Hold Me: Hugging and Weighted Pressure Vests as Treatments for
Anxiety, Stress, and Depression

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Abstract

Past research suggests that touch and pressure can have antidepressant and anxiolytic properties. The present investigation hypothesized that brief interventions of hugging, wearing a weighted pressure vest, and being in the presence of a friend during a stressful situation would reduce anxiety, stress, and depression while increasing social support. Undergraduate participants (N = 155) completed the Trier Social Stress Test while either receiving hugs from a friend (Hug), having a friend nearby (Friend), wearing a weighted pressure vest (Vest), or having nothing added (Control). None of the measures differed significantly between conditions. However, participants in the Hug condition had marginally higher state social support than Control participants. These findings suggest that brief interventions with hugs, weighted pressure vests, or the presence of a friend are not effective at reducing anxiety, stress, or depression, while hugs may be effective at increasing social support.

*Keywords:* hugs, weighted pressure vests, anxiety, stress
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Hold Me: Hugging and Weighted Pressure Vests as Treatments for Anxiety, Stress, and Depression

Touch and, more broadly, pressure, have long been held to have medicinal properties, even though scientific research has only recently begun to put these beliefs to the test (Classen, 2012). For the sake of clarity, pressure is defined here as “compression of a body part or surface,” while touch is defined as “pressure directly applied by another human being with their body or body parts” (Pressure, n.d., p. 1; Touch, n.d.). Touch in particular has been under-researched, with no formal evaluation of its benefits as a treatment for a variety of common psychological maladies, despite slowly mounting research largely lauding its wide-ranging benefits across a variety of mediums.

Massage, for instance, has been found to reduce anxiety and cortisol levels (Field et al., 1992). Several forms of touch (such as massage) have also been found to improve sleep and decrease substance P, a pain chemical, in addition to increasing oxytocin, serotonin, and dopamine (Field, 2010). Oxytocin, serotonin, and dopamine increases have been clearly linked to reductions in anxiety, stress, and depression (Field, 2010). According to the Polyvagal Theory, these neurochemical changes are likely due to vagus nerve stimulation from skin pressure (e.g. Field, 2010; Gamse, Lembeck, & Cuello, 1979; Porges, 2001; Stock & Uvnäs-Moberg, 1988). These neurochemical changes may explain why touch decreases anxiety in cardiac patients (Weiss, 1990), as well as existential anxiety after a death reminder (Koole, Tjew A Sin, & Schneider, 2014). Touch is also often used as a demonstration of affection, and some forms of affection (though not always physical affection) have been associated with reduced cortisol levels and stress (e.g. Floyd et al., 2007; Floyd & Riforgiate, 2008). Touch and other forms of tactile stimulation have also been implemented in sensorimotor therapy, which is used to help
traumatized individuals reconnect with their bodies and modulate their own arousal (Ogden & Minton, 2000; Van der Kolk, 2015). However, it is important to note that touch is not always a boon—a wrist touch on highly socially anxious people ended up increasing anxiety (Wilhelm, Kochar, Roth, & Gross, 2001).

This range of possible responses to touch suggests that these responses are, to some degree, dependent on context and individual perception. This idea is backed up by the finding that touch in close adult relationships increases oxytocin levels, and when that touch is paired with a positive interpretation of the touch, it leads to lowered stress and could cause cognitive changes that increase both relational and psychological well-being (Jakubiak & Feeney, 2016). Touch also stimulates the vagus nerve (which is afferent, i.e. connected to the brain) which activates the pregenual anterior cingulate cortex (related to rewarding pleasant stimulations) even more strongly than pressure, suggesting that interpreting skin pressure as touch may enhance any neurochemical benefits (Jakubiak & Feeney, 2016; Lindgren et al., 2012).

