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Effects of Oxytocin Administration on Receiving Help

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Receiving help can be a "mixed blessing." Despite the many psychosocial benefits it can carry, it sometimes has negative psychological consequences, such as loss in self-esteem or enhanced guilt. It is, therefore, important to understand the factors that modify responses to receiving help from others. We explored the role of the hormone oxytocin (OT) on affective and social responses to receiving help, given the putative role of OT in social bonding and attunement. To this end, we manipulated whether help was received from a same-sex interaction partner (confederate) versus a control condition, crossed with a double-blind administration of intranasal OT (vs. placebo), and examined subjective and observer-rated participant responses to help. We observed significant interactions between OT and the help manipulation. In the placebo condition, receiving help from the interaction partner compared with the control condition had negative consequences, such that participants reported greater negative affect and came to view themselves and their interaction partners more negatively after interacting together on several tasks. What is important, however, is that OT administration buffered against these negative subjective responses to receiving help. Further, outside observers rated participants who received OT administration as expressing greater happiness and gratitude in response to help, relative to those who received placebo. In sum, in the context of receiving help from a stranger, oxytocin administration fostered more positive affective and social responses.

Keywords: help, oxytocin, social interactions, gratitude

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Receiving help from others can be a positive experience—enhancing feelings of gratitude and prosocial behavior (Bartlett & DeSteno, 2006; DeSteno, Bartlett, Baumann, Williams, & Dickens, 2010). Gratitude and prosocial behavior, in turn, carry their own benefits for psychological and physical health (Deci, La Guardia, Moller, Scheiner, & Ryan, 2006; Emmons & McCullough, 2003; McCullough, Emmons, & Tsang, 2002; Thomas, 2010). Despite these potential benefits, receiving help or support has been also conceptualized as a "mixed blessing" (Fisher, Nadler, & Whitcher-Alagna, 1982) because it does not always foster gratitude (e.g., Chow & Lowery, 2010) and sometimes can have negative psychological consequences, exacerbating emotional reactivity to stress (Bolger & Amarel, 2007) and reducing self-esteem (Schneider, Major, Luhtanen, & Crocker, 1996). As such, it is important to understand factors that might foster more positive responses to receiving help. In the current study, we examined whether administration of the neuropeptide oxytocin, which has been associated with social bonding and attunement (Bartz et al., 2010; Taylor et al., 2000), would facilitate positive responses to receiving help.

Why does receiving help sometimes have negative consequences? Help and support appear to be particularly detrimental when they are *visible* (Bolger & Amarel, 2007; Bolger, Zuckerman, & Kessler, 2000; Shrout, Herman, & Bolger, 2006) or *assumptive*—unsolicited help received in the absence of perceived personal need (Schneider et al., 1996). This may be because receiving help can be a threat to one's self-esteem and competence (see Fisher et al., 1982 for review). In contrast, *invisible* support, or support that goes unnoticed or is not interpreted as support, is more beneficial (Bolger et al., 2000; Shrout et al., 2006). However, providing invisible support is a subtle skill (Bolger et al., 2000), and may be especially difficult to provide in initial interactions or new relationships. Thus, it is possible that the provider of help may not always be able to convey subtle, invisible support. As such, we examined whether it is possible to alter how positively recipients respond to more visible help.

In this study, we examined whether administration of the neuropeptide oxytocin (OT) would influence responses to receiving help on intra- and interpersonal outcomes. OT plays an important role in social interactions and bonding (e.g., Taylor et al., 2000). For example, OT administration has been found to enhance prosocial behaviors, such as trust and generosity (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Zak, Stanton, & Ahmadi, 2007; but see Baumgartner, Heinrichs, Vonlanthen, Fischbacher, & Fehr,

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2008; Conlisk, 2011; Klackl, Pfundmair, Agroskin, & Jonas, 2013; Lane et al., 2015; cf. Nave, Camerer, & McCullough, 2015, for critical review). It is important to note that OT levels and administration may facilitate more positive responses to others' prosocial behaviors. A variation in a gene associated with OT secretion (CD38) is associated with higher levels of expressed gratitude in romantic relationships (Algoe & Way, 2014), and a 10-day trial of OT administration enhanced trait-gratitude in older adults (Barraza et al., 2013). Thus, there are links between OT and the expression and experience of gratitude, which may indicate more positive responses to acts of help or support.

