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Social Ties and Cardiovascular Function: An Examination of Relationship Positivity and Negativity during Stress

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Abstract

The quality and quantity of one's relationships have been reliably linked to morbidity and mortality. More recently, studies have focused on links between relationships and cardiovascular reactivity as a physiological mechanism via the stress-buffering hypothesis. However, not all social relationships are consistently positive which points to the importance of a more comprehensive examination of relationship that includes negative qualities. In this study, we manipulated relationship positivity and negativity with an experimenter and examined its influence on cardiovascular reactivity. Results revealed that relationship positivity was associated with lower systolic blood pressure (SBP) reactivity for men and women. Relationship negativity, on the other hand, was related to less of an increase in diastolic blood pressure (DBP) reactivity in men. Internal analyses showed that perceptions of positivity and negativity interacted such that high positivity / high negativity perceptions (ambivalence) were related to the highest SBP reactivity. Results of this study suggest that the quality of one's relationships is an important moderator of cardiovascular reactivity during stress.

Epidemiological research indicates that social relationships may protect individuals from various causes of morbidity and mortality, including cardiovascular disease which is the leading cause of death in the U.S. (Berkman et al., 2000; Cohen, 2004; House, Landis, & Umberson, 1988; Uchino, 2004). For instance, a review by House et al. (1988) found evidence suggesting that the link between social relationships and health was comparable to risk factors such as smoking and lack of physical activity. Most of this research has focused on the protective benefits of supportive social relationships. However, not all social relationships are consistently positive. Although social relationships can be sources of support and

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understanding, they can also be sources of conflict, criticism, jealousy, and rejection (Major, Zubek, Cooper, & Cozzarelli, 1997; Braiker & Kelley, 1979). Prior research on social support has tended to ignore the complexity of relationships that may include both positive and negative aspects. A more comprehensive model of such relationship influences is depicted in Figure 1 (Uchino et al., 2001).

According to our model, social network members that are mostly sources of positivity would represent the high positivity / low negativity corner (e.g., a loving spouse or friend that you can always count on). Network ties that are mostly sources of negativity would represent low positivity / high negativity (e.g., an unreasonable supervisor). Those low in both positivity and negativity are labeled as indifferent and may represent network ties that are characterized by low levels of social interactions (a neighbor you rarely see, a student in a class with you). A relatively unique aspect of this model for the social relationships and health literature is represented in the high positivity / high negativity corner or what we label an ambivalent tie. This refers to network members that are a relatively strong source of both positivity and negativity (e.g., overbearing parent).

There are several reasons why a more comprehensive study of relationships may be important. Supportive ties appear to reduce cardiovascular reactivity, however, other ties such as ambivalent ties predict worse outcomes such as increased depression, perceived stress, and cardiovascular function (Holt-Lunstad, Uchino, et al., 2003; Holt-Lunstad, Uchino, Smith, & Hicks, 2007; Uchino et al., 2001). This may occur because a relationship characterized as ambivalent may lead to significant interpersonal stress above and beyond that of aversive ties. For instance, a network tie that is a source of both positivity and negativity may be considerably less predictable and thus may be associated with greater emotional responses, and, therefore, reactivity. Our prior work has focused on these relationships as they naturally occur in friendships (e.g., Holt-Lunstad et al., 2007). Although more limited in its generalizability to established relationships, a more controlled approach would be to experimentally manipulate these relationship dimensions using new relationships. Such an approach could provide converging evidence for the different operationalizations of support used in prior work that includes both strangers and friends (e.g., Christenfeld et al., 1997; Gerin, Pieper, Levy, & Pickering 1992; Lepore, Allen, & Evan, 1993). Thus, one aim of this study is to examine if an experimental manipulation of relationship positivity and negativity similarly predicts cardiovascular reactivity during stress.

A related aim of this study is to investigate the processes potentially associated with relationships. At the biological level, cardiovascular reactivity is one physiological indicator of stress, and studies have demonstrated the link between cardiovascular reactivity and disease processes (Manuck, 1994; Treiber et al., 2003). Most of the literature on relationships and reactivity as a physiological mechanism has examined the stress-buffering influences of social support which suggests that social support buffers the impact of stressful events (Cohen & Wills, 1985; Cohen, 1988). Consistent with this perspective, Gerin and colleagues (1992) found that social support (supportive vs. neutral confederate) was associated with significantly lower blood pressure and heart rate during a debate stressor. These studies support the assumption that the presence of a supportive other can reduce physiological response to a stressor, although there is mixed evidence on whether a stranger provides the same level of stress buffering effects as a friend (Christenfeld et al., 1997; Kamarck, Annunziato, & Amateau, 1995; Fontana et al., 1999). It is also important to note that according to our model, relationship processes may be related to health outcomes by not only decreasing (i.e., supportive ties) but also increasing (ambivalent ties) cardiovascular reactivity.

In summary, the link between social relationships and health outcomes are well-documented, but there are still unanswered questions concerning the relationship dimensions (e.g., positivity

and negativity) responsible for such links as well as potential biological pathways. In the present study, we addressed these issues in several ways. First, in contrast to prior work, we used direct manipulation of relationship positivity and negativity in a more controlled manner. This more controlled approach may increase the sensitivity of the experiment while replicating aspects of prior work using a different operationalization of relationship quality. Consistent with prior research, we predicted that experimenter positivity would be associated with lower state anxiety, threat, dominance, cardiovascular reactivity, and higher affiliation. In contrast we hypothesized that experimenter negativity would be associated with higher state anxiety, appraisals of threat and dominance, cardiovascular reactivity, and lower appraisals of affiliation. In addition, we predicted an interaction such that experimenters high in both positivity and negativity (ambivalence) would be associated with a more detrimental pattern on these psychological measures, as well as the highest levels of cardiovascular reactivity.