These benefits, while stronger from touch, have their roots in pressure. Pressure has been described as “relaxing” and “calming” ever since Temple Grandin’s seminal article on her famous “Squeeze Machine,” now termed the “Hug Machine” (Edelson, Edelson, Kerr, & Grandin, 1999; Grandin, 2013, pp. 63, 67). There have been several designs of this machine, but the general idea is that the individual using the machine lies on their stomach in it and pulls a lever which tightens cushioned pads and boards all around the user’s body (Edelson et al., 1999; Grandin, 2013). Grandin went on to state that her Hug Machine “calmed down [her] anxiety”—this has only ever been backed up in a single study evaluating twelve autistic children—note again the small sample size of children only, as well as the focus on non-normative populations—which found that the Hug Machine significantly reduced tension and marginally
reduced anxiety (Edelson et al., 1999; Grandin, 2013, p. 66). One other study did evaluate the effects of a similar contraption on college students, and while they found no clear effect on state anxiety, subjective relaxation did increase—and these conflicting results may be due to the unusual, mattress-based contraption employed, as well as the somewhat small sample size of the study (Krauss, 1987).

Unfortunately, the vast majority of the research, from Grandin onward, has been aimed at identifying the sensory benefits of pressure (particularly with small, non-normative samples of children), though little has come of it (Dunst et al., 2013; Losinski, Sanders, & Wiseman, 2016; Stephenson & Carter, 2009). The mixed results for pressure as an effective treatment for autism and other sensory disorders as well as the promising preliminary results highlighting pressure’s anxiolytic properties suggest that this focus on utilizing pressure to improve sensory and behavioral issues may be misguided. Any positive improvements for sensory disorders such as autism from the use of pressure may simply be the result of a reduction in anxiety, as there is some evidence that anxiety is related to sensory over-responsivity (Green & Ben-Sasson, 2010; Mazurek et al., 2013). It may also be the case that autistic participants respond especially well to pressure, as their elevated anxiety may be being treated by the pressure (White, Oswald, Ollendick, & Scahill, 2009). Previous experimenters may have been using the wrong metrics in their attempts to ascertain why pressure—particularly weighted pressure vests—seemed to help some autistic children.

These weighted pressure vests (adjustable vests that can be tightened and are filled with small metal or sand-filled weights that in total weigh anywhere from 1-10 pounds) have also been neglected in the research, with the majority of the studies on the vests addressing behavioral or sensory issues in autism, attention deficit disorders, or pervasive development disorder (e.g.
Kane, Luiselli, Dearborn, & Young, 2004; Lin, Lee, Chang, & Hong, 2014). Most of these studies were focused on children (who are less likely to be generalizable to the general population than adults) and relied on very small sample sizes (e.g. Fertel-Daly, Bedell, & Hinojosa, 2001; Losinski, Cook, Hirsch, & Sanders, 2017). Systematic reviews have revealed that weighted pressure vests are not effective at treating autism, among other disabilities (e.g. Dunst, Trivette, Hamby, & Simkus, 2013; Stephenson & Carter, 2009). There is very little literature on the effect of weighted pressure vests on anxiety. To date, this potential effect has been most clearly described in a handful of studies on dogs, where it has been effective at reducing dogs’ fear of thunder (Cottam, Dodman, & Ha, 2013; Fish, Foster, Gruen, Sherman, & Dorman, 2017; King, Buffington, Smith, & Grandin, 2014).

Weighted blankets, or blankets that have been filled with metal weights or a heavy material such as sand (these usually weigh much more than the vests, often 12 pounds or more), have more clear results than the weighted pressure vests (e.g. Champagne, Mullen, Dickson, & Krishnamurty, 2015). However, many of the studies have the same pitfalls: small sample sizes, samples that only include children, and samples that consist only of non-normative individuals (i.e. autistic individuals, or individuals with insomnia, or patients in a psychiatric inpatient facility; e.g. Champagne et al., 2015; Gee, Peterson, Buck, & Lloyd, 2016; Gringras et al., 2014). While the results have been mixed, there is some agreement that anxiety is reduced by the use of a weighted blanket, at least in some specific populations and contexts, such as inpatients at a psychiatric facility and individuals undergoing dental care (e.g. Chen, Yang, Chi, Chen, 2013; Novak, Scanlan, McCaul, MacDonald, & Clarke, 2012). The potential anxiolytic effects of other pressure modalities have yet to be confirmed empirically.
One common, perhaps ubiquitous modality of both pressure and touch is hugging (e.g. Fromme et al., 1989). Hugging has also been overlooked in the literature. One of the few hugging studies found that the number of daily perceived hugs correlated positively with increased social support, which then buffered stress and improved resistance to infection (Cohen, Janicki-Deverts, Turner, & Doyle, 2015). This supports the hypothesis that hugging can reduce stress while increasing social support. The frequency of hugs has also been associated with lower blood pressure and higher oxytocin, suggesting that hugs have a wide array of positive benefits that are all linked to vagal stimulation (Light, Grewen, & Amico, 2005; Porges, 2001; Stock & Uvnäs-Moberg, 1988). However, most of the experimental studies on hugging actually assessed “warm contact,” which consists of positive social and physical interaction with a partner (usually a romantic partner) that often culminates in a twenty-second hug – this has been found to increase oxytocin, reduce alpha amylase, reduce blood pressure, and increase happiness (Holt-Lunstad, Birmingham, & Light, 2008; Matsunaga et al., 2011). No study has analyzed the psychopathological effects of hugging alone, and the effects of hugging on anxiety and depression have yet to be the subject of published research.