There are several ways in which OT administration might facilitate such responses. First, OT administration may improve social perception (e.g., Bartz et al., 2010; Domes, Heinrichs, Michel, Berger, & Herpertz, 2007), which could help attune individuals to the positive intentions of the person providing help, thereby enhancing gratitude. This may only be beneficial, however, if awareness of the provision of help is not viewed as threatening to one's self-esteem or competence. It is important to note that OT administration might help reduce such negative interpretations of help by potentially enhancing trust (Kosfeld et al., 2005; Mikolajczak, Pinon, Lane, de Timary, & Luminet, 2010; Mikolajczak, Gross, et al., 2010; but see Lane et al., 2015), the processing of positive social cues (Unkelbach, Guastella, & Forgas, 2008), and more positive perceptions of others (Colonnello, Chen, Panksepp, & Heinrichs, 2013), including potential threat of others (Chen, Mayer, Mussweiler, & Heinrichs, 2015). Further, OT administration can result in more positive self-perceptions (Cardoso, Ellenbogen, & Linnen, 2012), which might make individuals less vulnerable to threats to their self-esteem. In sum, OT may simultaneously attune individuals to the positive intentions of an interaction partner providing help and lessen the likelihood of negative interpretations of receiving help, thereby facilitating more positive intrapersonal responses, such as gratitude.

Overview of the Study

Building on the help paradigm developed by Bartlett and DeSteno (2006) and DeSteno and colleagues (2010), we examined the participants' affective and social responses to an experimental condition, i.e., receiving help from a same-sex stranger who spontaneously helped fix a broken computer, versus a control condition. This task consists of a computer crashing right at the end of a participant completing a tedious task. In the help condition, a same-sex, similar-age stranger who was also a participant in the study (i.e., confederate) helps the participant restore the computer session. In DeSteno et al., the control condition did not include the aversive experience of the computer crashing; instead, the participant proceeded with the exercise once the computer tasks had been completed. We wanted to control for the negativity associated with the computer crash, so in our control condition, once a participant's computer crashed, the experimenter received information from a technician on the phone and was able to restore the computer. This design allowed us to compare a helping experience in which there was a clear target associated with the help (i.e., the interaction partner/confederate) with an affectively matched experience, but no identifiable person associated with providing help. Also, presumably, it was the technician's responsibility to restore the computer, creating ambiguity regarding whether one would be grateful to someone who was just doing his or her job effectively.

Using this modified help paradigm, we first examined whether receiving help would result in positive responses, similar to previous studies (Bartlett & DeSteno, 2006; DeSteno et al., 2010), or in negative responses, in line with work on receiving visible and assumptive help (Bolger & Amarel, 2007; Schneider et al., 1996). We then examined the role of OT in participants' affect and social perceptions in response to receiving help, predicting that OT would facilitate more positive responses to help, either enhancing the positive effects or buffering against negative effects.

Method

Participants and Design

Participants between the ages of 18 and 30, who spoke English as their first language, were recruited from the community. Prior to scheduling a lab appointment, participants were prescreened and excluded if they were pregnant, lactating, had a self-reported history of a psychiatric disorder (e.g., depression or anxiety disorder) or a physical health condition (e.g., cardiovascular, neurological, or endocrine diseases), or had a body mass index (BMI) greater than 30. A total of 131 participants arrived for their 2-hr lab appointment, of which five did not complete the study for a variety of reasons, including drug use prior to study arrival ($n = 1$), a positive pregnancy test ($n = 1$), prior participation in a related study ($n = 1$), or unusual behavior ($n = 2$; e.g., aggressive or despondent). We excluded two participants on an a priori basis because they were significantly older than the age limit ($n = 2$), and an additional eight participants were excluded from the current analyses as a result of technical malfunctions with the help manipulation (i.e., actual computer malfunction). The final dataset included 116 participants (70 women, 46 men; $M_{age} = 24.27$, $SD_{age} = 3.62$; $M_{BMI} = 22.30$, $SD_{BMI} = 2.53$). Sample size was determined a priori based on published studies examining interactive effects of OT and social context, which typically report between 60 and 80 total participants (e.g., De Dreu et al., 2010). The ethnic breakdown was as follows: Caucasian, 64; Asian, 30; Hispanic, 16; and other, 6. Note that controlling for gender, age, ethnicity, and BMI did not significantly change the pattern of results, so these variables were not included as covariates in the analyses presented below. Upon arrival, participants were randomly assigned to a 2 (intranasal spray condition: oxytocin vs. placebo, double-blind) $\times$ 2 (help-manipulation condition: stranger's help vs. technician's help) between-subjects design.