Methods

Participants

Participants were 77 healthy men and 101 healthy women with a mean age of 23.5. Participants were mostly white (75%) and 79% reported being single with some college education. Participants were recruited either from an introductory psychology course for extra course credit, or from the community and paid for their time. Because physiological measurements were assessed, participants were excluded who were not generally healthy, or had medical conditions with a cardiovascular component (e.g. no hypertension, see Cacioppo et al, 1995).

Procedure

Upon arrival to the study, participants were randomly assigned to a relationship positivity and negativity condition (see below). A first experimenter obtained informed consent from participants then positioned a properly sized cuff on their non-dominant arm. Participants were then given psychological and demographic questionnaires to complete after which a 10-minute baseline assessment was obtained with cardiovascular readings taken once every 90 seconds after the first five minute period.

After the baseline reading, participants were given measures of pre-task appraisals, perceived control, and a state anxiety questionnaire (see below). Participants were then turned over to a second experimenter in the control room whom they were told would give them further instructions, monitor their vital signs, and be recording and evaluating their speech. They were then given 3 minutes to prepare and 3 minutes to perform a speech stressor (see below) while cardiovascular measures were taken at 30 seconds and 2 minutes into each epoch. Following the speech task, participants completed a 5 minute recovery assessment with cardiovascular assessments obtained every 90 seconds after an initial 30 second period.

Following the recovery period, the first experimenter returned and obtained assessments of perceived control and state anxiety. As our manipulation check, participants were also asked to rate how helpful and upsetting they viewed the second experimenter on a 1 (not at all) to 6 (extremely) point scale using the social relationships index (SRI, Campo et al., 2009). A criterion measure of subjectively felt ambivalence was also assessed by asking participants to rate how mixed or conflicted they felt towards the second experimenter (Priester & Petty, 1996). Following these questionnaires, the blood pressure cuff was removed and participants were debriefed and thanked for their participation.

As noted above, we utilized two different female experimenters in order to separate the manipulation from the initial consent and procedure. We did not match the gender of the experimenter with the participant because our prior work has not revealed consistent evidence

for such gender differences (Uchino, Holt-Lunstad, Uno, Campo, & Reblin, 2007). The quality of the relationship between the participant and second experimenter was manipulated using recorded versions of instructions for a speech task which were delivered via an intercom system. The wording for the speech instructions given by the second experimenter was based on our theoretical model and adapted from Uchino & Garvey (1997) who used an experimenter positivity manipulation, and Gallo, Smith, & Kircher (2000) who examined experimenter negativity. In initial pilot testing of several participants, positivity ratings were relatively equivalent between the ambivalent and support condition and negativity ratings were relatively equal for the ambivalent and aversive conditions using the experimental manipulations described below. It is important to note that tone of voice and emphasis was an important part of these manipulations.

High positivity, low negativity (Supportive) experimenter—"I'll be just inside this room while you perform your speech. You will need to put together an organized and knowledgeable speech. However, if you need me for any reason or if you have any questions, don't hesitate to ask me. I appreciate your participation in this experiment, and I'd like to be helpful if you should need any help."

Low positivity, high negativity (Aversive) experimenter—"I'll be just inside this room while you perform your speech. Now – if you were listening a moment ago you know you need to put together an organized and knowledgeable speech if you can. If for some reason you need me because you are failing to do the task right, let me know and I will try to help you do better. "

High positivity, high negativity (Ambivalent) experimenter—"I'll be just inside this room while you perform your speech. Now – if you were listening a moment ago you know you need to put together an organized and knowledgeable speech if you can. However, if you need me for any reason or if you have any questions, don't hesitate to ask me. I appreciate your participation in this experiment and I'd like to be helpful. So if for some reason you need me because you are failing to do the task right, let me know and I will try to help you do better."

Low positivity, low negativity (Indifferent) experimenter—"I'll be just inside this room while you perform your speech. You need to put together an organized and knowledgeable speech."

The speech task consisted of participants imagining that they were shopping in a store when a security guard falsely accused them of shoplifting (see Cacioppo et al., 1995). In response to this scenario, participants were asked to formulate a speech to a store manager on (a) their side of the story, (b) what the security guard did wrong, (c) how they could prove they did not steal the belt, and (d) what should be done with the security guard who has made this false accusation.

Cardiovascular Assessments

A Dinamap Model 100 Pro monitor was used to measure SBP, DBP, and heart rate. The Dinamap uses the occillometric method to calculate blood pressure. Cardiovascular assessments were obtained via a properly sized occluding cuff positioned on the non-dominant upper arm. Mean SBP, DBP, and heart rate were calculated by averaging across each assessment period (i.e., baseline, preparation, speech, recovery) to increase reliability (Kamarck et al., 1992).

Psychosocial Measures

Social Relationships Index (SRI)—The SRI was initially developed as a self-report version of the social support interview (Pagel et al., 1987; Kiecolt-Glaser et al., 1991; Uchino,

Kiecolt-Glaser, & Cacioppo, 1992). Participants rated how helpful and how upsetting the experimenter generally was on a 1 (not at all) to 6 (extremely) point scale. A criterion measure of subjectively felt ambivalence was also utilized by asking participants how mix/conflicted they felt towards the experimenter (Priester & Petty, 1996). Prior studies suggest that the SRI has the predicted two factor structure (i.e., positivity and negativity) and good test-retest reliability (Campo et al., 2009).

Threat and challenge appraisals—Prior to the speech task, participants completed a measure of pre-task challenge and threat appraisals utilized by Tomaka et al. (1997). Participants were asked to rate on a 6-point Likert scale "how threatening do you expect the task to be" and "how able they were to cope" with the experiment using a 1 to 6 point Likert scale with 1 = Not at all and 6 = Very Much.