It is also unclear whether any benefits that might arise from hugging are due to the touch and pressure involved in the act, or if they are due simply to the presence of a supportive friend, as the presence of a friend alone can reduce some measures of stress, such as cardiovascular reactivity (Christenfeld et al., 1997). Cardiovascular reactivity also happens to be related to vagal stimulation, just like touch and pressure, implying that similar or connected processes may be at the root of these potential treatments (Huang, Webb, Zourdos, & Acevedo, 2013).

In sum, pressure, touch, and the presence of a friend all show promise as treatments for anxiety, stress, and depression. But why focus on these three points of concern? The answer is
threefold: anxiety, stress, and depression are all exceedingly common, both as various disorders and as subthreshold nuisances; these illnesses incur profound amounts of pain, suffering, economic costs, and death every year; and these illnesses have yet to have affordable and highly reliable treatment options (DuPont et al., 1996; Kessler et al., 2005). Any new treatments for the disorders and corresponding suffering these maladies cause has the potential to help millions of people around the world.

**Present Investigation**

Given past research, I hypothesized that hugging, weighted pressure vests, and the presence of a friend could be used as treatments to reduce anxiety, stress, and depression. More specifically, I hypothesized that brief interventions of hugging, wearing a weighted pressure vest, or being in the presence of a friend throughout a stressful situation would reduce state anxiety, state social anxiety, state stress, and state depression while increasing state social support. Participants completed the Trier Social Stress Test (TSST), which consisted of a speech task and a math task performed in front of a camera monitored live by a judge, in order to elevate stress and anxiety levels and thus make changes in them more easily measurable (Kirschbaum, Pirke, & Hellhammer, 1993). Throughout the TSST, participants either had nothing added (Control), wore a weighted pressure vest throughout (Vest), were hugged three times by a friend (Hug), or were visited briefly three times by a friend (Friend). State measures of anxiety, stress, depression, and social support were then completed after the TSST concluded.

Hugs, weighted pressure vests, and the presence of a friend were examined as treatments for anxiety, stress, and mood disorders for the first time in this study. These potential remedies could provide patients with affordable, mobile, and self-sufficient forms of treatment. This study put these hypotheses to empirical test.
Method

Participants

Participants were 155 (43 Males, 110 Females, 2 Other) students from a small liberal arts college on the Eastern Seaboard who either received research credit for an introductory psychology course or $5 in cash in exchange for their participation. These students were recruited from late February to late April 2018. Participants from introductory psychology courses were able to sign up for the study online through Sona (www.sona-systems.com); other participants were able to sign up on a publicly available Google Sheets spreadsheet (www.google.com). Participants were also recruited via word-of-mouth (this included paid recruiters, or individuals who were compensated $3 to recruit pairs of participants), Facebook posts to the college class pages the experimenter had access to (www.facebook.com), and emails to a randomized sample of 400 students. Participants were randomly assigned without replacement (based on when they signed up and their assumed gender) to one of four conditions: Control, Vest, Hug, or Friend.

