 3), verbal (*n* = 14), by other means (*n* = 4), both physical and verbal (*n* = 4), or both verbal and other (*n* = 1).[1] There were no bivariate associations of the composite variable representing confrontation with other key study variables (see Table 1). Confrontation also was uncorrelated with gender (coded female = 0, male = 1),

Table 1. Study 1: Descriptive Statistics and Correlations for Key Study Variables.

Variable	N	M (SD)	Range[a]	Correlations						
				1	2	3	4	5	6	7
1. Confrontation	69	1.15 (0.21)	0-3	1.00						
2. Trait aggression	69	3.38 (1.29)	1-7	.06	1.00					
3. Closeness to perpetrator	69	2.75 (2.02)	1-7	.06	.06	1.00				
4. Closeness to victim	69	5.42 (1.53)	1-7	.05	−.29*	.19	1.00			
5. Impulsivity	69	3.49 (0.84)	1-7	.04	.38**	.03	−.26*	1.00		
6. Threat to self	69	3.93 (2.02)	1-7	−.01	.10	.25*	.29*	−.20*	1.00	
7. Threat to close other	69	5.43 (1.66)	1-7	−.18	.13	.04	.01	−.15	.65***	1.00
8. Empathy	69	3.60 (1.44)	1-7		.02	.03	.05	−.12	.20	.23

[a]Mean of verbal confrontation and physical confrontation, as well as confrontation by other means.
*p < .05. **p < .01. ***p < .001.

Table 2. Study 1: Distribution of *AVPR1a* and *OXTR* Genotypes.

	AVPR1a polymorphisms		OXTR polymorphism	
	rs1 variant	rs3 variant		rs53576 variant
Genotype	Frequency	Frequency	Genotype	Frequency
Short/short	20 (28.99%)	33 (47.83%)	AA	1 (1.96%)
Short/long	31 (44.93%)	23 (33.33%)	AG	15 (29.40%)
Long/long	18 (26.09%)	13 (18.84%)	GG	35 (68.63%)
Total	69	69	Total	51[a]

[a]Numbers refer to European American Participants only. In addition, it was not possible to extract sufficient DNA from one participant's saliva sample to perform the analysis.

indicating that men and women did not tend to recall using different amounts of aggression, rs(26) < −.13, ps = .29.

AVPR1a and OXTR polymorphisms. The genotyping of *AVPR1a* rs1 revealed a range of repeat values from 300 to 325 repeats. A median split between 305 and 309 was performed to distinguish short from long alleles. Genotyping of *AVPR1a* rs3 yielded a range of repeat values from 319 to 348 repeats. A median split between 332 and 334 repeats was used to discern between short and long alleles. Prior research suggests that the function of *OXTR* rs53576 may be specific to Caucasian populations (Kim et al., 2010; Poulin et al., 2012). For this reason, only European American participants (n = 51) were included in analyses that included this variant (see Table 2).

All polymorphisms examined were in Hardy–Weinberg equilibrium, and there were no significant gender differences in genotype. The oxytocin and vasopressin polymorphisms in this study were uncorrelated, rs(69) < −.07, ps > .39. The vasopressin polymorphisms were marginally correlated in this study, r(69) = .22, p = .07.

Associations between empathy and aggression. We predicted that empathy for a distressed close other in need of assistance

(with distress measured as perceptions of perceived emotional harm to the close other) would be associated with aggression against the perpetrator that endangered the close other. To test this prediction, a standardized regression with aggression toward the perpetrator (physical, verbal, or by other means) as the dependent variable and three different independent variables—empathy, perceived distress of the close other, and their interaction—was conducted (see Table 3; Model I). Results revealed a significant two-way interaction between distress of the close other and empathy, B = 0.43, 95% confidence interval (CI) = [−0.28, −0.19], β = .43, p < .001. Simple slopes analyses with recentered interaction terms (distress recoded so that 0 fell at 1 SD above or below the mean) and all variables standardized revealed that when the close other was perceived as highly distressed, empathy marginally predicted *higher* likelihood of aggression on behalf of the close other, B = 0.06, 95% CI = [−0.01, 0.14], β = .28, p = .09; but when the close other was perceived as low in distress, empathy significantly predicted lesser likelihood to aggress against the close other's perpetrator, B = −0.12, 95% CI = [−0.18, −0.06], β = −.54, p < .001.

Associations of AVPR1a and OXTR genes with empathy and distress. We also predicted that the two-way interaction

Table 3. Study 1: Regression Models Predicting Confrontation of Close Other's Perpetrator.

Variable	Model I[a] B (95% CI)	β	Model II[b] B (95% CI)	β	Model III[c] B (95% CI)	β	Model IV[d] B (95% CI)	β
Distress	0.04 [−0.19, 0.26]	.04	0.02 [−0.14, 0.17]	.03	0.003 [−0.14, 0.15]	.01	−0.22 [−0.50, 0.06]	−.22
Empathy	−0.13 [−0.37, 0.10]	−.13	−0.12 [−0.29, 0.05]	−.18	−0.04 [−0.21, 0.12]	−.06	0.05 [−0.29, 0.40]	.05
AVPR1a rs1			−0.01 [−0.18, 0.15]	−.02				
AVPR1a rs3					−0.09 [−0.27, 0.09]	−.14		
OXTR rs53576							−0.18 [−0.79, 0.43]	−.08
Distress × Empathy	0.43 [0.21, 0.66]	.43***	0.27 [0.12, 0.42]	.43**	0.31 [0.17, 0.46]	.49***	0.62 [0.34, 0.90]	.63***
rs1 × Distress			−0.03 [−0.17, 0.11]	−.05				
rs1 × Empathy			0.03 [−0.12, 0.18]	.05				
rs1 × Distress × Empathy			0.04 [−0.10, 0.18]	.07				
rs3 × Distress					−0.04 [−0.18, 0.09]	−.08		
rs3 × Empathy					0.21 [0.04, 0.39]	.35*		
rs53576 × Distress							0.60 [0.01, 1.19]	.32*
rs53576 × Empathy							−0.24 [0.87, 0.40]	−.13
rs3 × Distress × Empathy					0.14 [0.004, 0.27]	.26*		
rs53576 × Distress × Empathy							−0.93 [−1.71, −0.16]	−.39*

Note. All variables are standardized in these models. Distress and Empathy were recentered for the purpose of calculating interactions in all subsequent models.
[a] $n = 69$, adjusted $R^2 = .17$, $p < .01$; $F(3, 65) = 5.77$.
[b] $n = 65$, adjusted $R^2 = .15$, $p = .02$; $F(7, 57) = 2.64$.
[c] $n = 65$, adjusted $R^2 = .25$, $p = .001$; $F(7, 57) = 4.05$.
[d] $n = 51$, adjusted $R^2 = .35$, $p < .01$; $F(7, 43) = 4.80$.
*$p < .05$. **$p < .01$. ***$p < .001$.

between empathy (empathic concern) and distress would be stronger for individuals with long versus short alleles of *AVPR1a* rs1 and r3 and also that the empathy–distress interaction would be stronger for individuals with the GG genotype of *OXTR* rs53576 than for individuals with the AA or AG genotypes. Separate models tested the inclusion of each of these three variants as a moderator, with each model including empathy, distress, the genetic variant, all three two-way product–term interactions among those variables, and the three-way product–term interaction. Results of these regression models can be seen in Table 3.