Interaction Partners

A total of 30 different research assistants (17 = women; 13 = men) served as confederates/interaction partners over the 20 months of data collection. Partners were of similar age range to participants (between 18 and 30) and dressed and behaved as typical research participants. Participant–partner pairs were always matched on gender and roughly matched on ethnicity, such that Caucasian and Asian participants could be matched with Caucasian or Asian partners, whereas Latino participants were matched with Latino partners. There were 11 cases of ethnic mismatch (9% of pairs); exclusion of these pairs did not substantially alter the

pattern of results presented below. Although partners were aware of the help condition (for reasons that will become apparent below), partners were blind to the OT/placebo condition, as were all the lab personnel until the conclusion of the study. Double blind procedures in this context aid in reducing or eliminating experimenter and participant expectancy effects that might influences responses.

Procedure

Arrival and nasal spray administration. Upon arrival at the lab, participants were given a brief overview of the procedure and a very general description of the study purpose, as follows (see Figure 1 for an overview of the study procedures).

> This is a study that compares physiology during active versus resting tasks after being administered a hormone (oxytocin) or a placebo. Today you will be asked to complete a variety of tasks here in our lab. We will give you the instructions for each task as we go along.

The experimenter then obtained informed consent from the participants and confirmed a negative test for pregnancy for all women participants via a urine sample (one participant tested positive, was informed of the outcome, and did not proceed with the study).

Participants were then taught how to self-administer a nasal spray, which contained either 40 IU of oxytocin (syntocinon spray, Novartis) or a placebo (same compounds as OT spray minus syntocinon) in a double-blind design in which the bottles appeared exactly the same other than a different color dot on the bottom of the bottle. To prevent any experimenter-expectancy effects, no one in the lab knew the assignment of colors to drug versus placebo. A medical doctor (second author) trained and supervised drug administration. In line with recommendations by Guastella et al. (2013), participants self-administered a metered multidose pump-spray bottle, with each spray containing no more than 100 μl, and alternated nostrils until the bottle was empty. When probed at the conclusion of the study, participants could not determine which substance they had received above chance levels, $\chi^2(1) = 2.54$, $p = .11$.

Intranasal administration has been shown to lead to increases in levels of plasma OT (Andari et al., 2010) and significant increases in OT levels of cerebrospinal fluid in humans, as measured by lumbar puncture (Striepens et al., 2013, although in Striepens et al., OT was detectable 75 min after administration). Also note that there is controversy surrounding the effects of OT administration on the brain (Leng & Ludwig, 2016). Further, salivary levels of OT have been shown to remain elevated for at least 2 and up to 7 hr after intranasal OT administration (Huffmeijer et al., 2012; Van IJzendoorn, Bhandari, Van der Veen, Grewen, & Bakermans-Kranenburg, 2012). Intranasal OT administration has been shown to have physiological effects within 30 min (Norman et al., 2011), so in the current study, the help manipulation did not begin until at least 40 min postadministration. During the waiting period, participants watched an emotionally neutral video about hiking the Appalachian Trail.

Help manipulation. Forty min after the OT/placebo administration, participants were told that they would now begin the formal part of the study, completing a task on a computer. In both conditions, the participant and interaction partner were then brought into the same room, each seated at his or her own computer, which set the stage for the help manipulation (derived from DeSteno & colleagues, 2010). The participant and partner were instructed that they would each be completing separate tasks on their own computers. The task was somewhat tedious, involving three trials in which each participant had to sort letter strings as

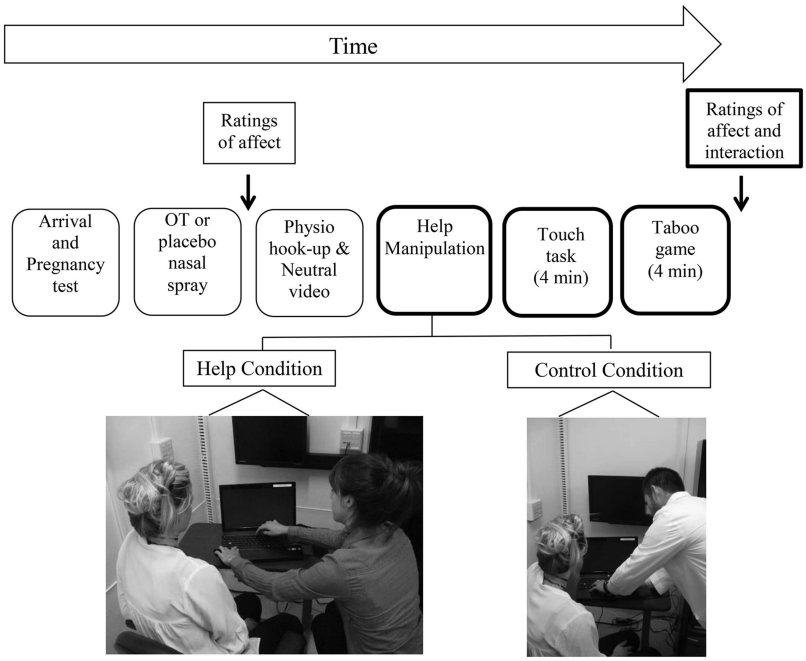

Figure 1. Overview of the study procedures.