Materials

Four weighted pressure vests (Hyper Wear Inc., Austin, TX) weighing 10 pounds each were required for this experiment, one in each of the four commonly available sizes (small, medium, large, and extra-large). One white lab coat, for the experimenter to wear, as well as an intercom system with a live video camera were needed for the stress test. A number of pretest measures were used, all of which were included to see if they moderated the impact of condition on the posttest measures. The pretest measures included the seven-item Generalized Anxiety Disorder scale, in order to measure trait anxiety (GAD-7; ranging in response from 0 = Not At All to 3 = Nearly Every Day, with items such as “Feeling nervous, anxious, or on edge”; Spitzer, Kroenke,
Williams, & Löwe, 2006), and the short, six-item form of the Social Interaction Anxiety Scale (SIAS-6) and the six-item short form of the Social Phobia Scale (SPS-6) combined into one scale in order to measure trait social anxiety (ranging in response from 0 = Not at all characteristic or true of me to 4 = Extremely characteristic or true of me, with items such as “I can feel conspicuous standing in a line”; Peters, Sunderland, Andrews, Rapee, & Mattick, 2012). The two-item Patient Health Questionnaire (PHQ-2; ranging in response from 0 = Not At All to 3 = Nearly Every Day, with items such as “Little interest or pleasure in doing things”; Löwe, Kroenke, & Gräfe, 2005) was also included, in order to measure trait depression, as was the twelve-item Multidimensional Scale of Perceived Social Support (MSPSS; ranging in response from 1 = Very Strongly Disagree to 7 = Very Strongly Agree, with items such as “There is a special person who is around when I am in need.”; Zimet, Dahlem, Zimet, & Farley, 1988), in order to measure trait social support. The ten-item Perceived Stress Scale (PSS; ranging in response from 0 = Never to 4 = Very Often, with items such as “In the last month, how often have you been upset because of something that happened unexpectedly?”; Cohen, Kamarck, & Mermelstein, 1994), was also included in order to measure trait stress. Participants also completed a demographics survey asking for their gender (one item, “What gender are you?”, with responses ranging from Male to Other) and age (one item, “How old are you?”, with responses ranging from 18 to 23). All pretest measures were significantly modified from their original forms to accommodate the specific circumstances of the study.

A number of posttest measures were also used in order to measure any immediate psychological changes as a result of the hugs, weighted pressure vests, or the presence of a friend. These included: the six-item short form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI; with responses ranging from 1 = Not At All to 4 = Very Much, and
items such as “I feel calm”; Marteau & Bekker, 1992), in order to measure state anxiety, as well as the six-item State Social Anxiety Questionnaire (ranging in response from $1 = \text{Not At All}$ to $5 = \text{Extremely}$, with items such as “I worried about what the judges thought of me.”; Kashdan & Steger, 2006), in order to measure state social anxiety. A one-item State Stress Scale based loosely on a daily stress measure (ranging in response from $1 = \text{Not At All}$ to $5 = \text{Extremely}$, with the item “How stressed did you feel \textbf{DURING} the speech and math tasks you just completed?”; Park, Armeli, & Tennen, 2004), in order to measure state stress, and the twenty-item Positive Affect and Negative Affect Schedule (PANAS; ranging in response from $1 = \text{Not At All}$ to $5 = \text{Extremely}$, with items such as “Interested”; Watson, Clark, & Tellegen, 1988), in order to measure state depression were also included. The posttest also included a one-item State Social Support Scale based loosely on the MSPSS (ranging in response from $1 = \text{Not At All}$ to $5 = \text{Extremely}$, with the item “To what extent did you feel emotionally supported \textbf{DURING} the speech and math tasks you just completed?”; Zimet, Dahlem, Zimet, & Farley, 1988) in order to measure state social support. All posttest measures were heavily modified from their original forms to accommodate the specific circumstances of the study.