Examination of the hypothesized three-way interactions for individuals ($N = 69$) with the vasopressin receptor genotype *AVPR1a* variants rs1 and rs3 (Vasopressin receptor variant × Empathy × Distress) revealed no significant interaction for rs1 (see Table 3, Model II), but a significant three-way interaction for rs3's number (0-2) of long alleles, $B = 0.14$, 95% CI = [0.004, 0.27], β = .26, $p = .04$; see Table 3, Model III.[2] This three-way interaction for rs3 was probed in three different regression models in which each of the three different genotypes in turn was examined as the reference category (i.e., 0) of a dummy-coded variable. These analyses produced a significant distress by empathy interaction for those with the long/long genotype, $B = 0.82$, 95% CI = [0.44, 1.21], β = .81, $p < .001$, or the short/long genotype $B = 0.53$, 95% CI = [0.30, 0.76], β = .52, $p < .001$, but not for those with the short/short genotype, $B = 0.24$, 95% CI = [−0.07, 0.55], β = .23, $p = .13$. These patterns can be viewed in Figures 1a, 1b, and 1c. Simple slope tests revealed that for long/long individuals, empathy significantly predicted higher aggression on behalf of a close other perceived as highly distressed, $B = 1.27$, 95% CI = [0.52, 2.04], β = 1.22, $p = .001$, and less aggression on behalf of a close other who was low in distress, $B = −0.38$, 95% CI = [−0.86, 0.10], β = −.36, $p = .12$. Similarly, for those with the short/long genotype, empathy predicted significantly higher aggression for a close other high in distress, $B = 0.56$, 95% CI = [0.17, 0.95], β = .54, $p < .01$, but less aggression on behalf of a close other low in distress, $B = −0.50$, 95% CI = [−0.80, −0.20], β = −.48, $p < .01$. By contrast, among individuals of the short/short genotype, empathy predicted less aggression on behalf of a close other either high in distress, $B = −0.15$, 95% CI = [−0.60, 0.30], β = −.14, $p = .51$, or low in distress, $B = −0.62$, 95% CI = [−1.05, −0.19], β = −.59, $p < .01$.
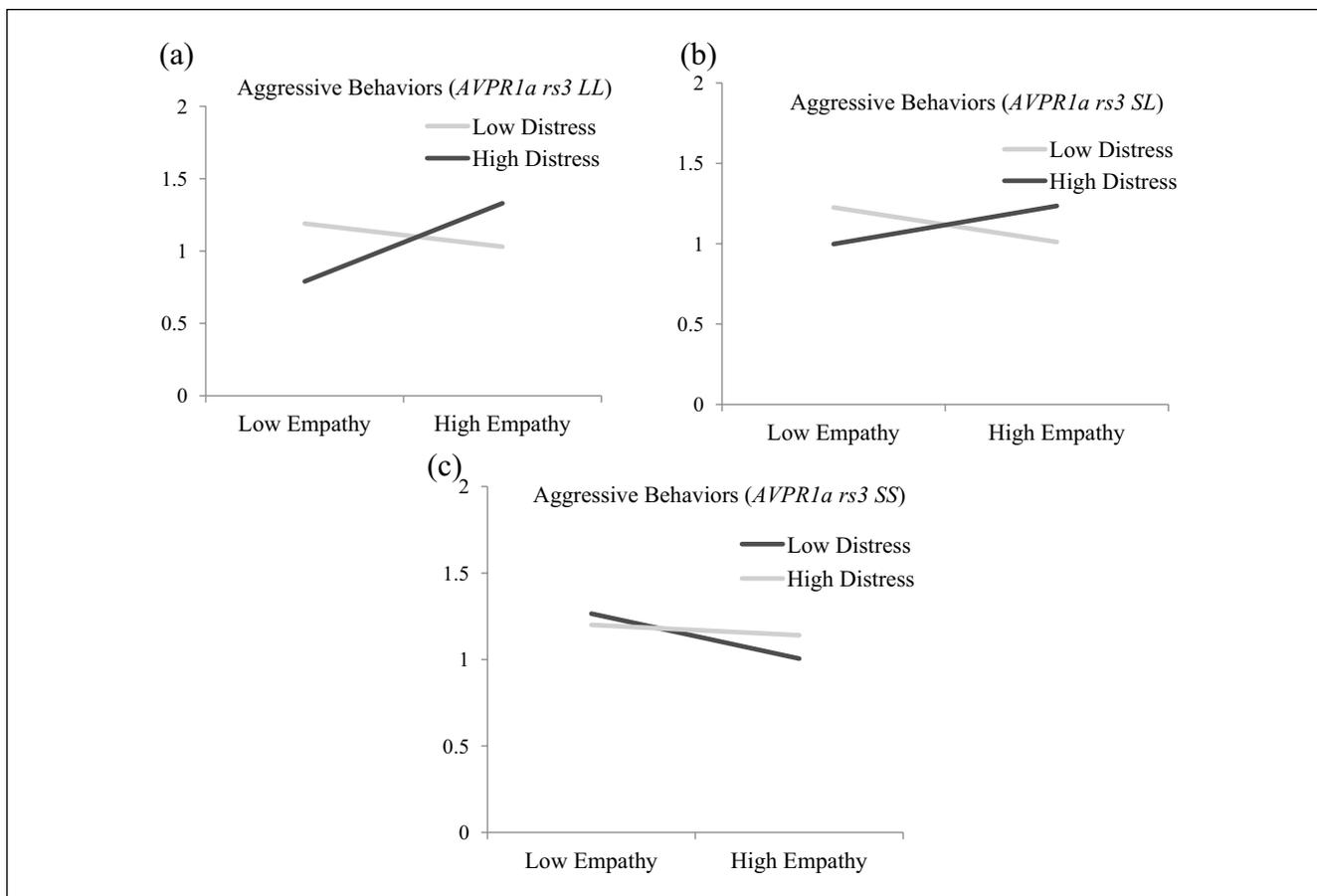
Figure 1. Study 1: Graphs of empathy by distress predicting confrontation of the close other's perpetrator separately for individuals with the (a) long/long genotype versus (b, c) any short genotype of *AVPR1a* rs3.
Note. Low and high values of distress are one *SD* below the mean and one *SD* above the mean, respectively. Confrontation is an index of physical, verbal, and other confrontation (range = 0-3).

In addition to the three-way interaction, there was a separate significant two-way interaction between rs3 genotype and empathy, $B = 0.21$, 95% CI = [0.04, 0.39], $\beta = .35$, $p = .02$. Simple slope tests indicated that for individuals with the short/short genotype, empathy predicted decreased aggression, $B = -0.26$, 95% CI = [−0.47, −0.04], $\beta = −.38$, $p = .02$, while there was no such association among those with the short/long genotype, $B = -0.09$, 95% CI = [−0.37, 0.19], $\beta = −.14$, $p = .50$, and a non-significant trend for empathy to predict greater aggression among those with the long/long genotype, $B = 0.41$, 95% CI = [−0.10, 0.92], $\beta = .60$, $p = .11$.

The proposed three-way interaction between the dichotomous version of the oxytocin receptor gene (AA and AG = 0, GG = 1), distress, and empathy (*OXTR* × Distress × Empathy) was significant, $B = -0.93$, 95% CI = [−1.71, −0.16], $\beta = −.39$, $p = .02$ (see Table 3, Model IV). Probing of the interaction was done by examining the predicted two-way interaction of empathy with distress with all variables standardized and the oxytocin variable coded in separate analyses with either AA/AG or GG set equal to 0. Results demonstrated

that the effect of the distress by empathy interaction was significant for individuals with the GG genotype of *OXTR*, $B = 0.62$, 95% CI = [0.34, 0.90], $\beta = .63$, $p < .001$, but that there was no such significant interaction for those with the AA or AG genotypes, $B = − 0.41$, 95% CI = [−1.05, 0.22], $\beta = −.42$, $p = .20$. This pattern is illustrated in Figures 2a and 2b. Simple slopes analyses revealed that for those with the GG genotype of *OXTR*, empathy predicted *higher* likelihood of aggression on behalf of a close other high in distress, $B = 0.68$, 95% CI = [0.15, 1.20], $\beta = .63$, $p = 0.01$, but lower aggression on behalf of a close other low in distress, $B = −0.57$, 95% CI = [−0.91, 0.23], $\beta = −.53$, $p < .01$.