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either words or nonwords as quickly and accurately as possible. After the first two trials, the participant's scores (ostensibly) appeared on the monitor, but after the third and final trial, the computer program was set to flicker and appeared to crash as soon as the scores were about to appear. At this point, for all participants, the experimenter returned to the room and briefly attempted to fix the computer, but after failing, announced that the participants would have to redo the trials and then stepped out of the room to "call the technician" to try to restart the task. Thus everyone had an aversive experience and believed they would have to redo the task. Once this occurred, participants then experienced either the help manipulation or control condition. In the help condition, the partner, followed a behavioral and verbal script that required him or her to come over to the participant's computer to offer to try to fix it, so the participant would not have to redo the task. The partner then immediately and surreptitiously hit a specific button, which took 30 s to restore the task; during that time the partner appeared to continue working to fix the computer until the scores reappeared. In the control condition, the experimenter reentered the room after approximately 30 s and "fixed" the computer after receiving the technician's instructions. In the control condition, both the partner and participant wore noise-cancelling headphones during the task so that the partner would be "unaware" that the participant's computer had malfunctioned, and therefore would not appear particularly unhelpful for not getting involved.

Interactive tasks. After the help manipulation, participants took part in two interactive, cooperative tasks with the partner.

Touch task. The first task was designed to facilitate interpersonal closeness in a nonthreatening way. We designed a tactile finger-spelling task during which the partner spelled out words using American Sign Language and the participant tried to guess the letters of each word by touching the partner's hand (West, Page-Gould, Koslov, Major, & Mendes, in press). In this task, a table with a cardboard box was placed between the participant and partner and the experimenters asked both the participant and partner to put their dominant hands inside the box, so that the participant could not see the communicator's hand and had to feel it instead. Hanging on each side of the table was a laminated sheet of the sign language letters for their reference, and the partner was given a stack of words to communicate to the participant. They were told that the experimenter would be counting how many words they could communicate in 4 min.

Taboo game. Following the touch task, participants were asked to play a cooperative game with their partners, based on the game Taboo, which is similar to executive functioning tasks that require inhibition, and has features of the false-memory paradigm (Roediger & McDermott, 1995). In this game, the participant and partner each took two 1-min turns trying to get their partner to guess words, without being able to use any of five "taboo" words listed on their prompt cards (e.g., if the word to be guessed was "birthday," the clue giver could not say "happy," "anniversary," "candles," "cake," or "presents"). The game lasted for 4 min and the partners' responses were scripted, ensuring a similar experience for each participant. After the game, participants provided ratings of their affect and perceptions of the self and their partners (see Measures section below).

After the taboo game, the partner and participant were separated and we used a funnel debriefing to ascertain suspicions. Participants were compensated the advertised $50 plus an additional $17—the full amount participants could have ostensibly earned from the bonuses on the cooperative tasks.

Measures

Affect. Participants rated their affect on an extended, 30-item version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) at the beginning of the experiment and then again after the taboo game. The items were completed on a scale of 1 (*not at all*) to 5 (*extremely*); Positive Affect (PA) items included the original PANAS items (i.e., attentive, active, alert, determined, enthusiastic, excited, inspired, interested, proud, and strong), with the additional items, grateful, appreciative, calm, friendly, happy, loved, successful, sociable, and warm. Negative Affect (NA) included the original PANAS items (i.e., afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared, and upset), plus the item sad. For each time point, the PA and NA items were combined to create new subscales for PA ($M_{baseline}$ = 3.27; SD = .59; M_{Taboo} = 3.15; SD = .65; αs > .89) and NA ($M_{baseline}$ = 1.43; SD = .49; M_{Taboo} = 1.32; SD = .41; αs > .83).