Perceived control—Perceptions of perceived control were assessed via items used in prior social psychophysiological studies (Gerin et al., 1995). Participants were asked to rate the amount of control they perceived they had over the evaluation of their speech task on a 1 to 10 point Likert scale with 1 = Low and 10 = High This measure has been shown to be sensitive to experimental manipulations of control (Gerin, Litt, Deich, & Pickering, 1995)

State anxiety scale—The short-form of the Spielberger State-Trait Anxiety Scale was administered to participants both before and following the psychological stressor with participants being asked to rate their current feelings on a 1 (not at all) to 4 (very much) point scale. (Marteau & Bekker, 1992). The short-form correlates highly with the longer version and evidences good internal consistency in prior work (Chronbach's alpha > .78).

Impact Message Inventory, Form II (IMI)—The IMI (Kiesler et al., 1985) is a circumplex-based inventory designed to evaluate perceptions of another's interpersonal behavior, along the dimensions of the interpersonal circumplex (IPC) – specifically affiliation (i.e., friendliness vs. Hostility) and control (i.e., dominance vs. Submissiveness). Previous research has established the relevance of the IPC in the conceptualization and measurement of social support (Trobst, 2000). The IMI contains 32-items with 4 items per octant. Evidence supports the circumplex structure of the IMI (Kiesler, Schmidt, & Wagner, 1997) and the version used here has been demonstrated to have adequate psychometric properties (e.g., Nealey-Moore et al., 2007; Smith et al., 2009).

Results

Manipulation Checks and Psychosocial Processes

To verify the relationship classification, we first examined the characteristics of the relationship manipulation as assessed by the SRI using a 2 (Positivity: low, high) × 2 (Negativity: low, high) × 2 (Gender: male, female) ANOVA. Analysis revealed a main effect for positivity such that participants found the high positivity experimenter to be more helpful than the low positivity experimenter (M_{low}=3.50, M_{high}=4.16), $F(1,164)=6.76$, $p=.01$, eta-squared=.036. Moreover a negativity main effect showed participants found the high negativity experimenter more upsetting compared to the low negativity experimenter (M_{low}=1.26, M_{high}=1.98), $F(1,164)=20.47$, $p< .0001$, eta-squared=.106. Additionally, examination of mixed and conflicted feelings also revealed a negativity main effect such that participants in the high negative condition also experienced more mixed and conflicted feelings toward the experimenter (M_{low}=1.50, M_{high}=2.35), $F(1,163)=17.36$, $p<.0001$, eta-squared=.095. These findings suggest the effectiveness of our main manipulations. However, no statistical interaction of positivity and negativity was obtained on the subjective criterion measure of ambivalence (i.e., mixed / conflicted feelings).

We next examined psychosocial processes before and during the stressful speech task by conducting a 2 (Positivity: low, high) × 2 (Negativity: low, high) × 2 (Gender: male, female) ANOVA. In examining levels of perceived threat we found a significant main effect for gender, $F(1,166)=13.9$, $p=.0003$, eta-squared=.074, such that women felt more threatened by the task than men ($M_{men}=1.64$, $M_{women}=2.32$). Consistent with this finding, when examining levels of perceived control, a main effect for gender was found such that women felt less control over the task than men ($M_{men}=6.49$, $M_{women}=5.37$), $F(1,166)= 6.66$, $p=.01$, eta-squared=.037. A gender X negativity interaction was also found, $F(1,166)=5.10$, $p=.02$, eta-squared=.027, such that women's perceived threat was highest in the high negativity condition ($p=.09$), whereas men's perceived threat was lowest in the high negativity condition ($p=.11$). Overall, these results suggest some gender differences in that women may have been more sensitive to the experimental context than men. No findings were significant in analysis of state anxiety.

The Impact Message Inventory (IMI) was also completed by the participants in order to determine differences in perceived levels of the experimenter's control and affiliation. A gender main effect showed women viewed the experimenter as more controlling or dominant ($M_{men}= -0.37$, $M_{women}=0.09$), $F(1,166)=11.07$, $p<.001$, eta-squared=.056, and lower in affiliation ($M_{men}=1.40$, $M_{women}=0.32$), $F(1,166)=11.55$, $p<.001$, eta-squared=.051, than did men. Significant negativity condition main effects on control and affiliation were also found such that the high negativity experimenter was viewed as more dominant ($M_{low}=-.043$, $M_{high}=0.15$), $F(1,166)=16.85$, $p<.001$, eta-squared=.085, and less friendly ($M_{low}=1.75$, $M_{high}=-0.03$), $F(1,166)=30.92$, $p<.001$, eta-squared=.136. Additionally, a positivity main effect was found on affiliation scores such that participants rated the high positivity experimenter as friendlier than the low positivity experimenter ($M_{low}=0.22$, $M_{high}=1.50$), $F(1,166)=15.98$, $p=.0001$, eta-squared=.070. No other effects were significant.

Physiological Processes

A 2 (Positivity: low, high) X 2 (Negativity: low, high) X 2 (Gender: male, female) X 3 (Epoch: preparation, task, recovery) mixed model ANCOVA was conducted on the cardiovascular change scores (i.e., prep, task, or recovery minus baseline).[1] Baseline scores for each respective measure were statistically controlled in the analyses and p-levels were adjusted for violations of compound symmetry via the Greenhouse-Geiser correction. Analysis first revealed a positivity X epoch interaction on SBP, $F(2,326)=4.09$, $p<.03$, eta-squared=.023 (see Figure 2). Consistent with our predictions, follow up analysis within epochs revealed a significant positivity main effect for the task period ($p<.04$) *only* such that SBP reactivity was significantly lower in the high positivity condition compared to the low positivity condition. No other effects on SBP were found.