In addition to the three-way interaction, there was a separate significant two-way interaction between rs53576 genotype and the close other's distress, $B = 0.60$, 95% CI = [0.01, 1.19], $\beta = .32$, $p = .045$. Simple slope tests indicated that for individuals with the AA/AG genotype, there was a non-significant trend for distress to predict increased aggression, $B = 0.22$, 95% CI = [−0.11, 0.55], $\beta = .36$, $p = .18$, while among those with the GG genotype, there was a non-significant
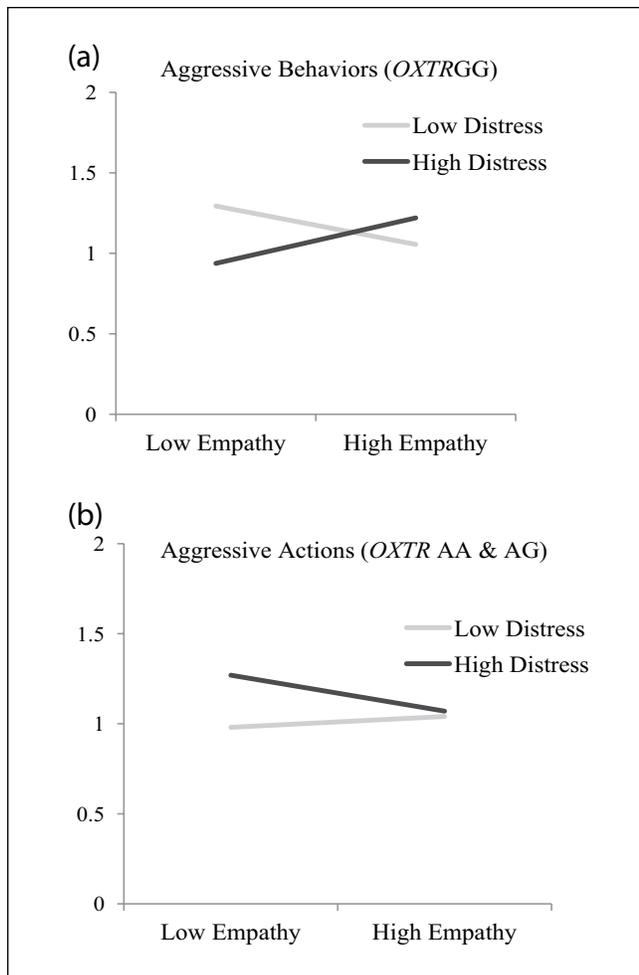
Figure 2. Study 1: Graphs of empathy by distress predicting confrontation of the close other's perpetrator separately for European American individuals with the (a) GG or (b) AA/AG genotypes of *OXTR* rs53576.
Note. Low and high values of distress are one *SD* below the mean and one *SD* above the mean, respectively. Confrontation is an index of physical, verbal, and other confrontation (range = 0-3).

trend for distress to predict decreased aggression, $B = -0.13$, 95% CI = [−0.31, 0.05], β = −.21, *p* = .14.

Gender effects. Given that there are frequently gender differences in patterns of aggression (for a review, see Archer, 2009) and in the effects of oxytocin and vasopressin (e.g., Carter, 1998; Hoge et al., 2014), we examined whether our effects would differ by gender. Looking at the analyses for men and women separately, we found that the two-way interaction between distress of the close other and empathy appeared to be greater for women, $B = 0.46$, 95% CI = [0.05, 0.87], β = .38, *p* = .03, than for men, $B = 0.17$, 95% CI = [−0.19, 0.52], β = .19, *p* = .34. The effects of empathy did not appear to be confounded by gender differences: The Empathy × Distress interaction remained significant when gender and two-way interactions between gender and distress and

gender and empathy were added into the model, $B = 0.33$, 95% CI = [0.07, 0.62], *t*(65) = 2.55, *p* = .01.

The three-way interaction with *AVPR1a* rs3 appeared to be greater among females, $B = 0.52$, 95% CI = [−0.12, 1.16], β =.43, *p* = .11, than among males, $B = 0.07$, 95% CI = [−0.52, 0.67], β =.09, *p* = .80. Similarly, the three-way interaction with *OXTR* rs53576 appeared to be greater among females, $B = -1.00$, 95% CI = [−2.26, 0.26], β = −.39, *p* = .11, than among males, $B = -0.39$, 95% CI = [−2.09, 1.30], β = −.21, *p* = .63. The role of genotype did not appear to be confounded by gender differences: There was no Gender × Empathy × Distress interaction (*p* = .41).

Follow-up analyses. A series of follow-up analyses tested alternate explanations for our findings. First, we tested whether trait aggression and impulsivity—two factors associated with aggressive acts—or self–other overlap—a potential correlate of empathy—would account for the observed associations between empathy and aggression. None of these variables was a significant predictor of aggression, and also did not moderate our findings as no two- or three-way interactions with these variables were significant.

Next, we examined the possibility that high levels of both empathy and aggression were merely due to high levels of threat by entering participants' own feelings of being threatened as a covariate. All models were unaffected when this variable was entered, and it also did not moderate any of our results. Last, gender, kind of relationship, or age of the close other experiencing the conflict that participants reported on similarly did not affect any of the results when entered into any of the regression models as covariates. In addition, these variables did not moderate our findings as no two- or three-way interactions with these variables were significant.

Discussion

Consistent with our hypotheses about the caregiving system motivating aggression, it was empathy, and not trait aggression or perceptions of emotional threat toward the self, that predicted aggression in our study. This pattern of findings suggests that the reported aggression was situation-specific and directed toward helping a relationship partner and not a function of hostility (cf. Keller & Pfattheicher, 2013). As predicted, empathy predicted aggression on behalf of a close other if the close other was perceived to be distressed—and thus a reasonable target of empathy—but not if the close other was not perceived to be distressed.

In addition, empathy predicted less aggression on behalf of a distressed close other in need among individuals with the short/short version of the *AVPR1a* rs3 genetic variant, but predicted higher aggression on behalf of a distressed, vulnerable close other among those with at least one long version of this variant. Similarly, the combination of target distress and empathy significantly predicted increased empathy-linked aggression for individuals with the GG genotype of *OXTR*

rs53576, but reduced aggression for those with the AG or AA genotypes. Together, these results suggest that empathy may have predicted aggression due to its effects on vasopressin and oxytocin.

Study 1 provided evidence of empathy-linked aggression in the real world, which was consistent with our predictions. However, several features of this study limit our ability to draw firm conclusions about this phenomenon. First, the correlational design of Study 1 prevents drawing of conclusions about causality. In addition, Study 1's reliance on retrospective self-reports makes the accuracy and predictive validity of such data unclear. Moreover, given that the conflicts reported in Study 1 were those of a close other, we cannot say whether empathy could facilitate aggression beyond the realm of pre-existing close relationships. Finally, we cannot rule out the possibility that empathic anger explains the phenomenon of empathy-linked aggression. Together, these limitations suggested the need for additional research. Study 2 used an experimental design with assessed laboratory aggression to rule out potential biases of self-report and to establish causality. The study's core design was a scenario in which the third party was a stranger, as was the empathy target, but was not a wrongdoer, reducing the likelihood of empathic anger and allowing a test of whether empathy-linked aggression generalizes beyond close relationships.

Study 2

Method

Participants. Introductory psychology subject pool participants at SUNY Buffalo ($N = 162$; gender: 105 women, 57 men; age: $M = 19.18$ years) were recruited for this study. The ethnic composition of the sample was 25 African or African American, 17 Asian or Asian American, 112 European or European American, 6 Hispanic, 1 Arab American, and 1 Native American. All participants were compensated with course credit.

Procedure and measures. Participants were told that they would assist with two studies: first, a study on individual differences in social behavior, for which they would provide a saliva sample for DNA extraction; and second, a study on whether different personality constructs would moderate the usually hindering effects of pain on cognitive performance. For the second study, participants were informed that their role would be to rate the personality of one of a pair of other participants, supposedly seated in one of our laboratory's additional lab rooms, based on an essay that the individual had written. These participants, who were actually fictional, were described as strangers to each other. Actual participants were further told that one of the pretend participants in this pair would be exposed to a painful but harmless stimulus, hot sauce (a non-reactive measure of aggression; Lieberman, Solomon, Greenberg, & McGregor, 1999), and then compete

in a math test. To motivate the (fictional) competitors, so participants were further led to believe, the winner would win US$20 and the loser would win nothing. To make it clear to participants that the hot sauce consumed would inflict pain on the participant, participants were told that the study investigated "the effects of physical pain on performance," that the hot sauce was used as the "painful stimulus," and that we were "using hot sauce as the source of participants' pain."

Empathy manipulation. After donating the saliva sample, participants completed a short demographic questionnaire and some filler questionnaires. Immediately following the completion of these items, participants were instructed to read a short essay by one of the (fictional) math-test participants (referred to hereafter as the "empathy target"). The instructions the actual participants received were modeled after Batson and colleagues (Batson et al., 1997) and comprised the empathy manipulation, with one randomly assigned set of participants being asked to pay attention to *how the person feels* rather than all of the information presented (the *high empathy* condition), whereas the other set of participants were asked to remain objective and pay attention only to the *facts* presented (the *low empathy* condition).