Social perceptions. After Taboo, participants rated themselves and their partners on a variety of measures to assess the positivity of the self- and partner perceptions. Specifically, participants rated themselves (self-ratings), their partners (partner ratings), and how they believed their partners perceived them (metaperceptions) on the following positive characteristics: likable, smart, fair, genuine, helpful, intelligent, cooperative, trustworthy, and compassionate, and on performance on the Taboo game. The composite self- (M = 5.68; SD = .74) and partner ratings (M = 5.92; SD = .73) and metaperceptions (M = 5.12; SD = .84) were all highly reliable (αs > .89).

Video Coding

To further assess participant responses to the help manipulation, three outside observers, trained research assistants unaware of the OT condition and not involved in data collection, coded participant affect in response to receiving help. Videos of the help manipulation (n = 69; some participants did not consent to video coding, and other files were lost as a result of technical or experimenter error) were coded by the trained observers, who rated affect/behavior on a 1 (*not at all*) to 5 (*a great deal*) scale. Observers rated the extent to which participants appeared to be grateful toward the person fixing the computer (M = 2.22; SD = 1.27), and happy that the computer was fixed (M = 2.51, SD = 1.32). Roughly 20% of the video clips were double coded (n = 20) and intraclass correlation coefficients (ICC) were acceptable (mean ICC = .76).

Results[1]

Suspicion

Participant suspicion was probed and rated on a 0–2 scale (0 = *not at all suspicious*; 1 = *expressed suspicion after told*; 2 =

[1] All data and syntax are available at https://osf.io/hkp92

independently expressed suspicions prior to full debriefing). The vast majority of participants were not suspicious ($n = 83$), with fewer participants expressing suspicion after being told ($n = 15$) and independently during probing ($n = 16$). We first examined effects on participant suspicion as a function of OT and help condition with a logistic regression predicting participant suspicion as binary variable (0 = *no suspicion*; 1 = *suspicion either after told or independently*). There was a significant interaction between help condition and OT administration predicting the likelihood of suspicion, $b = -2.21$, $z = -2.30$, $p < .05$. Examining the simple effects revealed that, for those in the placebo condition, receiving help predicted greater likelihood of expressing suspicion ($n = 16$) relative to those in the control condition ($n = 5$), $OR = 8.65$, $z = 3.48$, $p < .001$. In the OT condition, however, participants who received help from a partner were no more likely to be suspicious ($n = 4$) than the no-help (control) participants ($n = 5$), $OR = .95$, $z = -.07$, $p = .95$. Further, being in the OT-administration condition significantly reduced the likelihood of expressing suspicion within the help condition, $OR = .12$, $z = -3.13$, $p < .01$.

Thus, being helped by another person led to a greater likelihood of suspicion that the partner was a confederate. However, OT administration diminished the likelihood of suspicion, which is consistent with findings that OT administration can increase trust (Kosfeld et al., 2005; Mikolajczak, Pinon, et al., 2010). Because the experimental conditions played a role in triggering suspicion, we retained all participants for the analyses, as it appears that enhanced suspicion may be one of the outcomes of the experimental manipulations, rather than a failure of the research assistant to act convincingly as a participant. Nevertheless, the effects were highly consistent when suspicious participants were not included in the analysis.

Subjective Responses to Help

We examined whether there were baseline differences by conditions on NA and PA, and observed no significant main effects or interactions, all ps $> .18$. Baseline affect was included as a covariate in the analyses presented below; the results are similar without the covariate.

Negative Affect. There were no significant main effects of help condition or OT administration on NA after taboo; however, there was a significant interaction between OT administration and help condition on NA, $F(1, 111) = 5.15$, $p < .05$. Specifically, in the placebo condition, participants who received help reported marginally greater NA than those in the control condition, suggesting that the help manipulation may have increased NA. However, for participants in the OT-administration condition, there were no significant differences in NA as a function of help condition, suggesting that OT administration buffered against the negative affective consequences of receiving help (see Figure 2; Table 1).

Positive Affect. The effects of manipulations on self-reported PA were weak, and were not below standard α levels: help condition, $F(1, 111) = 3.59$, $p = .06$, and OT administration, $F(1, 111) = 2.67$, $p = .11$. PA was somewhat lower at the end of the study for participants in the help condition ($M = 3.06$, $SD = .68$) relative to the control condition ($M = 3.22$, $SD = .62$), and somewhat higher for participants in the OT-administration condition ($M = 3.22$, $SD = .55$), relative to placebo condition ($M = 3.09$, $SD = .72$). However, there was not a significant interaction between help condition and OT administration, $F(1, 111) = .80$, $p = .37$.