**Procedure**

Prior to arrival at the lab, participants signed up for the study, entitled “Social Behavior and Emotions” in order to minimize demand characteristics on Sona or the Google Sheets spreadsheet. It was made clear to all participants in the description of the study that they needed to sign up with a friend. This was necessary to ensure that all conditions had equivalent groups of participants; otherwise the conditions that do not require a friend to come along (Control and Vest) would have more participants who cannot bring a friend, while the friend-bringing conditions (Hug and Friend) would have more participants who can bring a friend, thus creating
inequivalent groups with differing characteristics. However, it would also be problematic for all participants to bring a friend, as the Friend condition is specifically trying to measure the effect of the presence of a friend, and this variable would be very difficult to differentiate if all participants brought a friend. It would also make it impossible to ascertain if any benefits in the Vest condition were from the weighted pressure vest alone if a friend was also present. As such, after signing up, participants were randomly assigned without replacement to condition based on when they signed up and their assumed gender, and were then either emailed a reminder to bring a friend to the study (if in the Hug or Friend conditions) or an update informing them to instead come alone (if in the Control or Vest conditions).

The following procedure can be most clearly understood by examining Figure 1. All participants, upon arrival to the lab, were greeted by the male experimenter, who wore a white lab coat in order to be more imposing and thereby generate more stress and anxiety during the TSST. All participants were then asked to read and sign an informed consent form. After completing the consent process, if participants were in the Control condition, they were then led into the lab room and asked to complete the pretest measures on the computer using Qualtrics (www.qualtrics.com). Some participants completed the pretest measures online, before arriving for the lab session. After completing the pretest measures, the participants informed the experimenter that they were done, and the experimenter took them back to the waiting area where they had arrived and instructed the participants to wait for one minute while the experimenter set something up. This was the participants’ first one-minute break. After the one-minute break was over, the experimenter led the participants back to the lab room. The experimenter then informed them that they would be giving a five-minute speech to the camera in the lab room (which the experimenter said was monitored live by three judges, including the
experimenter, but it was in actuality only monitored by himself) about why they would be a good candidate for their ideal job. Participants then began the TSST, which consisted of a three-minute preparation period, a five-minute speech task, and a five-minute math task (Kirschbaum et al., 1993; Kirschbaum, 2015). Participants were first given three minutes to prepare for their speech task before performing the five-minute speech (Kirschbaum, 2015). During the speech task, if the participants stopped speaking for an extended period of time, the experimenter would tell the participants via intercom to continue, as there was still time remaining. After the speech was completed, the second one-minute break took place, though the participants remained in the lab room for this break. Then participants were instructed to serially subtract 17 from 2023 for another five minutes and were told to restart if they made a mistake (Kudielka, Hellhammer, Kirschbaum, Harmon-Jones, & Winkielman, 2007). Afterwards, the experimenter informed the participants that they now had a third and final one-minute break; the participants again remained in the lab room for the break. After the break, the participants were instructed to complete the posttest measures on the computer using Qualtrics (www.qualtrics.com).

The procedure for the Vest condition was nearly identical to the above procedure for the Control condition, except during the first one-minute break the experimenter helped participants put on the weighted pressure vest. Participants in the Vest condition wore the vest throughout the experiment, until the final one-minute break, when the experimenter helped participants remove the vest. However, the vest was accidentally left on two participants throughout the posttest measures.

If the participant was in the Hug condition, then the procedure was also similar to that of the Control condition but with a few major changes. One such change is that, at the beginning of the study, the participant and friend were told that during the study they will not be allowed to
talk to or touch each other without permission from the experimenter. This was to ensure that communication and touch that was not a part of the protocol—both of which could generate social support or reduce stress and anxiety—were relatively constant across participants and conditions. They were also informed that the participant would be doing tasks in the lab room while the friend primarily waited in the waiting area, where they arrived. The procedure was then identical to that of the Control condition until the first one-minute break, when the participant and friend were instructed to hug each other, using both hands and arms for fifteen seconds. Then both the participant and the friend waited together for the rest of the one-minute break. The procedure was then identical to that of the Control condition until the second one-minute break, when the friend was then asked to follow the experimenter to the lab room and hug their friend in the same way as before for fifteen seconds. After the hug was over, the experimenter asked the friend to return to the waiting area. The participant and friend then waited out the rest of the second one-minute break alone. The procedure was then identical to that of the Control condition until the third and final one-minute break, when the same fifteen second hug was repeated once more before the friend was asked to return to the waiting area.