Distress manipulation. The content of the empathy target's essay comprised the distress manipulation. All participants read this essay, which described a series of the empathy target's financial setbacks, including the need to pay for course registration and to replace a totaled car. However, one (randomly assigned) half of the participants read a version of the essay that concluded with the empathy target expressing high distress over their financial need (i.e., "I've never been this low on funds and it really scares me, to be honest. What if I need to pay for something else I didn't expect?"), whereas the remainder of the participants read a version in which the empathy target expressed low distress over their financial need ("I've never been this low on funds, but it doesn't really bother me. I'm pretty sure things will get better soon, plus at least I have a new car").

Hot sauce assignment (aggression). Next, participants were given the opportunity to aggress against the empathy target's math-test competitor by assigning hot sauce to the competitor. To prevent hypothesis guessing, a further part of the presented cover story led participants to believe that the researchers were interested in examining math performance across different amounts of a painful stimulus, and for that reason, the amount of hot sauce the (fictional) math-test participants would receive was variable. Participants were told that to "assure random assignment" to hot sauce amounts, the researchers were asking the participants to assign hot sauce to the competitor in the dyad about whom they had not received any prior information. Participants were further told that the study participants were supposedly participating in measured the effects of *pain on performance*, that hot sauce served as

Table 4. Study 2: Distribution of *AVPR1a* and *OXTR* Genotypes.

| | *AVPR1a* polymorphisms | | | *OXTR* polymorphism | |
| | rs1 variant | rs3 variant | | | rs53576 variant |
Genotype	Frequency	Frequency	Genotype		Frequency
Short/short	14 (12.84%)	35 (26.12%)	AA		9 (8.65%)
Short/long	76 (69.72%)	84 (62.69%)	AG		47 (45.19%)
Long/long	19 (11.19%)	15 (11.12%)	GG		48 (46.15%)
Total	109	134	Total		104[a]

[a]Numbers reflect European American individuals only.

the *painful stimulus*, and that we expected the stimulus to be sufficiently painful to hinder performance. Following a procedure similar to that of McDermott, Tingley, Cowden, Frazzetto, and Johnson (2009), participants were asked to select an amount of hot sauce for the empathy target's competitor on a 6-point scale ranging from *no hot sauce* to *three teaspoons (one tablespoon) in half-teaspoon increments*.

Suspicion probe. Finally, participants were carefully probed for suspicion via two questions: "Could you please tell me in your own words what this study was about?" and "Did anything about this study seem odd or out of place to you?" Participants were counted as suspicious if they did not believe that there was another set of participants or if they stated that the study measured aggressing on behalf of the empathy target. Participants were then thoroughly debriefed, thanked for their participation, and dismissed.

AVPR1a and OXTR *variables*. DNA from saliva samples was analyzed for genetic data using procedures identical to those used in Study 1 for *AVPR1a* rs1 and rs3 and for *OXTR* rs53576. Also as in Study 1, ordinal variables were created for *AVPR1a* rs1 and rs3 representing the number of alleles classified as "long" (0-2) according to a median split. However, examining these data revealed that relatively few individuals were of the long/long genotype of rs3 (*n* = 15), so individuals with any long allele (long/long and short/long) were grouped together and a dichotomous variable contrasted these individuals with those with only short alleles. In addition, a dichotomous variable was created for *OXTR* rs53576 representing GG status (AA/AG = 1, GG = 0).

Additional measures. Participants rated the empathy target on likeability and a variety of personality items to keep consistent with the cover story.

Results

Descriptive statistics
Suspicion. A total of 12 participants were suspicious. Excluding these participants from the analyses did not alter

our results for any model except the three-way interaction with oxytocin. Here, the three-way interaction only reached marginal significance after excluding suspicious participants (*p* = .06).

Hot sauce assignment. The mean of the hot sauce assigned was 4.17 on the 6-point scale, corresponding to approximately 1.5 teaspoons of hot sauce assigned on average.

AVPR1a *and* **OXTR** *polymorphisms*. Genotyping of *AVPR1a* rs1 resulted in a range of repeats from 297 to 337 repeats. A median split at 317 repeats was used to distinguish long from short alleles, and 134 individuals provided a saliva sample large enough for DNA extraction. The genotyping of *AVPR1a* rs3 yielded a range of repeat values from 326 to 352 repeats. A median split between 334 and 336 repeats was used to discern between short and long alleles. Analyses of the *OXTR* SNP (rs53576) revealed that within the group of European Americans (*n* = 112), 104 individuals provided enough saliva for their genotype to be identified (see Table 4). All polymorphisms examined were in Hardy–Weinberg equilibrium, and there were no significant gender differences in genotype. In this study, all of the oxytocin and vasopressin polymorphisms were uncorrelated, rs(162) < .10, *p*s > .27.

Associations between empathy and aggression. A two-way ANOVA tested the hypothesis that empathy and distress would interact such that participants induced to feel empathy would assign more hot sauce to the competitor when the empathy target was described as being highly distressed over his or her financial need but not when the empathy target was described as not being very distressed over his or her financial need.

The Distress × Empathy interaction was significant, $F(3, 158) = 14.62$, *p* < .001 (see Table 5; Model I). Probing via *t* tests showed that empathy led to aggression when the empathy target self-described as being highly distressed $t(161) = 3.57$, *p* < .001, such that those in the empathy condition allocated significantly *more* hot sauce to the competitor (*M* = 4.70, *SD* = 1.67) than did those in the objective condition (*M* = 3.27, *SD* = 1.81); mean difference between groups:

Table 5. Study 2: ANOVA Models for Hot Sauce Assignment Predicted by Empathy, Distress, and Genotype.

Variable	Model I[a]	Model II[b]	Model III[c]	Model IV[d]
	F	F	F	F
Empathy	3.35	1.18	2.71	2.73
Distress	12.03***	0.02	14.84***	1.31
AVPR1a rs1		2.12		
AVPR1a rs3			0.05	
OXTR rs53576				2.41
Empathy × Distress	14.62***	3.82	16.86***	0.05
rs1 × Empathy		0.57		
rs1 × Distress		3.71*		
rs1 Empathy × Distress		1.67		
rs3 × Empathy			0.04	
rs3 × Distress			3.08	
rs3 × Empathy × Distress			4.86*	
rs53576 × Empathy				8.75**
rs53576 × Distress				0.75
rs53576 × Empathy × *Distress*				5.10*

[a]$n = 162$; $F(3, 158) = 5.69$, $p = .001$.
[b]$n = 109$; $F(11, 97) = 2.35$, $p = .01$.
[c]$n = 134$; $F(7, 126) = 3.34$, $p < .01$.
[d]$n = 104$; $F(7, 96) = 3.15$, $p < .01$.
*$p < .05$. **$p < .01$. ***$p < .001$.

1.41, 95% CI = [0.63, 2.20]. However, when the target self-described as not being too distressed over their financial situation, empathy ($M = 3.91$, $SD = 1.74$) led to marginally *less* aggression, $t(161) = -1.83$, $p = .07$, compared with remaining objective ($M = 4.64$, $SD = 1.91$); mean difference between groups: -0.74, 95% CI = [-1.53, 0.05]. Together, these results support our prediction that the interactive effect of target distress and observer empathy leads to aggression.

Interactions of AVPR1a *and* OXTR *genes, empathy, and distress.* As in Study 1, we predicted that the two-way interaction between empathy and target distress would be stronger for individuals with more long versus short alleles of *AVPR1a* rs1 and r3, and that the empathy by target distress interaction would be stronger for individuals with the GG genotype of *OXTR* rs53576 than for individuals with the AA or AG genotypes. To test these predictions, each polymorphism was entered into an ANOVA predicting amount of hot sauce assigned along with empathy, distress, all three two-way product–term interactions, and the three-way (Genotype × Empathy × Distress) product–term interaction. Thus, three three-way ANOVAs (one for each polymorphism) were tested.

Examination of the hypothesized interactions for *AVPR1a* rs1 and rs3 revealed again no significant hypothesized interaction for rs1. However, there was a significant two-way interaction between rs1 genotype and target distress, $F(1, 108) = 3.71$, $p = .03$ (see Table 5, Model II). Simple contrast tests indicated that for individuals with the short/short or short/long genotypes, high target distress led to lower levels of aggression ($M = 3.60$, $SD = 1.62$) compared with low distress ($M = 4.51$, $SD = 1.79$), $t(108) = -2.16$, $p = .03$; mean difference between groups: -0.77, 95% CI = [-1.49, -0.06]. However, for individuals with the long/long genotype, high target distress caused greater aggression ($M = 4.30$, $SD = 2.31$) compared with low distress ($M = 2.67$, $SD = 1.41$), $t(108) = 2.01$, $p = .047$; mean difference between groups: 1.71, 95% CI = [0.02, 3.39].