Analysis of DBP revealed a negativity X gender interaction, $F(1,163)=4.30$, $p<.05$, eta-squared=.023, such that men ($p<.02$), but not women (n.s.) showed significantly less of an increase in diastolic blood pressure reactivity in the high negativity experimenter condition. This effect was further qualified by a positivity X negativity X gender interaction, $F(1,163)=4.57$, $p<.05$, eta-squared=.025, such that men ($p<.05$), but not women (n.s.), showed the highest DBP reactivity in the low positivity / low negativity condition. No effects were significant for heart rate.

Internal Analyses

Contrary to our predictions, the experimentally-manipulated positivity X negativity interaction was not significant on any cardiovascular measure. Although the positivity and negativity main effects on helpful and upsetting ratings suggest that our manipulations resulted in the co-

[1]We also replicated our analyses using residualized change scores which produced comparable results.

activation of positivity and negativity (ambivalence), it may be that our manipulation resulted in weaker influences given the lack of a significant interaction on participants' ratings of mixed / conflicted feelings. It is still possible that some individuals may have been more sensitive to aspects of the evaluative relationship context such that a test of positive and negative perceptions of the experimenter as they occurred naturally would be informative. For instance, individuals who may be apprehensive about the evaluative nature of an experimenter might still rate the supportive experimenter as high in both positivity and negativity.

We thus conducted internal analyses of experimenter positivity and negativity ratings from the SRI collapsed across experimental groups utilizing moderated regression. In our model, we first controlled for gender and baseline assessments and all main effects were centered and the cross-product term was calculated (Aiken & West, 1991). Consistent with our prediction, we found a ratings-based positivity X negativity interaction on SBP reactivity (b=1.71, p=.01, eta-squared=.033). As shown in Figure 3, participants who tended to view the experimenter with relatively high levels of both positivity and negativity (ambivalence) had the highest levels of SBP reactivity. In fact, simple slope analyses (one standard deviation above and below the mean) for negativity ratings showed that when upset ratings were relatively low, helpfulness ratings were associated with a nonsignificant decrease in SBP reactivity (p=.20). However, when upset ratings were relatively high, helpfulness ratings were associated with significant increases in SBP reactivity (p<03).

Discussion

The primary aim of this study was to examine if experimental manipulations of relationship positivity and negativity influenced cardiovascular reactivity during stress. Overall, a positive or supportive tie was related to lower cardiovascular reactivity during stress. Although these results were only found for SBP, these findings appear consistent with the stress-buffering influences of social support in that the impact of a stressful event can be buffered by the influence of positive network ties (Cohen & Wills, 1985). However, we also found the high negative experimenter was associated with decreased DBP reactivity for men. Ancillary analyses also provided some support for our hypothesis that a high positivity / high negativity (ambivalent) relationship would be associated with increased cardiovascular reactivity. These main findings are discussed below.

Although several researchers have found that the presence of a supportive other can reduce blood pressure response to a stressful task, there is mixed evidence on whether a stranger can provide a stress-buffering influence (Kamarck et al., 1995; Christenfeld et al., 1997). Prior work on friendships may be limited because an ambivalent or indifferent tie may be viewed in a more positive light simply because they came to assist the participant with the study, thereby producing a transient shift toward a supportive friend. We therefore attempted to manipulate the relationship between a stranger (i.e., experimenter) and the participant in a more controlled manner in order to create relationships that differed in their positive and negative substrates. Although limited in its generalizability to existing relationships, our manipulation checks showed participants found the high positivity experimenter to be more helpful and the high negativity experimenter to be more upsetting. These data suggest that we were able to co-activate relationship positivity and negativity. However, ratings of mixed / conflicted feelings were elevated only in the high negativity condition and there was no evidence that this was especially true in the high negativity / high positivity experimenter condition. Thus, our manipulation of ambivalence may have been weaker than anticipated.

Our weaker manipulation of ambivalence in the laboratory may simply be that ambivalence is best established over the length of more established relationships. The mere definition of ambivalence lends itself to a more extended time frame in that one must have enough

interactions with a person to become familiar with their good points and bad points and then be motivated enough by the good points to remain in the relationship (Berscheid & Reis, 1998). Additionally, an ambivalent network member is considered to be less predictable than a supportive or aversive network member (Uchino et al, 2001) and unpredictability may also be a characteristic of the relationship which must be established through multiple interactions. Furthermore, an individual may need to feel a "closeness" with the network member (as opposed to a stranger in the laboratory) as the individual likely has a vested interest in maintaining the relationship despite its negativity, a condition that in hindsight may not be easily replicable in a laboratory situation. It may also be the case that the nature of ambivalent relationships requires an overlap between self-other representation for it be impactful (Aron, Aron, Tudor, & Nelson, 1991). Thus, even if we were able to manipulate state-like ambivalence in a stranger it may not result in the same degree of interpersonal stress given this lack of overlap. Elucidating such social-cognitive process associated with these relationship processes is an important avenue for future work.

Despite our weaker ambivalence manipulation, we did find in internal analyses that regardless of group assignment, participants who viewed the experimenter as high in positivity and negativity evidenced the greatest SBP responses. Although we do not know the precise processes leading to this association, it is possible that these participants focused on aspects of the manipulation that were salient to them (e.g., voice cues suggesting positive and negative aspects). In a related point, it might be the case that these participants had social networks with more ambivalent ties hence they were especially sensitive to such cues. Unfortunately, we do not have data to directly address these explanations. Nevertheless, these data are consistent with our diary study in which interactions with network ties who were perceived to be high in positivity and negativity were associated with the highest ambulatory SBP during daily life.

It is also worth noting that our findings indicate that strangers can effectively provide support (Lepore et al., 1993; Uchino & Garvey, 1997). Participants found the high positivity experimenter to be more helpful, and SBP was significantly lower during the speech task if the participant was interacting with the positive experimenter. This is consistent with prior research but also adds to prior work in that even strangers can provide stress-buffering support. Of course, it is likely that a highly positive friend may provide the most effective support given their prior history (Christenfeld et al., 1997), but simply receiving support without that relationship history appears sufficient to lower stress responses.