The Friend condition was nearly identical to the Hug condition. However, instead of receiving a hug during the first break, the participant and friend just waited together for one minute in the waiting area (note: the gender of the friend in both the Hug and the Friend conditions was not recorded, though the experimenter anecdotally observed that the majority of participants brought a same-sex friend). During the two other minute-long breaks the friend entered the second room and stood near the participant for the same fifteen-second interval that the hug took place in in the Hug condition, but the friend did not touch or talk to them before being asked to leave after fifteen seconds.
Afterwards, both participants and friends were debriefed verbally and given a debriefing form. They were then compensated for participating and dismissed.

Results

All of the scales were accordingly reduced to their corresponding indices by following each scale’s instructions on how to do so. This required adding up the scores for each item on each scale, reverse-scoring if necessary, and then averaging the scores. An identical reduction strategy was done for scales without explicit instructions, such as the State Social Anxiety Scale. No participants were dropped from analyses, as statistical power was already suboptimal. The data was analyzed using SPSS Version 24.0 (IBM Corp., Armonk, NY).

A one-way Analysis of Variance (ANOVA) with condition was run in order to determine if there were any significant differences in state anxiety ($M = 2.74$, $SD = .65$, $\alpha = .81$) between conditions. No significant differences in state anxiety were found, $F(3, 151) = .64, p = .589$. An identical one-way ANOVA with condition was also run on state social anxiety ($M = 2.67$, $SD = 1.20$, $\alpha = .93$). No significant differences in state social anxiety were found, $F(3, 151) = .73, p = .534$. An identical one-way ANOVA with condition was also run on state stress ($M = 3.16$, $SD = 1.10$). This failed to find significant differences in state stress, $F(3, 150) = 1.23, p = .300$. A one-way ANOVA with condition was also run on state depression, ($M = 3.10$, $SD = .65$, $\alpha = .89$). This also failed to find any significant differences in state depression, $F(3, 151) = .78, p = .509$. Lastly, a one-way ANOVA with condition was run on state social support, ($M = 1.68$, $SD = .97$). This also failed to find any significant differences in state social support, $F(3, 151) = 1.08, p = .359$. These results are completely contrary to hypotheses, see Figure 2.
**Exploratory Analyses**

Least Significant Difference (LSD) post-hoc tests were also run to look for significant comparisons between groups. One point of interest from the post-hoc test was that state social support was marginally higher in the Hug condition ($M = 1.87, SD = 1.06$) than in the Control condition ($M = 1.47, SD = .80$), $p = .074$, see Figure 3. The only other revelation of note from the post-hoc test was that state stress was marginally higher in the Friend condition ($M = 3.42, SD = 1.11$) than in the Control condition ($M = 2.95, SD = 1.14$), $p = .062$.

Five three-way ANOVAs with condition, gender, and each of the trait measures (trait anxiety, trait social anxiety, trait stress, trait depression, and trait social support), which were median-split, were also run. This was done in order to assess whether any of the trait measures moderated the impact of condition or gender on the state measures. High trait anxiety ($M = .96, SD = .68, \alpha = .87$), high trait social anxiety ($M = .88, SD = .62, \alpha = .85$), high trait stress ($M = 1.88, SD = .63, \alpha = .84$), and high trait depression ($M = .81, SD = .76, \alpha = .70$) did not significantly moderate the impact of condition on their respective state measures, nor did they significantly interact with condition or gender ($ps > .16$). However, a three-way ANOVA with condition, gender, and median-split trait social support found that gender and trait social support ($M = 5.66, SD = .87, \alpha = .87$) significantly interacted to predict state social support, $p = .003$, $\eta^2_p = .062$, see Figure 4. Males with low trait social support had much higher state social support ($M = 2.09 \pm .21$) than males with high trait social support ($M = 1.33 \pm .21$), and females with high trait social support had much higher state social support ($M = 1.82 \pm .13$) than females with low trait social support ($M = 1.54 \pm .13$). No other significant differences with regards to the trait measures were found ($ps > .16$).
Discussion