In addition, the hypothesized Genotype × Empathy × Distress three-way interaction emerged for rs3, $F(7, 126) = 4.86$, $p = .03$ (see Table 5, Model III). Simple contrast analyses revealed a significant Empathy × Distress interaction for individuals with any long version of the gene, $F(1, 126) = 16.86$, $p < .001$, but no significant interaction for those with the short version of the gene—that is, those of the short/short genotype: $F(1, 126) = 0.02$, $p = .90$. This pattern can be viewed in Figures 3a and 3b. Specifically, among those with any long alleles, when the target self-described as highly distressed, empathy led to greater ($M = 4.59$, $SD = 1.57$) hot sauce assignment on behalf of the target, $t(133) = 4.21$, $p < .001$, than did remaining objective ($M = 3.13$, $SD = 1.77$); mean difference between groups: 2.04, 95% CI = [1.08, 3.00]. By contrast, when the target self-described as low on distress, empathy ($M = 2.67$, $SD = 1.15$) marginally led to *less* aggression against the competitor, $t(133) = -1.64$, $p = .10$, compared with remaining objective ($M = 5.50$, $SD = 1.87$); mean difference between groups: -0.85, 95% CI = [-1.86, 0.15].
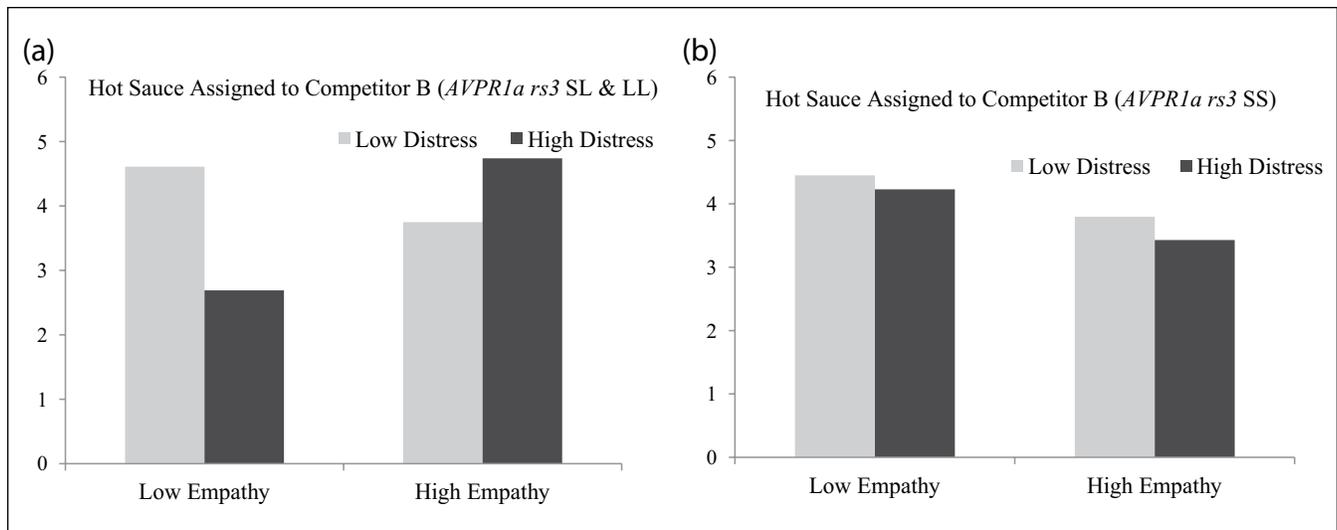
Figure 3. Study 2: Graphs of empathy by distress predicting assignment of hot sauce (original range = 0-6) separately for individuals with (a) any long genotype versus those with the (b) short/short genotype for *AVPR1a* rs3.
Note. Scores reflect estimated marginal means.

As in Study 1, the proposed three-way *OXTR* × Distress × Empathy interaction reached significance for the European Americans whose saliva contained enough DNA for analysis ($n = 104$), $F(7, 96) = 5.10$, $p = .03$ (see Table 5, Model IV). Simple contrast tests revealed that the only difference between *OXTR* rs53576 GG individuals and AA/AG individuals occurred in the low distress condition. Specifically, in the low distress condition among GG individuals, empathy ($M = 5.10$; $SD = 1.73$) trended to cause greater aggression, $t(103) = 1.65$, $p = .10$, compared with remaining objective ($M = 3.83$, $SD = 1.99$); mean difference between groups: 1.27, 95% CI = [−0.26, 2.79]. However, in the low distress condition among AA/AG individuals, empathy ($M = 3.09$, $SD = 1.64$) caused *less* aggression, $t(103) = −2.58$, $p = .01$, compared with remaining objective ($M = 4.88$, $SD = 1. 90$); mean difference between groups: −1.79, 95% CI = [−3.17, −0.42].

In addition to the three-way interaction, there was a separate significant two-way interaction between rs53576 genotype and empathy, $F(1, 103) = 8.75$, $p = .004$. Simple contrast tests indicated that for individuals with the AA/AG genotype, empathy did not cause any differences in aggression ($M = 3.90$, $SD = 1.70$) compared with remaining objective ($M = 3.91$, $SD = 2.09$), $t(103) = −0.04$, $p = .97$; mean difference between groups: −0.02, 95% CI = [−1.00, 0.96]. However, for individuals with the GG genotype, empathy did cause increased aggression ($M = 4.62$, $SD = 1.86$) compared with remaining objective ($M = 3.47$, $SD = 1.81$), $t(103) = 2.52$, $p = .01$; mean difference between groups: 1.39, 95% CI = [0.29, 2.48]. In sum, while the three-way interaction of empathy, need, and *OXTR* rs53576 genotype did not match predictions, empathy did cause greater aggression for individuals with the GG genotype versus the AA/AG genotype, regardless of need condition.

Gender effects. The Distress × Empathy interaction appeared to be greater among women, $F(3, 101) = 15.04$, $p < .00$, than among men, $F(3, 53) = 1.25$, $p = .27$. The effects of empathy did not appear to be confounded by gender differences: The Empathy × Distress interaction remained significant when gender and two-way interactions between gender and distress and gender and empathy were added into the model, $t(161) = 3.75$, $p < .001$.

The three-way interaction with *OXTR* rs53576 appeared to be present in the subgroup of females, $t(67) = −2.24$, 95% CI = [−6.88, −0.39], $p = .03$, but not in the subgroup of males, $t(35) = −0.74$, 95% CI = [−9.50, 4.47], $p = .47$. The three-way interaction with *AVPR1a* rs3, by contrast, appeared to be non-existent among females, $t(85) = −0.67$, 95% CI = [−2.42, 1.20], $p = .51$, but present among males, $t(47) = −2.94$, 95% CI = [−5.38, 1.00], $p < .01$. The role of genotype did not appear to be confounded by gender differences: There was no Gender × Empathy × Distress interaction ($p = .19$).

Discussion

To build on the correlational, retrospective data of Study 1, Study 2 used an experimental design with laboratory assessment of aggressive behaviors. Study 2 again supported our hypotheses about empathy motivating aggression. We showed that an empathy manipulation increased aggression—amounts of hot sauce assigned—against the empathy target's competitor, but only when the empathy target was described as distressed. The results from Study 2 are also noteworthy in that they demonstrate that empathy-linked aggression can occur for a stranger, not just a loved one, and that provocation by the target—or indeed, any target

characteristic—is unlikely to be the sole mechanism for empathy-linked aggression. In this study, the competitor was an innocent (bogus) participant about whom the test participant did not have any information, let alone any cause for provocation.

In the current study, we again found evidence for the role of vasopressin and oxytocin in the phenomenon of empathy-linked aggression. The distress by empathy interaction was significant specifically for individuals with long alleles of *AVPR1a* rs3. This pattern in our data is consistent with the possibility that vasopressin facilitates empathic responses, including aggression, to individuals in need. In addition, although we did not find the expected three-way interaction for *OXTR* rs53576, we did find that the effects of empathy, regardless of distress condition, were greater among *OXTR* rs53576 GG individuals than among AA/AG individuals. Although we can only speculate as to the reason why distress functioned differently in this study versus Study 1, one possibility is that the range of distress in real-life situations such as those examined in Study 1 provides more variability to detect differential effects of *OXTR*, a possibility worth examining in future research.