Consistent with current literature (Kiecolt-Glaser & Newton, 2001), we further observed that gender played a role in how the experimenter and context was perceived. Overall, women perceived the experimenter as lower in affiliation and higher in dominance. Additionally, women not only felt they had less control over the evaluation of the task, but they also felt more threatened by the task in the high negativity experimenter condition. These findings seem to indicate that women were more psychologically reactive to the experimental context than men. One reason for this may be because women think more about their relationships and think with greater complexity regarding those relationships, than men do (Acitelli & Young 1996). Indeed, some researchers suggest that women's self concept is more relational than men's self concepts (Markus & Oyserman, 1989); that is, they tend to use relationships in order to define themselves relative to individual, personal characteristics. Unlike prior work, we did not find these differences to be mirrored in physiological reactivity. This could be due to differences in the use of strangers versus established relationships which may result in a weaker relationship context (Kiecolt-Glaser & Newton, 2001).

Unexpectedly, we also found that increases in DBP were significantly less in men presenting their speech to a high negativity experimenter. One possible explanation for this pattern could be related to a withdrawal of effort in response to a negative female experimenter. Christensen

and Heavey (1993) postulated a *demand-with-withdrawal* pattern in marital interactions which is consistent with such a gender difference. In hindsight, this disengagement or *withdrawal* could be relevant to our study as all experimenters interacting with the male participants (both positive and negative) were women. Unfortunately we did not have any assessments of task effort or engagement so future work will be needed to examine the psychological and behavioral processes underlying such differences.

There are several important limitations of our study. First, this was a time-limited laboratory setting. Additionally, we used a fairly young, healthy population and our sample was fairly homogeneous—predominantly white, college-age students. Although blood pressure can be a predictor of future cardiovascular health, whether the blood pressure differences we saw in our young population are indicative of actual cardiovascular risk is something that needs further study. Finally, we cannot with full confidence infer that these data can be applied to more long-lasting relationships; however one strength of this study is our ability to make more causal inferences regarding our manipulated variables, thus providing converging evidence for the general support literature that has used both strangers and existing relationships (Thorsteinsson & James, 1999). Despite these and other related limitations noted above, this study suggests the promise of examining relationship positivity and negativity and physiological processes in a controlled laboratory context although there are significant challenges in creating more “complex” relationships.

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References

Acitelli, LK.; Young, AM. Gender and thought in relationships. In: Fletcher, GJO., editor. Knowledge structures in close relationships: A social psychological approach. Mahwah, NJ: Erlbaum; 1996. p. 147-168.

Aiken, LS.; West, SG. Multiple regression: Testing and interpreting interactions. London: Sage; 1991.

Aron A, Aron EN, Tudor M, Nelson G. Close relationships as including other in the self. Journal of Personality and Social Psychology 1991;60:241–253.

Berkman LF, Glass T, Brissette I, Seeman TE. From social integration to health: Durkheim in the new millennium. Social Science and Medicine 2000;51:843–857. [PubMed: 10972429]

Berscheid, E.; Reis, HT. Attraction and close relationships. In: Gilbert, DT.; Fiske, ST.; Lindzey, G., editors. The Handbook of Social Psychology. Vol. Volume II. New York: Oxford University Press; 1998. p. 193-281.

Braiker, HB.; Kelley, HH. Conflict in the development of close relationships. In: Burgess, RL.; Huston, TL., editors. Social exchange in developing relationships. New York: Academic Press; 1979. p. 135-168.

Cacioppo JT, Malarkey W, Kiecolt-Glaser JK, Uchino BN, Sgoutas-Emch SA, Sheridan JF, Berntson GG, Glaser R. Heterogeneity in neuroendocrine and immune responses to brief psychological stressors as a function of autonomic cardiac activation. Psychosomatic Medicine 1995;57:154–164. [PubMed: 7792374]

Campo RA, Uchino BN, Holt-Lunstad J, Vaughn AA, Reblin M, Smith TW. The Assessment of Positivity and Negativity in Social Networks: The Reliability and Validity of the Social Relationships Index. Journal of Community Psychology 2009;37:471–486.

Cohen S. Social relationships and health. American Psychologist 2004;59:676–684. [PubMed: 15554821]

Christenfeld N, Gerin W, Wolfgang L, Sanders M, et al. Social support effects on cardiovascular reactivity: Is a stranger as effective as a friend. Psychosomatic Medicine 1997;59:388–398. [PubMed: 9251159]

Christensen, A.; Heavey, C. Gender differences in marital conflict: The demand/withdraw interaction pattern. In: Oskamp, S.; Costanzo, M., editors. Gender issues in contemporary society. Thousand Oaks, CA US: Sage Publications, Inc; 1993. p. 113-141.

Cohen S. Psychosocial models of the role of social support in the etiology of physical disease. Health Psychology 1988;7:269–297. [PubMed: 3289916]

Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. Psychological Bulletin 1985;98:310–357. [PubMed: 3901065]

Fontana AM, Diegnan AV, Lepore SJ. Nonevaluative social support reduces cardiovascular reactivity in young women during acutely stressful performance situation. Journal of Behavioral Medicine 1999;22:75–91. [PubMed: 10196730]

Gallo LC, Smith TW, Kircher JC. Cardiovascular and electrodermal responses to support and provocation: Interpersonal methods in the study of psychophysiological reactivity. Psychophysiology 2000;37:289–301. [PubMed: 10860407]

Gerin W, Pieper C, Levy R, Pickering TG. Social support in social interaction: A moderator of cardiovascular reactivity. Psychosomatic Medicine 1992;54:324–336. [PubMed: 1620808]

Gerin W, Litt MD, Deich J, Pickering TG. Self-efficacy as a moderator of perceived control effects on cardiovascular reactivity: Is enhanced control always beneficial. Psychosomatic Medicine 1995;57:390–397. [PubMed: 7480569]

