



Health Communication

Publication details, including instructions for authors and subscription information:
<http://www.tandfonline.com/loi/hhth20>

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Available online: 22 Nov 2011

To cite this article: Graham D. Bodie (2011): Task Stressfulness Moderates the Effects of Verbal Person Centeredness on Cardiovascular Reactivity: A Dual-Process Account of the Reactivity Hypothesis, Health Communication, DOI:10.1080/10410236.2011.618433

To link to this article: <http://dx.doi.org/10.1080/10410236.2011.618433>



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Task Stressfulness Moderates the Effects of Verbal Person Centeredness on Cardiovascular Reactivity: A Dual-Process Account of the Reactivity Hypothesis

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This study sought to investigate the impact of person-centered comfort on cardiovascular reactivity and to test a recently developed dual-process theory of supportive message outcomes proposing that the impact of supportive communication is moderated by the motivation and ability to attend to message content. Participants ($n = 179$) completed a public speaking task that served to experimentally manipulate stress. During the preparation period, instant messages containing either low or high person-centered messages or containing no imbedded supportive message were sent. Results indicated that, in line with theoretical predictions, message content did influence mean arterial pressure and heart rate for participants exposed to moderate but not to low or high stress. Results are discussed in terms of the dual-process theory of supportive message outcomes, and the discussion offers both theoretical and practical implications of the research.

A corpus of interdisciplinary research shows that individuals with more resources for quality support are more mentally and physically healthy, and various pathways have been identified explaining the positive health outcomes of social support (e.g., support encourages health-promoting behaviors) (Albrecht & Goldsmith, 2003; Uchino, 2004). One of the most notable pathways is the ability of support to reduce cardiovascular reactivity (CR) when individuals are exposed to a stressor (Christenfeld & Gerin, 2000). Research on support and CR is especially important given that “unusually large or frequent blood pressure responses to stress are associated with later cardiovascular disease” (Hillmert, Christenfeld, & Kulik, 2002, p. 122; for review see Uchino, Carlisle, Birmingham, & Vaughn, 2011), a phenomenon known as the *reactivity hypothesis*. Fortunately, there is growing evidence that by reducing CR to stressful events, social support can “[help] promote health and prolong life” (Christenfeld & Gerin, 2000, p. 256).

The study reported here makes three primary contributions to the literature documenting that support can

mitigate the stress response. First, although showing a robust relationship between social support (broadly defined) and physiological reactions to stress (Thorsteinsson & James, 1999), research rarely explores the impact of support on CR from a distinctly communication perspective (MacGeorge, Feng, & Burleson, 2011). Thus, this study explores specific aspects of message content proposed to mitigate the negative impact of stress.

Second, research exploring the impact of supportive message content on its outcomes primarily focuses on self-reports of message supportiveness, sensitivity, and helpfulness, leaving the exact message features that influence CR largely unexplored (MacGeorge et al., 2011). Thus, we are left to question whether the same message features that impact self-reported outcomes have similar effects on CR. The study reported here attempts to answer the MacGeorge et al. (2011) call for research into potential pathways explaining the link between supportive message content and health outcomes.

Third, this study recognizes that although message content is consistently connected to positive outcomes, there is growing evidence that the effect of message quality on various outcomes is moderated by a host of factors (Bodie & Burleson, 2008). Particularly relevant to tests of the

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reactivity hypothesis is the degree of stress imposed by a particular task. To date, it is not clear that scholars recognize the importance of testing various levels of task-related stress and how social support might variably impact the stress response based on the severity of the stressor (Thorsteinsson & James, 1999).

THE IMPACT OF SUPPORTIVE MESSAGE QUALITY ON CARDIOVASCULAR REACTIVITY

Cardiovascular reactivity (CR) has been a primary dependent variable in research exploring the ability of social support to buffer stress. The focus on CR stems from the recognition that individuals who exhibit heightened CR to laboratory stressors are likely candidates for long-term cardiovascular damage and disease like hypertension (Gerin et al., 2000; Krantz & McCeney, 2002). Since eliminating our exposure to stressful situations is often impractical (Cassel, 1976), mitigating the deleterious impact of the stress to which we are exposed is vastly important. One way to reduce CR to stressful situations is to provide quality support (see MacGeorge et al., 2011). In the extant research, quality support has been defined in a variety of ways, including, but not limited to, the potential to access support from a research assistant (e.g., Uchino & Garvey, 1997), the presence of a close other (e.g., Christenfeld et al., 1997), and the reception of standard supportive or unsupportive handwritten messages from close others (e.g., Uno, Uchino, & Smith, 2002).

Though this latter strategy comes the closest, none of this research takes a communication-based approach to conceptualizing and subsequently operationalizing the support individuals receive when faced with a stressor (Goldsmith, 2004; MacGeorge et al., 2011). In the Uno et al. (2002) study, for example, the messages contained either an emotionally (e.g., "I would think that some people are a little nervous doing this, but you are doing just fine") or instrumentally (e.g., "I was thinking about your topics and jotted down these ideas in support of the statement") supportive comment. While these comments might be instantiations of broader categories of support, supportive communication scholarship consistently shows that there is tremendous variability in what constitutes "good" and "bad" emotional and instrumental aid (MacGeorge et al., 2011). Indeed, a core contribution from communication scholarship is that supportive message content, not just support type, matters. Consequently, our collective knowledge about the precise message features that influence CR is limited.