As happens so often in research, the hypotheses this project began with did not hold up under empirical test. It appears that brief interventions utilizing weighted vests, hugging, and the presence of a friend were all ineffective at reducing state anxiety, state social anxiety, state stress, and state depression during a stressful situation. And any increases in state social support appear to be modest at best and heavily influenced by gender and trait social support (and are largely in the Hug condition). The increase in state stress in the Friend condition might also just be the result of the awkward, confusing nature of the situation participants in that condition were put in (they had to stand near their friend silently for fifteen seconds at a time). In any case, these results do not appear, at least at first glance, to align with previous research suggesting that all of these conditions can produce rapid beneficial effects (e.g. Field, 2010; Light et al., 2005), but further examination suggests that they may have a substantial theoretical background nonetheless (e.g. Jakubiak & Feeney, 2016).

There are a number of possible explanations as to why these results occurred. The most likely of these explanations is that the beneficial effects of touch, pressure, and the presence of a friend are heavily moderated (and perhaps fully mediated) by the perception or interpretation of the touch, pressure, or presence of a friend. This idea is robustly supported in a number of studies on touch and pressure, which suggest that many of its benefits are due to the release of oxytocin via vagal stimulation (Jakubiak & Feeney, 2016). Oxytocin has been clearly linked to perceived social support, as well as dopaminergic and serotonergic pathways, which could be why massage has antidepressant and anxiolytic properties (Baskerville & Douglas, 2010; Field, 2010; Marazziti et al., 2012). If oxytocin is indeed at the root of all of the benefits related to touch, pressure, and social support, then it would make sense that these benefits would only present
themselves in positive contexts, as oxytocin is a context-dependent hormone (Jakubiak & Feeney, 2016). Most of the benefits of oxytocin are not realized unless they are paired with a positive interpretation of the oxytocin-releasing stimulus – and no such positive interpretation was made during this study (Jakubiak & Feeney, 2016).

This theory fits well with the collected data. It explains why there was generally no significant effects, across a wide variety of conditions. It also explains why the Hug condition was the only condition to demonstrate a marginal increase in social support, as the Hug condition was the only condition to convey an inherent degree of positive context (as hugs are generally thought of as very positive actions). However, this positive context was likely subdued, as the hugs were asked for by an experimenter—not generated naturally out of prosocial impulses; this could explain why this effect was only marginal. Oxytocin also explains why an interesting interaction occurred with trait social support and gender on state social support, as there are a number of studies that suggest that men and women process oxytocin (and therefore social support) very differently from one another (e.g. Kubzansky, Mendes, Appleton, Block, & Adler, 2012). For instance, men given intranasal oxytocin had a decrease in negative affect, while women given the same had more anger and better performance on a math task (Kubzansky et al., 2012). Females also appear to respond more positively to touch in general, as well as hugs specifically, though this was not linked to oxytocin (Stier & Hall, 1984). In addition, it has been hypothesized that women often use oxytocin and estrogen to engage a tend-and-befriend response instead of a fight-or-flight response when stressed, suggesting that oxytocin has a direct effect on arousal systems, which are critical in managing stress and anxiety (Olff, Langeland, Draijer, & Gersons, 2007). Also, if oxytocin and the dopaminergic and serotonergic systems are linked, then it makes sense that anything affecting the benefits of oxytocin (such as a
negative context) might also inhibit the effects of the dopaminergic and serotonergic systems, thus demonstrating null effects on state anxiety and state depression.

It is also possible that these interventions are effective, but only when implemented for long periods of time (e.g. wearing the vest for a longer period of time), or when used repeatedly (e.g. wearing the vest for several short intervals a day for several weeks). Long-term intervention strategies (e.g. massaging a participant daily for several weeks) have been used effectively in previous research (e.g. Field, 2010). This theory, however, conflicts with several other studies that demonstrate relatively rapid changes in oxytocin and its accordant benefits (Jakubiak & Feeney, 2016).