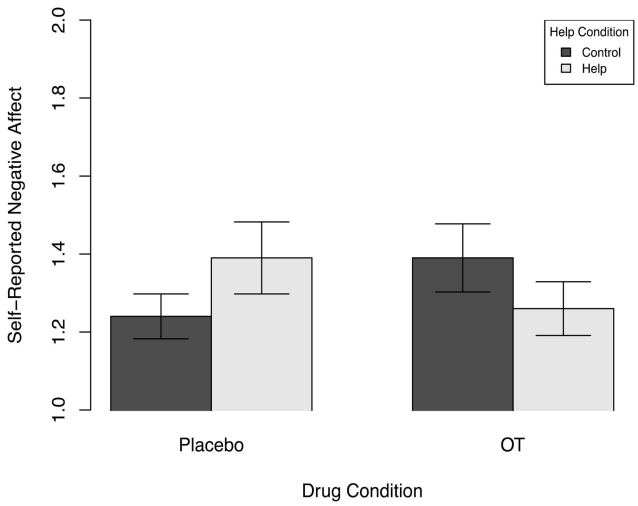

Figure 2. Effects of the help condition on self-reported Negative Affect (NA) as a function of oxytocin (OT) administration.

Social Perceptions

At the conclusion of the joint tasks, there were significant and marginal interactions between help condition and OT administration predicting the positivity of self-perceptions, $F(1, 108) = 7.43$, $p < .01$, partner perceptions, $F(1, 108) = 3.39$, $p = .07$, and metaperceptions, $F(1, 108) = 2.71$, $p = .10$ (see Table 1). For example, participants in the placebo condition perceived themselves less positively (e.g., as less likable, smart, and genuine) when receiving help from their partners, compared with participants in the control condition (see Figure 3). However, this difference was not observed among those who received OT.

Parallel effects emerged for meta- and partner perceptions, such that participants in the help condition tended to perceive their partners less positively and believed their partner perceived them (metaperception) less positively in the placebo condition than the OT condition. Furthermore, within the help condition, OT administration led to significantly more positive self-perceptions, $F(1, 108) = 5.64$, $p < .05$. Overall, participants came to view themselves and their partners less positively after the social interactions if they received help, but these more negative social perceptions were eliminated among those who received OT (see Figure 4).

Observer-Rated Affect

To corroborate subjective reports, we examined observer ratings of participants' responses to the help manipulation, including their expressed gratitude and happiness. The video coders could not be blinded to the help manipulation, and not surprisingly, there were very large effects of the help condition on observer ratings of participant gratitude toward the person fixing the computer, $F(1, 63) = 23.97$, $p < .001$, and happiness that the computer was fixed, $F(1, 63) = 28.95$, $p < .001$. It is important to note, though, that

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Table 1
Self-Rated Outcomes as a Function of Help Condition and Oxytocin Administration

Self-ratings	Placebo *M* (*SD*) Control	Placebo *M* (*SD*) Help	*d* [.95 CI]	Simple-effect *F* test	Oxytocin *M* (*SD*) Control	Oxytocin *M* (*SD*) Help	*d* [.95 CI]	Simple-effect *F* test	Interaction *F* test
Affect									
Negative	1.24 (.31)	1.39 (.48)	.37 [−.14, .88]	2.46†	1.39 (.47)	1.26 (.33)	−.32 [−.85, .22]	2.12	5.75*
Positive	3.21 (.63)	3.09 (.59)	−.20 [−.70, .31]	1.10	3.14 (.81)	3.16 (.49)	.02 [−.51, .55]	.05	.80
Social									
Self-perceptions	5.89 (.56)	5.37 (.87)	−.71 [−1.23,−.19]	−7.51**	5.62 (.82)	5.85 (.87)	.27 [−.26, .80]	1.35	7.43**
Partner perceptions	5.74 (.65)	5.38 (.77)	−.51 [−1.01, .01]	−3.50†	5.54 (.79)	5.69 (.68)	.20 [−.33, .73]	.58	3.39†
Meta-perceptions	5.32 (.81)	4.85 (.90)	−.55 [−1.06,−.03]	−4.54*	5.11 (.87)	5.17 (.77)	.07 [−.46, .60]	.06	2.71†

Note. *d* = Cohen's *d*. Analyses with positive and negative affect include baseline affect as a covariate.
† $p < .10$. * $p < .05$. ** $p < .01$.