In sum, Study 2 provided further documentation, in the lab, of the role of empathy as a cause of aggression independent of provocation by the aggression target. In addition, this study provided further evidence that oxytocin and vasopressin may function as biological mechanisms for this effect.

General Discussion

The present research found that assessed or elicited empathy predicted aggression to benefit a distressed empathy target, and that the effect of empathy may be partially explained by the empathy-linked neurohormones vasopressin and oxytocin. Specifically, Study 1 showed that when participants reported feeling higher levels of empathy during a past episode when a close other was threatened and felt distressed, participants were more likely to report having aggressed on the close other's behalf. Study 2 conceptually replicated this pattern of results: Participants induced to be empathetic in a lab setting assigned higher levels of a painful stimulus—hot sauce—to a distressed empathy target's competitor, compared with participants instructed to remain objective. In addition, in both studies, empathy predicted aggression more strongly for *OXTR* rs53576 GG and *AVPR1a* rs3 long-allele individuals than for others. Together, this pattern of findings provides evidence that activation of the caregiving system prompts aggression toward those in conflict or competition with caregiving or empathy targets, even independent of traditional predictors of aggression such as threat to self, self–other overlap, trait aggression and impulsivity, and in the absence of wrongdoing or provocation from the target of aggression. The findings of the present work have several implications for understanding empathy and empathy-linked aggression.

The Caregiving System and Aggression

Although the idea that people aggress on behalf of others is not new at all (Batson et al., 1992; Hoffman, 1987, 1989; Lickel, Miller, Stenstrom, Denson, & Schmader, 2006; Neumann, 2000; Staub, 1978; Stotland, 1969; Vitaglione & Barnett, 2003; Weiner, 1995), we believe the idea that empathy can drive aggression absent provocation or injustice to be quite novel. We predicted that this would be the case based on the notion that empathy derives from the behavioral caregiving system (Goetz et al., 2010; Preston, 2013). This system is most frequently described as being focused on nurturing and soothing valued others, but it extends beyond these functions and emotions to include the function of protecting vulnerable others (Bell & Richard, 2000). Among non-human animals, aggression on behalf of offspring (i.e., maternal and paternal aggression) has long been studied as an integral part of the caregiving system (Gammie & Nelson, 2000; Lonstein & Gammie, 2002; Wolff, 1985). In humans, however, caregiving has been studied primarily in terms of prosocial tending to offspring or other valued individuals (Bell & Richard, 2000; Bowlby, 1969; Brown & Brown, 2006; Mikulincer, Shaver, Gillath, & Nitzberg, 2005). Our findings affirm that, for humans as well, caregiving and aggression are linked.

We had specifically predicted that the effects of empathy on aggression would be accounted for by the actions of the neurohormones vasopressin and oxytocin. Our finding that variation in vasopressin and oxytocin receptor genes moderate empathy's effects supports this prediction. More broadly, a role of these neurohormones in empathy's effects is consistent with the possibility that empathy facilitates a broad array of behaviors—whether kind or aggressive—geared toward benefiting vulnerable others (Goetz et al., 2010; Preston, 2013). These findings, combined with data from the present studies and the known associations of vasopressin and oxytocin with aggression (e.g., Bosch et al., 2005; Bosch et al., 2010; Campbell, 2010; Carter, 1998; De Dreu, 2012; Hahn-Holbrook, Holbrook, & Haselton, 2011; Hahn-Holbrook, Holt-Lunstad, et al., 2011; Mah et al., 2014; Thompson et al., 2006), make the effects of these neurohormones promising mechanisms for empathy-linked aggression.

Implications for Real-World Aggression

Prior research only found empathy to predict aggression toward an anger-arousing wrongdoer (Hoffman, 1989; Neumann, 2000; Staub, 1978; Stotland, 1969; Weiner, 1995), such as a drunk driver who injured an empathy target (Vitaglione & Barnett, 2003). Although the situations reported in Study 1 may have been likely to lead to anger or provocation, in Study 2, the competitor who received hot

sauce had neither indirectly nor directly caused the empathy targets' distress but nonetheless became the victim of aggression. If empathy can facilitate aggression independent of provocation or wrongdoing, it may do so in a broader variety of situations and toward a broader variety of targets than has previously been considered. That is, empathy could facilitate aggression any time such aggression is instrumental to helping or benefiting the empathy target, independent of whether or not such acts of aggression are just or morally sound. For example, empathy could lead an individual to blame an innocent person for a crime or misdeed to protect a friend or child from punishment. This idea, although novel, is not entirely without precedent: Batson and others have shown that empathy can promote unjust—though not aggressive—outcomes (Batson et al., 1995; Batson et al., 1992; Hoffman, 1987; Lickel et al., 2006).

In the real world, situations in which empathy works hand-in-hand with—and augments the effects of—anger in response to provocation are likely more common than empathy-linked aggression that is not fueled by angry affect. Batson and colleagues have previously suggested that people may sometimes be more motivated to aggress on behalf of others than on behalf of themselves (Batson et al., 1992). This effect may in fact be a result of empathy and may manifest in real-world phenomena ranging from playground fights to large-scale aggression. Concern over the distress and suffering of loved ones and other ingroup members may augment the desire to aggress seen in terrorists, gang members, and others (cf. Cikara, Bruneau, & Saxe, 2011).

Limitations and Future Directions

The current work has limitations that point the way to future research. First, and most notably, the functioning of the *AVPR1a* and *OXTR* variants examined is still incompletely understood. Although both are believed to affect sensitivity to their respective neurohormones—vasopressin and oxytocin (e.g., Knafo et al., 2008; Rodrigues et al., 2009)—the mechanisms for these effects and the range of implications of this increased sensitivity are unknown.

Second, in both studies, aggression was the only potential behavioral outcome assessed. It is thus not known whether or how empathy-linked aggression is associated with other forms of helping, including directly providing assistance to an empathy target. For example, it is possible that empathy-linked aggression would be less likely if aggressing against a third party were one of many different options to help. Future research should examine this and other possible boundary conditions of empathy-linked aggression.

In addition, in Study 2, we did not have participants taste the hot sauce themselves to verify its painful nature, and we did not have a statement by the third party claiming that they disliked hot foods—both common procedures in research using hot sauce as a measure of aggression. However, instructions to participants made it very clear that the (pretend) other participants were participating in a study supposedly measuring the effects of *pain on performance*, that hot sauce served as the *painful stimulus*, and that we expected performance to decrease in response to the ingestion of hot sauce. Nonetheless, future research should examine other types of aggression as potential forms of empathy-linked aggression.

Finally, in both studies, the pattern of results suggested that the effects of empathy and the role of oxytocin and (to a lesser extent) vasopressin may have been greater among females than among males, but our studies were not powered to test these gender differences. Given the sexually dimorphic roles of these neurohormones in non-human animals, researchers with interests specifically in gender differences may benefit from studies designed specifically to test the prediction that empathy may promote aggression differentially in females versus males.

In sum, the present work represents the first evidence that empathy predicts aggressive behavior on its own, even independent of provocation, and in conjunction with the empathy-linked hormones/neuropeptides oxytocin and vasopressin. These findings shed new light on the nature of empathy, as well as on predictors of aggression and violence. Our findings additionally reaffirm the view that the caregiving behavioral system functions in humans to address not only needs for nurturance and comfort, but also needs for protection. In closing, we should note that our findings also provide a note of caution given recent enthusiasm for interventions that involve administering caregiving-related neurohormones or empathy training (Bornstein, 2010). Just as the self-esteem movement was not a panacea leading to happy, successful, and well-adapted children (Baumeister, Campbell, Krueger, & Vohs, 2003), oxytocin and/or empathy interventions may not stop problems such as bullying and other forms of aggression and violence, because aggression itself may result from empathy. Whether empathy is gentle or fierce depends very much on for whom the empathy is felt.

Declaration of Conflicting Interests

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Notes

1. Due to the small number of people reporting "other" forms of aggression, we also conducted all Study 1 analyses with a dependent variable comprised just of physical and verbal aggression. The results were substantively identical (i.e., all significant results and directions of association were unchanged). In addition, to address possible violations of the assumption of heteroskedasticity given the count nature of this variable, all analyses

for Study 1 were examined using Huber–White robust standard errors (Huber, 1967; White, 1980); results were substantively identical.