Glynn L, Christenfeld N, Gerin W. Gender, social support, and cardiovascular responses to stress. Psychosomatic Medicine 1999;Vol 61(2):234–242. [PubMed: 10204977]

Holt-Lunstad J, Uchino BN, Smith TW, Cerny CB, Nealey-Moore JB. Social Relationships and Ambulatory Blood Pressure: Structural and Qualitative Predictors of Cardiovascular Function During Everyday Social Interactions. Health Psychology 2003;22:388–397. [PubMed: 12940395]

Holt-Lunstad JL, Uchino BN, Smith TW, Hicks A. On the Importance of Relationship Quality: The Impact of Ambivalence in Friendships on Cardiovascular Functioning. Annals of Behavioral Medicine 2007;33:278–290. [PubMed: 17600455]

House JS, Landis KR, Umberson D. Social relationships and health. Science 1988;241:540–545. [PubMed: 3399889]

Kamarck TW, Jennings JR, Debski TT, Glickman-Weiss E, Johnson PS, Eddy MJ, Manuck SB. Reliable measures of behaviorally-evoked cardiovascular reactivity from a PC-based test battery: Results from student and community samples. Psychophysiology 1992;29:17–28. [PubMed: 1609024]

Kamarck TW, Annunziato B, Amateau LM. Affiliations moderate the effects of social threat on stress-related cardiovascular responses: Boundary conditions for a laboratory model of social support. Psychosomatic Medicine 1995;Vol 57(2):183–194. [PubMed: 7792377]

Kiecolt-Glaser JK, Dura JR, Speicher CE, Trask JO, Glaser R. Spousal caregivers of dementia victims: Longitudinal changes in immunity and health. Psychosomatic Medicine 1991;53:345–362. [PubMed: 1656478]

Kiecolt-Glaser JK, Newton TL. Marriage and health: His and hers. Psychological Bulletin 2001;127:472–503. [PubMed: 11439708]

Kiesler, DJ.; Anchin, JC.; Perkins, MJ.; Cirico, BM.; Kyle, EM.; Federman, EJ. Palo Alto, CA: Consulting Psychologists Press; 1985. The Impact Message Inventory: Form II.

Kiesler, DJ.; Schmidt, JA.; Wagner, CC. Circumplex models of personality and emotions. Plutchik, R.; Conte, HR., et al., editors. Washington, DC: APA; 1997. p. 221-244.

Lepore SJ, Allen KA, Evan GW. Social support lowers cardiovascular reactivity to an acute stressor. Psychosomatic Medicine 1993;55:518–524. [PubMed: 8310112]

Major B, Zubek JM, Cooper ML, Richards C. Mixed messages: Implications of social conflict and social support within close relationships for adjustment to a stressful life event. Journal of Personality and Social Psychology 1997;72:1349–1363. [PubMed: 9177021]

Manuck SB. Cardiovascular reactivity in cardiovascular disease: “Once more unto the breach”. International Journal of Behavioral Medicine 1994;1:4–31. [PubMed: 16250803]

Markus, H.; Oyserman, D. Gender and thought: The role of self-concept. In: Crawford, M.; Gentry, M., editors. Gender and thought: Psychological perspectives. New York: Springer-Verlag; 1989. p. 100-127.

Marteau TM, Bekker H. The development of a six-item short form of the state scale of the Spielberger state-trait anxiety inventory (STAI). British Journal of Clinical Psychology 1992;31:301–306. [PubMed: 1393159]

Nealey-Moore JB, Smith TW, Uchino BN, Hawkins MW, Olson-Cerny C. Cardiovascular reactivity during positive and negative marital interactions. Journal of Behavioral Medicine 2007;30:505–519. [PubMed: 17882542]

Pagal MD, Erdly WW, Becker J. Social networks: We get by with (and in spite of) a little help from our friends. Journal of Personality and Social Psychology 1987;53:793–804. [PubMed: 3681652]

Priester JR, Petty RE. The gradual threshold model of ambivalence: Relating the positive and negative bases of attitudes to subjective ambivalence. Journal of Personality and Social Psychology 1996;71:431–449. [PubMed: 8831157]

Smith T, Berg C, Florsheim P, Uchino B, Pearce G, Hawkins M, et al. Conflict and collaboration in middle-aged and older couples: I. Age differences in agency and communion during marital interaction. Psychology and Aging 2009 June;24:259–273. [PubMed: 19485646]

Thorsteinsson EB, James JE. A meta-analysis of the effects of experimental manipulations of social support during laboratory stress. Psychology and Health 1999;14:869–886.

Tomaka J, Blascovich J, Kibler J, Ernst JM. Cognitive and physiological antecedents of threat and challenge appraisal. Journal of Personality and Social Psychology 1997;73:63–72. [PubMed: 9216079]

Treiber FA, Kamarck T, Schneiderman N, Sheffield D, Kapuku G, Taylor T. Cardiovascular reactivity and development of preclinical and clinical disease states. Psychosomatic Medicine 2003;65:46–62. [PubMed: 12554815]

Trobst KK. An interpersonal conceptualization and quantification of social support transactions. Personality and Social Psychology Bulletin 2000;26:971–986.

Uchino, BN. Social support and physical health: Understanding the health consequences of our relationships. New Haven, CT: Yale University Press; 2004.

Uchino, BN.; Holt-Lunstad, J.; Uno, D.; Campo, R.; Reblin, M. The social neuroscience of relationships: An examination of health relevant pathways. In: Harmon-Jones, E.; Winkielman, P., editors. Social neuroscience: Integrating Biological and Psychological Explanations of Social Behavior. New York: Guilford; 2007. p. 474-492.