these effects were qualified by interactions with OT, gratitude: $F(1, 63) = 4.32$, $p < .05$; happiness: $F(1, 63) = 3.73$, $p < .06$. Specifically, in the placebo condition, receiving help was associated with expressing significantly more gratitude, $M = 2.53$, $SD = 1.28$, and happiness, $M = 2.94$, $SD = 1.18$, compared with the control condition, gratitude: $M = 1.73$, $SD = .98$, $F(1, 63) = 5.25$, $p < .05$, $d = .71$, .95 CI = [.18, 1.22]; happiness: $M = 1.95$, $SD = 1.09$, $F(1, 63) = 7.57$, $p < .01$, $d = .86$, .95 CI = [.33, 1.39]. This same pattern was found in the OT-administration condition, gratitude: $M_{control} = 1.43$, $SD = .94$ vs. $M_{help} = 3.33$, $SD = 1.05$, $F(1, 63) = 23.03$, $p < .001$, d = 1.92, .95 CI [1.27, 2.55]; happiness: $M_{control} = 1.64$, $SD = 1.01$ vs. $M_{help} = 3.67$, $SD = 1.05$, $F(1, 63) = 25.10$, $p < .001$, $d = 1.97$, .95 CI [1.31, 2.61], but the effects of help on expressed gratitude and happiness were stronger for those in the OT-administration condition than the placebo condition, gratitude: $F(1, 63) = 3.48$, $p = .07$; happiness: $F(1, 63) = 4.37$, $p < .05$. Thus, participants who received OT exhibited stronger positive affective responses to the help manipulation, including greater gratitude in response to help, and happiness when it was fixed.

Discussion

Receiving help and experiencing gratitude can have a range of positive consequences for the recipient (Bartlett & DeSteno, 2006; DeSteno et al., 2010; Emmons & McCullough, 2003; McCullough et al., 2002). However, receiving help does not always translate into positive experiences and can sometimes backfire (Bolger & Amarel, 2007). As such, it is critical to understand factors that influence responses to help. This study provides evidence that acute increases in OT, which is implicated in social bonding and affiliation, facilitate more positive subjective and observed responses to help. Here, we summarize and interpret the effects we observed and discuss their potential implications.

In the placebo condition, compared with not receiving help, participants' receiving help from partners had negative consequences, reporting greater NA, perceiving themselves and their interaction partners less positively after several interactive tasks, and believing their partners viewed them less positively (e.g., as less likable, smart, and genuine). Furthermore, participants who

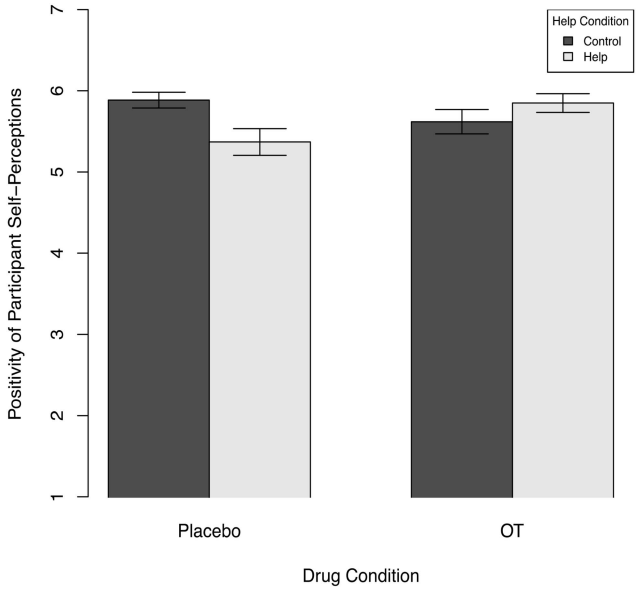

Figure 3. Effects of the help condition on the positivity of participant self-perceptions as a function of oxytocin (OT) administration.

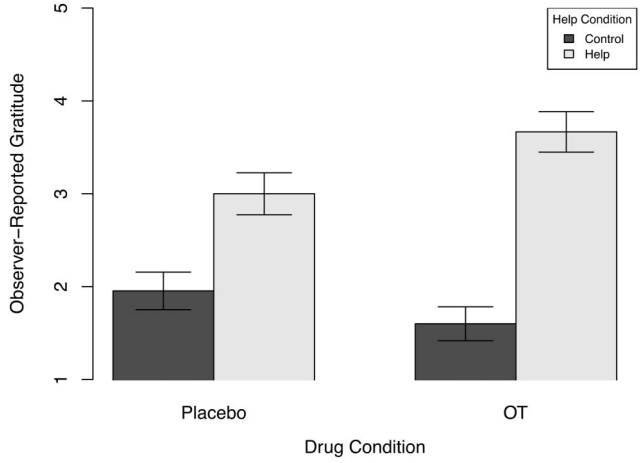

Figure 4. Effects of the help condition on observer-rated participant gratitude as a function of oxytocin (OT) administration.