2. Although many investigations of *AVPR1a* rs1 and rs3 rely on dichotomizing repeat lengths into "long" and "short," we also conducted all analyses reported in Studies 1 and 2 using the within-person mean number of repeats as a continuous variable. Results obtained using this strategy yielded the same pattern of results as reported in the studies' respective results sections.

Supplemental Material

The online supplemental material is available at http://pspb.sagepub.com/supplemental.

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Manuscript Empathy, Target Distress, and Neurohormone Genes Interact to Predict Aggression for Others—Even Without Provocation

STUDY 1[1]

To begin, we would like to ask several questions about your general traits or characteristics.
Please indicate on the scale below how much you agree or disagree with these statements.
1=strongly disagree
2=disagree
3=slightly disagree
4=neither agree nor disagree
5=slightly agree
6=agree
7=strongly agree

My friends say that I am somewhat argumentative.
At times, I feel I have gotten a raw deal out of life.
Sometimes, I fly off the handle for no good reason.
Given enough provocation, I may hit another person.
I can't help getting into arguments when people disagree with me.
I have trouble controlling my temper.
I sometimes feel that people are laughing at me behind my back.
If somebody hits me, I hit back.

How much are these statements true for you?
1=strongly disagree
2=disagree
3=slightly disagree
4=neither agree nor disagree
5=slightly agree
6=agree
7=strongly agree

I act on impulse.
I act on the spur of the moment.
I do things without thinking.
I say things without thinking.
I buy things on impulse.
I plan for job security.
I plan for the future.
I save regularly.
I plan tasks carefully.
I am a careful thinker.
I am restless at lectures or talks.

I squirm at plays or lectures.
I concentrate easily.
I don't pay attention.
I get easily bored solving thought problems.

For the next set of questions, please think about a time in the past 12 months when someone you cared about (e.g., a close friend, romantic partner, parent, sibling) had a serious conflict with another person. Examples of a serious conflict might be a one-time event (e.g., being physically assaulted, a fight with a relationship partner or other person, an instance of discrimination) or something ongoing (e.g., a bad relationship, conflict at work, being made fun of or humiliated). Please pick just one conflict experienced by someone you care about, and keep that in mind for the next group of questions.

Please describe this conflict (the one experienced by the person you cared about).

Thank you very much for describing this conflict in your own words. Now, please indicate which of the **categories** below fit the conflict you just described. Please select **all that apply** to the **one** experience you described.
Someone close to me was physically abused in a romantic relationship
 Someone close to me was emotionally abused in a romantic relationship
 Someone close to me was physically attacked or assaulted by someone other than a romantic partner
 Someone close to me was harmed emotionally (e.g., insulted, abused) by a friend or family member
 Someone close to me experienced interpersonal conflict with someone other than a friend or romantic partner (e.g., acquaintance, co-worker, roommate)
 Someone close to me experienced discrimination or prejudice or was otherwise judged unfairly
 Someone close to me was pressured or blackmailed by somebody
 Someone close to me experienced bullying or was being picked on by one or several others at their workplace.
 Someone close to me was continually insulted or mocked by others
 Other (Please Specify)

To what extent do you think the person you cared about was **physically** endangered by this conflict?
1=not at all
2=
3=
4=
5=
6=
7=extremely

To what extent do you think this conflict was **emotionally** harmful to the person you cared about?
1=not at all
2=
3=
4=
5=
6=
7=extremely

To what extent did **you** feel **physically** endangered by this conflict?
1=not at all
2=
3=
4=
5=
6=
7=extremely

To what extent was this conflict **emotionally** harmful to **you**?
1=not at all
2=
3=
4=
5=
6=
7=extremely

Please tell us a little bit about the person you cared about (i.e., the person who experienced the conflict).

How old was that person, in years?

Was that person male or female?

What was your relationship with the person who you cared about? That person was
my＿＿＿＿＿ (choose one from the list below).
Parent
 Brother
 Sister
 Close Same Sex Friend
 Close Opposite Sex Friend
 Romantic Partner
 Relative other than parent or sibling
 Mentor
 Teacher
 Other (Please Specify)

How close did you feel toward the person you cared about? Please choose the number of the image below that best represents your relationship with this person.
1=
2=
3=
4=
5=
6=
7=

Please rate your agreement with the following statements in terms of your relationship with the person you cared about (i.e., the person who experienced the conflict).
1=strongly disagree
2=disagree
3=slightly disagree
4=neither agree nor disagree
5=slightly agree
6=agree
7=strongly agree

I would risk my life for this person.
I feel unconditional love for this person.
I rely on this person for emotional support.
I would do anything for this person, whatever the cost.
I need this person as much as they need me.
Whenever I need something important, I go to this person for help.
No matter what, I will always love this person.
This person needs me as much as I need them.

Now we'd like to ask you some questions about the other party in the conflict—that is, the person who was in conflict with the person you cared about.

How old was this person, in years?

Was this person male or female?

What was your relationship with this person? That person was my_____ (choose one from the list below).
 Parent
 Brother
 Sister
 Close Same Sex Friend
 Close Opposite Sex Friend
 Romantic Partner
 Relative other than parent or sibling

Mentor
Teacher
Acquaintance
Had no relationship to me
Other (Please Specify)

How close did you feel toward this person? Please choose the number of the image below that best represents your relationship with that person.
1=
2=
3=
4=
5=
6=
7=

Now we would like to learn more about your feelings and actions DURING THE TIME of the conflict (the one experienced by the person you cared about).

Thinking back on the conflict experienced by the person you cared about, please try to remember your feelings. Using the scale below, how well do these emotions describe how you felt **at the time**?
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

alarmed
sympathetic
upset
moved
disturbed
compassionate
distressed
tender
perturbed
warm
grieved
troubled
softhearted
worried

When this conflict was going on, did you confront the other person (i.e., the person who was in conflict with the person you cared about) using physical force?
 No
 Yes (Please describe briefly)

Whether or not you actually **used** physical force against the other person, to what extent did you **want** to physically confront that person?
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

When this conflict was going on, did you confront the other person (i.e., the person who was in conflict with the person you cared about) verbally?
 No
 Yes

Whether or not you actually **verbally confronted** the other person, to what extent did you **want** to confront the other person in the conflict verbally?
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

When this conflict was going on, did you confront the other person (i.e., the person who was in conflict with the person you cared about) in another way (e.g., through the justice system, notifying authorities, getting assistance from others)?
 No
 Yes (please describe briefly)

Whether or not you actually confronted the other person **in another way** (e.g., through the justice system, notifying authorities, getting assistance from others), to what extent did you **want** to confront the other person in the conflict in another way?
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

The next several questions are about feelings you might have **now** about the conflict you described. Sometimes even after a conflict is over, people still have feelings or want to do things about that conflict. So the next few questions will be concerned with your feelings and desires **right now**.

Regardless of whether it would be possible or socially acceptable, how much do you **want** to use **physical force** against the other person **now?**
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

Regardless of whether it would be possible or socially acceptable, how much do you want to **verbally confront** the other person **now**?
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

Regardless of whether it would be possible or socially acceptable, how much do you want to confront the other person **in another way** (e.g., through the justice system, notifying authorities, getting assistance from others) **now**?
1=not at all
2=
3=
4=somewhat
5=
6=
7=extremely

Is there anything else we have not asked that you would like to tell us about the recent conflict experienced by the person you cared about?

You're almost at the end of the survey. We would like to ask just a few more questions about your background for statistical purposes.

What is your gender?
Male   Female

What is your age, in years?

What year are you in college?

What is your ethnic background? If you are of mixed ethnic background, please check all that apply.
 African or African American
 East-Asian (e.g., Chinese, Japanese, Vietnamese, Korean) or -Asian-American
 South-Asian (e.g., Indian, Pakistani) or –Asian-American
 European or European-American (White)
 Latino/Latina
 Arab or Arab-American
 Native American (American Indian or Eskimo)

Which of these terms best describes your religious identity?
Christian- Catholic or Orthodox
Christian-Protestant
Christian-Evangelical
Jewish
Muslim
Hindu
Buddhist
Other
None

What is your current relationship status?
Single, never married
Single, divorced
In a relationship
Married
Widowed

What was your saliva sample ID number (should be a number between 1 and 250)?