Uchino BN, Garvey TG. The availability of social support reduces cardiovascular reactivity to acute psychological stress. Journal of Behavioral Medicine 1997;20:15–27. [PubMed: 9058176]

Uchino BN, Holt-Lunstad J, Uno D, Flinders JB. Heterogeneity in the Social Networks of Young and Older Adults: Prediction of Mental Health and Cardiovascular Reactivity during Acute Stress. Journal of Behavioral Medicine 2001;24:361–382. [PubMed: 11523333]

Uchino BN, Kiecolt-Glaser JK, Cacioppo JT. Age-related changes in cardiovascular response as a function of a chronic stressor and social support. Journal of Personality and Social Psychology 1992;63:839–846. [PubMed: 1447696]

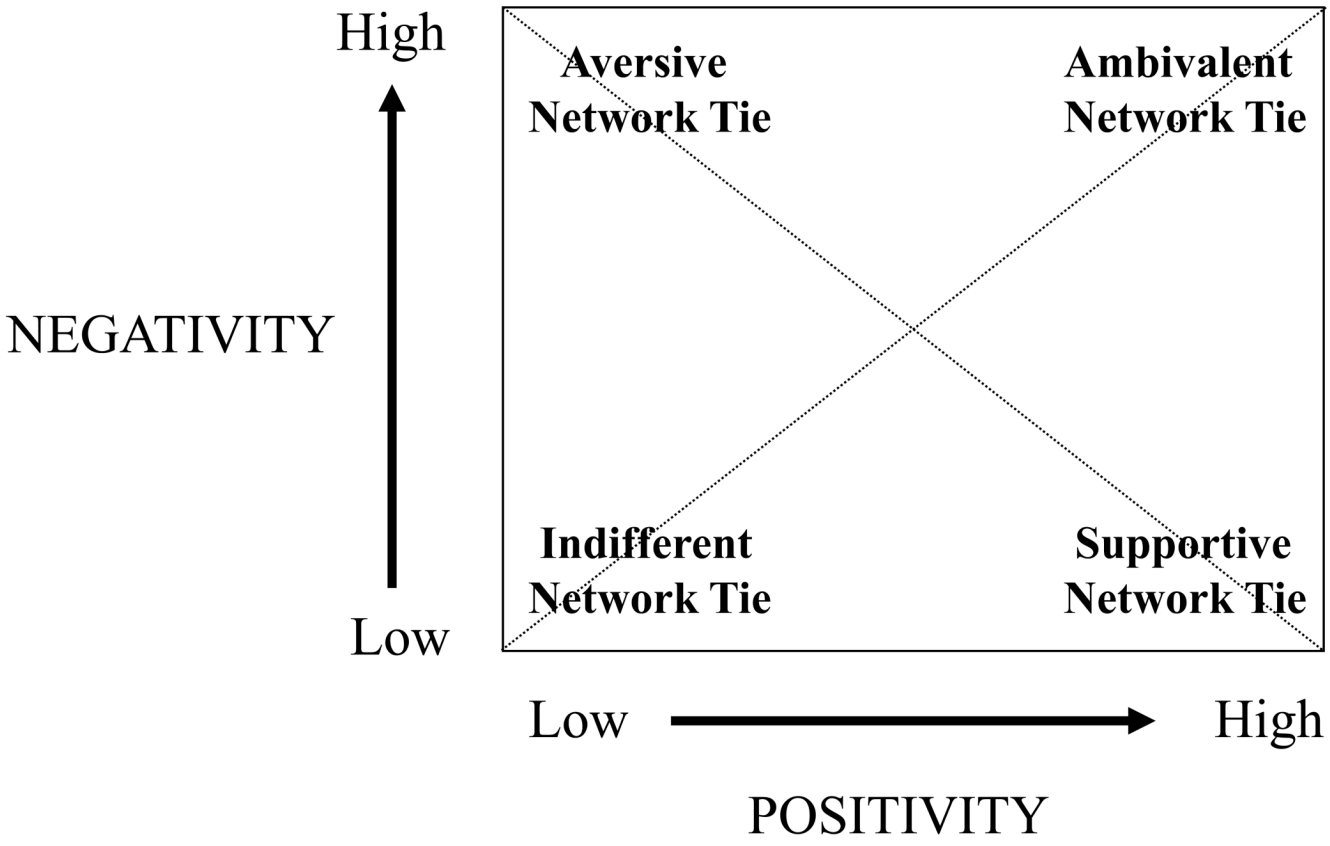

Figure 1.
A general framework for examining positive and negative aspects of relationships on health.