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received help were more likely to express suspicion about whether their partners were confederates. It is important to note that each of these outcomes was assessed after the participant engaged in multiple interactive tasks with the helpful partner, rather than directly after receiving help. These negative consequences may, therefore, be more a result of prolonged interaction with the helpful other than of the experience of receiving the help itself. Overall, then, interactions with helpful partners in our paradigm incurred unpleasant experiences and triggered suspicion in some, but this was primarily observed in the placebo condition.

These findings contrast with work using a similar paradigm (Bartlett & DeSteno, 2006; DeSteno et al., 2010), which revealed positive effects of receiving help on gratitude and prosocial behavior. However, our version of this paradigm differed in several ways, including a modified, more aversive control condition and a more diverse community sample, both of which may have altered the experience of and response to receiving help from another. Instead, our findings are more in line with work on visible or assumptive help, which demonstrates that receiving such help can have negative consequences, such as emotional distress (Bolger & Amarel, 2007), perhaps by threatening one's self-esteem and sense of competence (Fisher et al., 1982; Schneider et al., 1996).

It is important to note, however, that OT administration buffered against the adverse effects of receiving help from a partner in our paradigm, eliminating these negative consequences. Further, outside observers rated participants who received OT administration as expressing greater happiness and gratitude in response to receiving help than those who received placebo, corroborating these participants' more positive subjective responses to help. However, given that participants did not report greater PA, it is unclear whether OT administration actually increased the subjective experience of PA in response to help in addition to the expression of it.

Overall, OT administration appeared to facilitate fewer negative responses to help, perhaps because exogenous OT administration may increase trust (Kosfeld et al., 2005; Mikolajczak et al., 2010; cf. Nave et al., 2015), and more positive perceptions of others (Chen et al., 2015; Colonnello et al., 2013), which may have made participants less likely to be suspicious of their partners' behavior, and in turn, more receptive to their help. Indeed, participants who received OT administration were less suspicious of their helpful partners and viewed them somewhat more positively. Further, OT administration was associated with participants viewing themselves more positively (e.g., as more likable, smart, and genuine), consistent with other work (Cardoso et al., 2012), which may have made the receipt of help less threatening. Alternatively, OT administration may have helped to buffer participants from the stress of receiving unwanted help, consistent with work demonstrating stress-buffering effects of OT administration (Cardoso, Ellenbogen, Orlando, Bacon, & Joober, 2013; Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003). In sum, OT administration appears to facilitate more positive, or at least fewer negative, responses to others' prosocial acts.

Implications and Future Directions

These findings have a number of implications for research on affective responses to help and the role of oxytocin in social settings. First, these findings suggest that it is possible to minimize the negative responses to visible, assumptive help through factors that enhance social bonding or reduce stress. Of course, these findings are tentative and need to be replicated, ideally with larger samples, especially given that the effects we observed were small. Further, a better understanding is needed of the psychological mechanisms through which OT administration has these effects, such as social trust and reduced stress, which could, in turn, inform psychological manipulations that could similarly foster more positive responses to help. Indeed, the effects of OT administration on trust are controversial (e.g., Conlisk, 2011; Lane et al., 2015), making it important to directly test this proposed mechanism.

This work also contributes to the literature indicating that OT administration can play a role in prosocial behavior (Kosfeld et al., 2005; Zak et al., 2007). Previous work has generally indicated that OT administration can boost *one's own* prosocial behavior, whereas here we demonstrated that OT administration facilitated positive responses to *others'* prosocial behavior. These findings dovetail with recent work linking OT to the expression and experience of gratitude (Algoe & Way, 2014; Barraza et al., 2013) and point to one potential mechanism for such effects, i.e., acute increases in OT may promote how positively one responds to specific instances of help or support.

Conclusion

Receiving help can have many benefits for individuals, yet people do not always respond positively to help. Indeed, in our study, participants who received help experienced negative intrapersonal consequences, including more NA and negative perceptions of the self. As such, it is critical to examine factors that might help buffer against negative intrapersonal responses to help. In our study, OT administration did just that, indicating that OT and related psychosocial processes, such as trust and social engagement, may facilitate more positive responses to help. In sum, acute increases in oxytocin may help individuals reap the intrapersonal benefits of receiving help from peers.

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