If you would like to receive PSY 101 credit, please enter your student number below. Remember, this number will be deleted from our files after your credit has been assigned, so your answers will remain COMPLETELY confidential.

Would you like to make any additional comments about the survey?

THANK YOU VERY MUCH FOR COMPLETING OUR SURVEY!

STUDY 2

Thank you for your saliva donation. The second part of your session today will involve participation in a study unrelated to the genetic study you have just participated in. Of course we will tell you about the rationale for both studies before the laboratory today.

(Timer)

Welcome to our study on the effects of pain on performance. Should you agree to further participate your task will be to help us with a study that deals with the effects of physical pain on subsequent performance.

(Timer)

In this study you yourself will have an observer function only. You will not be experiencing any pain or be asked to demonstrate any performance yourself, but function as an assistant in our study. As it is important to understand your very important role in this study we would like to ask you respectfully to please be patient as we thoroughly explain to you your role in this study. Please be assured that this part of the study will take no more than 25 minutes of your time.

(Timer)

Recent findings in behavioral neuroscience suggest that pain has adverse effects on performance. As a lab interested in personality psychology we are currently researching individual differences for this effect.

(Timer)

Specifically, according to what we know from personality research there is reason to believe that effects of pain on performance may differ tremendously depending on the target's personality types and traits.

(Timer)

The actual participants in our study will be assigned to taste hot sauce which will serve as our pain induction. Immediately thereafter their performance on a math test will be assessed.

(Timer)

Two 101 students each will be paired to participate together in the 'pain and performance' study. These two participants will directly compete with each other in the math test. In order to increase participant's motivation the better participant will win 20 Dollars for their performance.

(Timer)

Your task however, will not involve partaking in this experiment, but rather helping us assess the personality of one of the actual participants in the study.

(Timer)

This means that today, rather than functioning as an actual participant, you will be helping with our study as an anonymous and neutral rater.

(Timer)

Why do we need to recruit participants that function solely as raters? Well, in research within psychology we want to avoid the so-called

'experimenter bias', referring to us researchers interpreting what we observe in such ways that it confirms our hypotheses. If that were to happen our results would not actually be scientifically accurate.

(Timer)

As a result, we prefer the opinion of someone unaware of our hypotheses. By using you as an unbiased rater that knows only very little about our actual hypotheses we are trying to prevent our results from being inaccurate. Do you understand now why it is important for us to have someone like you help us with making certain judgments?

(Timer)

All you will be asked to do for this study is to evaluate an actual participant in this study in terms of their personality and select an experimental condition for a different participant.

(Timer)

In the following, we will give you a self-description of one individual that will be participating in our study and your task will be to read and answer a few questions about this description. Specifically, we will ask you to infer certain personality traits based on this self-description.

(Timer)

From what we explained to you earlier, it should make sense that we cannot tell you what exactly you should pay attention to when answering questions about the participant's personality whose description you will read shortly.

(Timer)

In addition, you should know that it may seem somewhat arbitrary to make personality judgments based on such limited information, but please be assured that we have a good theoretical reason behind asking you to do so. We are looking forward to telling you exactly what we are hypothesizing after you have completed your task.

(Timer)

After you have completed the rating task we will then ask you to briefly assign a second participant who will be competing in the study together with the participant you have evaluated to a tasting condition.
(Timer)

The reason for this is another important element in scientific research that you may or may not have heard of in Psychology 101, called 'random assignment'. We want to make sure that which participant is assigned to which amount of hot sauce to taste is not biased by knowing about their personality. If participant Bob for example seems like a tough guy, we may want to assign him to more hot sauce because we think he can handle it (or because we want to see if he can).

(Timer)

Without random assignment we could not ensure that all participants would have the same chance to be in a certain condition, which would sabotage good scientific research. Do you see why we do not want someone with prior knowledge to assign a participant to the amount of hot sauce they will be assigned to taste?

(Timer)

If you agree to evaluate one participant's personality and then assign the other participant in the pair to a tasting condition, please click continue.

(Continue…)

Thank you for agreeing to participate in our study as a rater. Please click on continue and wait for a few seconds while the computer selects a participant pair for you.

Loading…
Loading…
Loading…

Selected: Participant 129A and B

Personality Description for Participant A:

Perspective-Taking Instructions: *For the recall of participant A's statement please try to imagine how the person that described themselves feels about what has happened and how it has affected his or her life. Try not to concern yourself with attending to all the information presented, because it will distract you from recall for the relevant information. Just concentrate on trying to imagine how the person described in the story feels."*

Objective Instructions: *For the recall of participant A's statement please try to read the statement as objectively as possible and pay attention only to the facts presented. Please try not to get caught up in thoughts about how the person feels about the things they chose to write about.*

Participant A (low need)

I am a 20 year old junior at UB majoring in history. I am originally from the Buffalo area and have maintained many friends that I grew up with. My favorite food is pepperoni pizza and medium wings. In my free time I like hanging out with friends, going to the movies and listening to music. I work as a cashier at Wegman's to make some extra money. At the moment money's really tight for me because my car died, so I had to buy a new one, and I've also had to pay for summer classes. I've never been this low on funds, but it doesn't really bother me. I'm pretty sure things will get better soon, plus at least I have a new car.

Participant A (high need)

I am a 20 year old junior at UB majoring in history. I am originally from the Buffalo area and have maintained many friends that I grew up with. My favorite food is pepperoni pizza and medium wings. In my free time I like hanging out with friends, going to the movies and listening to music. I work as a cashier at Wegman's to make some extra money. At the moment money's really tight for me because my car died, so I had to buy a new one, and I've also had to pay for summer classes. I've never been this low on funds and it really scares me, to be honest. What if I need to pay for something else I didn't expect?

First we would like you to answer two questions to make sure that you recall the description adequately:

1. How old is participant A?
2. Please describe in two to three sentences how typical you find participant A for a UB student.

Now we would like you to provide your personality evaluation of Participant A:

3. Please describe how likable you find this person. (May be a good additional control)
4. Please rate participant A on the following personality items:

1	2	3	4	5	6	7
Disagree	Disagree	Disagree	Neither Agree	Agree	Agree	Agree
Strongly	Moderately	A Little	Nor Disagree	A Little	Moderately	Strongly

I would describe Participant 1's personality as:

1. _____ Extraverted, enthusiastic.

2. _____ Critical, quarrelsome.

3. _____ Dependable, self-disciplined.

4. _____ Anxious, easily upset.

5. _____ Open to new experiences, complex.

6. _____ Reserved, quiet.

7. _____ Sympathetic, warm.

8. _____ Disorganized, careless.

9. _____ Calm, emotionally stable.

10. _____ Conventional, uncreative.

Thank you very much for your assessment.

(Please click continue…)

Before you leave our laboratory today, we would like you to help us
with one other task. AS YOU MAY RECALL, THE PURPOSE OF OUR STUDY IS
TO EXAMINE THE EFFECTS OF PAIN ON MENTAL PERFORMANCE, AND WE ARE
USING HOT SAUCE AS THE SOURCE OF PARTICIPANTS' PAIN. WITH THIS IN MIND,
we would like you to assign an amount of hot sauce to participant B (that
is, the participant you have NOT just rated), who will be competing
with participant A (the one that you HAVE just rated).

(Timer)

You have purposely not received any information about participant B in this study in order to make sure that the amount

of hot sauce a participant will be assigned to in our study is not influenced by any prior knowledge about the person. The participant you have previously rated will be assigned to an amount of hot sauce by a different anonymous rater who has not read his/her description.

(Timer)

As an additional precaution, please confirm first, that you have not received any information about participant B, the person you will be assigning to a hot sauce amount of your choice.

(Timer)

I confirm that I have not received any information about participant B, the person I will be assigning to a hot sauce condition.

Yes

No

(Please click continue)

Please now select an amount of hot sauce for participant B, the participant you have not received any information about and who will be paired with participant A (the person you read about) in the experiment.

1) None
2) ½ teaspoon
3) 1 teaspoon

4) 1 ½ teaspoons
5) 2 teaspoons
6) 2 ½ teaspoons
7) 3 teaspoons (1 tablespoon)

Thank you very much for your help with our study. Please let the experimenter know that you have finished for receiving background information about this study as well as your RPG credit.

Footnote

[1] The Study 1 survey also included several other individual difference measures not relevant for the hypotheses of the present research but relevant to another project.