It is also, of course, possible that the hypotheses and assumptions that this study was based on are false, and that there are very little to no actual benefits conferred from being hugged, wearing a weighted pressure vest, or being in the presence of a friend. However, it is important to note that this conclusion would have a number of caveats. One such caveat would be that the presence of a friend condition only measured the effect of the presence of a friend when behavior between friends was restricted; it is possible some benefits could have been gained if social behavior had not been restricted. There is also the potential for these results to simply be the product of demand characteristics, as it was somewhat obvious that the vests, hugs, and the friend visitations were meant to change how participants felt; the experimenter noted anecdotally that some participants guessed before debriefing that the hug in particular was meant to be beneficial in some way (Nichols & Maner, 2008). While both of these explanations are possible, they seem unlikely to be responsible for the results given the amount of research suggesting that these brief interventions have at least some measurable benefits (e.g. Field, 2010;
Light et al., 2005; Novak et al., 2012). The research indicating the importance of context and interpretation is also at odds with these explanations (Jakubiak & Feeney, 2016).

If the “Oxytocin Theory” mentioned above is true, then this study seems to confirm that theory’s findings as well as to suggest that the effects from the basic actions of wearing a weighted vest, being hugged by a friend, or being in the presence of a friend have very little psychological value when they are not interpreted positively.

**Limitations**

The study, however, is not without limitations. The sample size is not as large as it was hoped to be (its power is below 0.8), as the study had limited funding and access to participants. The gender of the friend in both the Hug and Friend condition was also not accounted for, and it is likely that the gender of the friend is a significant moderator, as the gender of both the hugger and individual receiving the hug has a major role in touch behaviors and touch responses during a hug (Stier & Hall, 1984). This may be due to concerns about the possibility of intimacy, as well as social norms (Stier & Hall, 1984).

The study may also have lacked ecological validity; that is, the forced, clinical nature of the experiment may have made a lab-based hug irreconcilable with a real, genuine hug born from prosocial impulses (Sbordone, 1996). This may well be the case, and, if it is indeed what occurred, serves to further support the aforementioned “Oxytocin Theory,” in that the context and interpretation of the hug is what makes a hug genuine and beneficial, as opposed to the action itself.

As mentioned before, demand characteristics may also have contributed to the results (Nichols & Maner, 2008). It is thoroughly possible that participants believed that the hug (or any of the other conditions) was meant to be beneficial (or perhaps harmful) and therefore were
biased to report more positive (or negative) results. However, this seems somewhat unlikely given the weak results across all conditions, and no indications of negative bias from participants, but it is a potential factor that should be considered.

Another limitation was that a handful of participants had somewhat flawed data (e.g. they were friends with the experimenter or their vest was not removed before the posttest measures) that was kept in the analysis for the time being in an effort to increase the power of the study. Further analyses eliminating these individuals will be done at a later time.

**Future Research**

Future research should focus on how context, meaning, and framing can impact the benefits of both social interactions and touch and pressure stimulations. It would be interesting to see what the benefits of a truly naturalistic hug in a positive context are, but that might be impossible to truly accomplish, as the act of trying to generate a hug between two friends is inherently artificial and would likely be detected by the participants. However, further studies examining the context of touch and pressure, particularly in the form of hugs, should be performed, in an effort to truly understand the benefits that may be gained.

Oxytocin, and its relationship to touch, pressure, social support, and the dopaminergic and serotonergic systems needs to be studied in much more depth. Once these systems are understood, manipulating them for human benefit becomes much easier.

**Conclusions**

In sum, weighted pressure vests, hugs, and the presence of a friend do not reduce anxiety, stress, or depression, while hugging may increase social support. As such, it appears that weighted pressure vests, hugs, and the presence of a friend are not viable as treatments for anxiety, stress, or mood disorders. However, it is likely that the effects of these potential
treatments were attenuated by the lack of positive context or interpretation during the stress test; it is therefore possible that weighted pressure vests, hugs, and the presence of a friend are effective treatments once they are situated in a positive context or interpretation. More research must be done on the role of oxytocin in touch and pressure (especially with regard to hugs), as well as on how context and interpretation moderate this relationship.
References


**Appendix**

**Figure 1.** A flow chart of the four conditions in the experiment, demonstrating the procedures that each undergoes.
Figure 2. Mean state variable scores across conditions.
Figure 3. Mean state social support in the Control condition and the Hug condition.
Figure 4. The interaction between gender and mean trait social support on mean state social support.