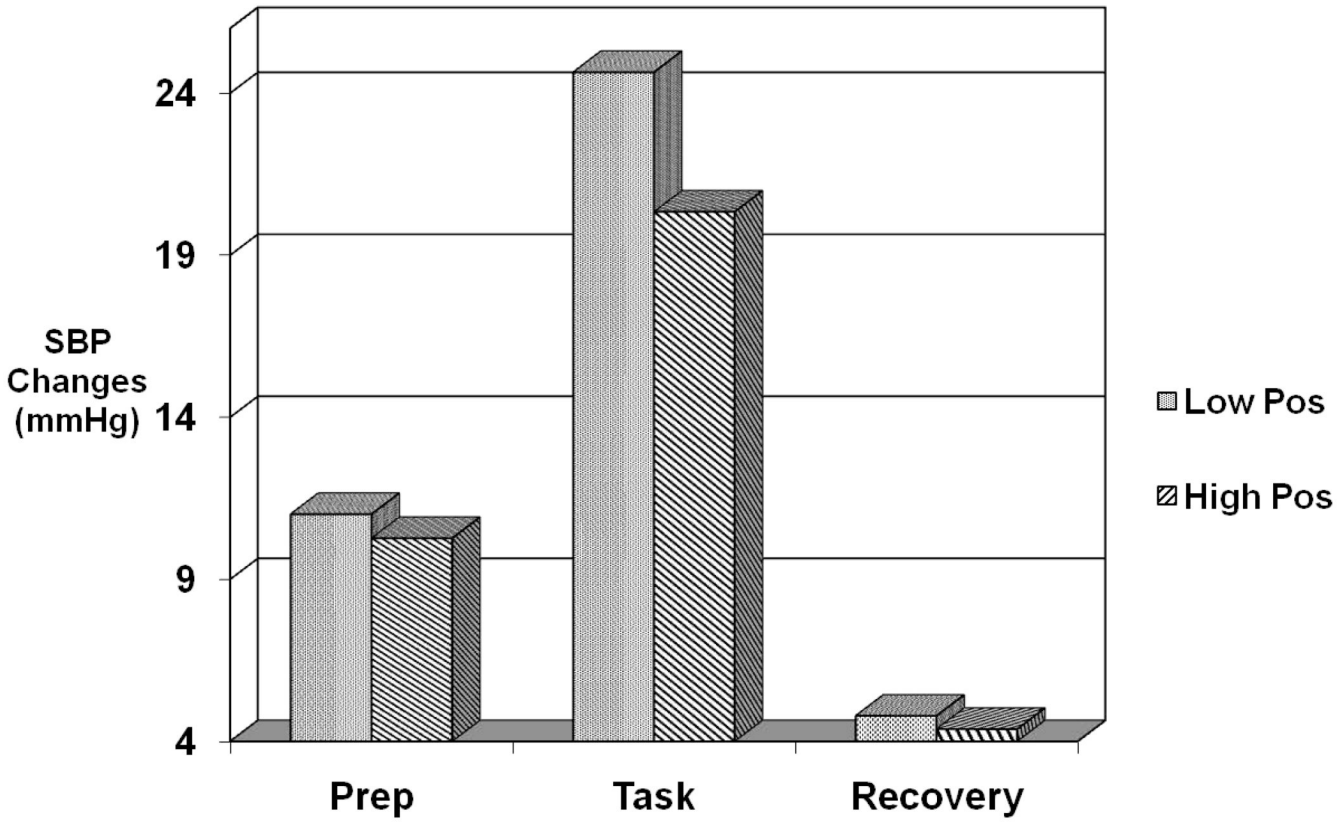

Figure 2.
Relationship positivity main effect on SBP changes from baseline during stress.

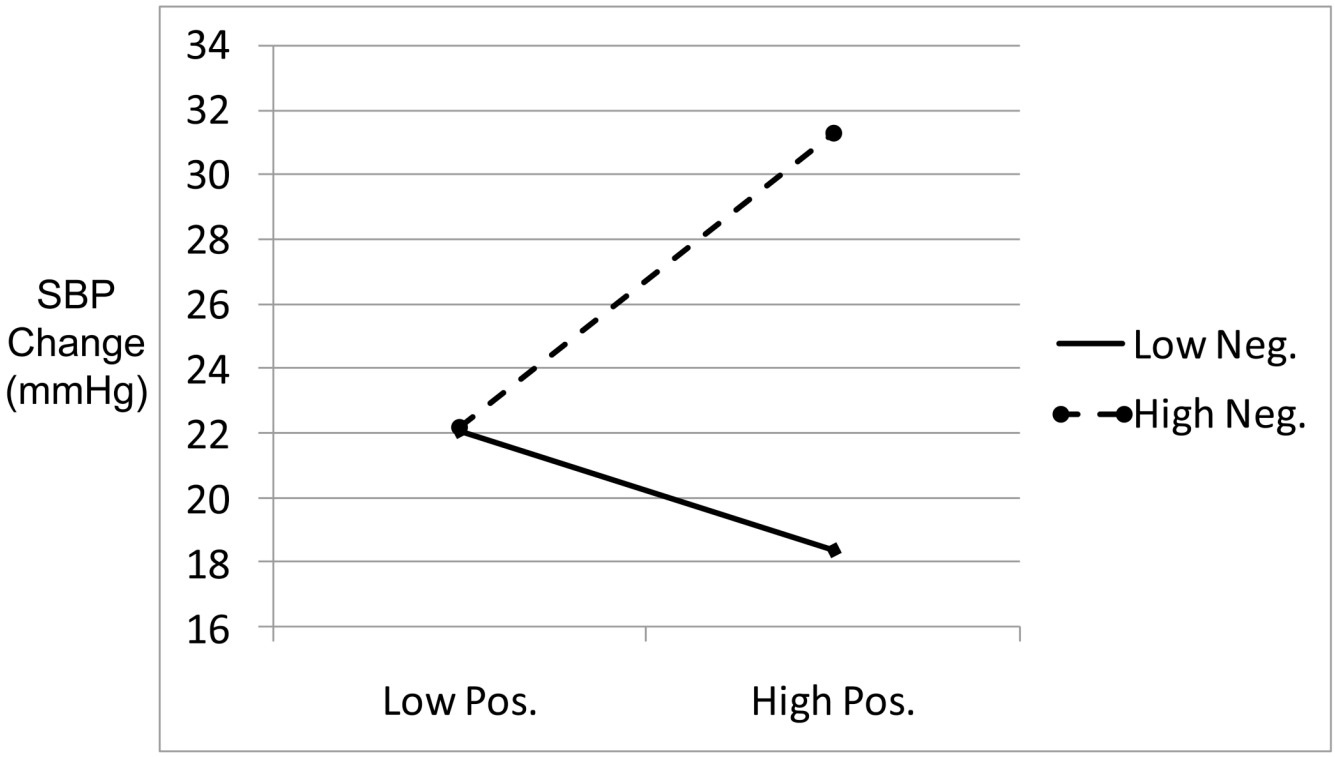

Figure 3.
Predicted SBP changes (task minus baseline) using values one standard deviation above and below the mean for experimenter positivity and negativity.