Recently, MacGeorge et al. (2011) called for research that affords attention to identifying specific characteristics of supportive communication responsible for buffering the physiological reactions to stress. One feature of supportive message content that regularly influences outcomes is

verbal person centeredness (VPC), or the extent to which messages explicitly acknowledge, elaborate, legitimize, and contextualize the feelings and perspective of a distressed other (Burleson, 1994). Messages that exhibit low person centeredness (LPC) deny the other's feelings and perspective by condemning or ignoring feelings or by challenging their legitimacy. Moderately person-centered (MPC) comforting messages afford an implicit recognition of the other's feelings by attempting to divert attention from the troubling situation, offering simple expressions of condolence, or presenting non-feeling-centered explanations intended to reduce the other's distress. Highly person-centered (HPC) comforting messages explicitly recognize and legitimize the other's feelings by helping the other to articulate those feelings, elaborate reasons why those feelings might be felt, and explore how those feelings fit within a broader context.

Substantial research indicates that HPC comforting messages have more positive outcomes than do either MPC or LPC comforting messages (Burleson et al., 2005). With few exceptions (e.g., Jones & Burleson, 2003; Jones & Guerrero, 2001; Jones & Wirtz, 2006), however, our knowledge regarding the impact of VPC is limited to evaluations of message effectiveness from studies that utilize hypothetical scenarios to elicit stress. To the extent that "the dynamics of comforting . . . [are] more complex than has been previously suggested by self-report studies" (Jones & Guerrero, 2001, p. 591), the theory and practice of supportive communication should recognize that complexity. A recent study by Priem and Solomon (2009) took an important step forward in this regard by assessing the effects of two types of supportive communication, distraction and reappraisal, on physiological stress reactivity during a public speaking task. In this study, results suggested that salivary cortisol was lower for participants who engaged in a conversation that primarily distracted (i.e., talk unrelated to the upcoming speech) than for participants who engaged in feeling-centered talk. Results from Priem and Solomon are consistent with other research that suggests that stress may not be mitigated (and may, in fact, be exacerbated) when individuals talk about the impending stressor and how they feel (see Derlega, Barbee, & Winstead, 1994; Tardy, 1994).

Although the reappraisal conversations observed by Priem and Solomon (2009) included elements of person-centered comforting, the manipulation checks suggested that other elements (e.g., visualization) were also included. Indeed, conflating various components of supportive communication is common in experimental studies. As a result, our knowledge concerning the specific message features that can (or cannot) impact stress reactivity is limited. The current study directly assesses the impact of one theoretically important aspect of feeling-centered support, namely, VPC, on CR. Thus, the first hypothesis is forwarded to test the extent to which the impact of VPC support on CR is similar to that in the self-reported literature:

H1: Individuals exposed to a stressful situation receiving HPC messages will experience less CR than those receiving LPC messages.

THE RELATIVE IMPACT OF “GOOD” AND “BAD” SUPPORT

As noted earlier, research in social psychology consistently compares “supportive” and “unsupportive” interactions or people to no-support control conditions, with the general finding that good support helps while bad support can exacerbate reactivity (Thorsteinsson & James, 1999). In terms of VPC, the overwhelming consensus is that HPC messages should help reduce CR compared to receiving no support (Burleson et al., 2005). With regard to LPC messages, social psychological research suggests that individuals who perform stressful tasks in front of nonsupportive audience members (e.g., nonverbally nonimmediate) have heightened CR as compared to those in a no-support control condition (e.g., Lepore, Allen, & Evans, 1993). Although theoretically distinct from forms of support used in past research, LPC comfort explicitly denies the legitimacy of feelings, suggesting to the stressed other that she or he is not handling the situation appropriately. Similarly, elements of LPC support (e.g., telling others how they *should* act and feel) are reported as potentially harmful responses, likely to thwart efforts to cope (Dunkel-Schetter, Blasband, Feinstein, & Herbert, 1992; Wortman & Lehman, 1985). Thus:

H2: When exposed to a stressful task, individuals receiving HPC support will experience less CR than individuals assigned to a no support control group.

H3: When exposed to a stressful task, individuals receiving LPC support will experience more CR than individuals assigned to a no support control group.

EXPLORING MODERATORS TO THE IMPACT OF VPC: A DUAL-PROCESS FRAMEWORK

Although a large body of research consistently shows a strong linear trend for VPC on a variety of outcomes, there is also growing evidence that the effect of VPC is moderated by several factors (for review see Bodie & Burleson, 2008). Unfortunately, most explanations for these effects are localized to one variable like biological sex (Kunkel, 2002) or a small set of similar variables such as collectivism and individualism (Burleson & Mortenson, 2003), with less attention afforded to developing more encompassing theoretical frameworks (cf. Goldsmith, 2004; Reis & Collins, 2000; Uchino, 2004). To remedy this theoretical lacuna, Bodie and Burleson (2008) posited a dual-process framework to organize the extant literature (see Bodie, in press-a; Burleson, 2009, 2010). The basic thesis of their dual-process theory of supportive message outcomes is that supportive

messages should vary in their effects as a function of how they (and accompanying elements of the situation) are processed by recipients. Specifically, and consistent with other dual-process theories, differences in outcomes generated by better and worse supportive messages should increase as these messages receive greater scrutiny from recipients; if message content is to make a difference, it must be noticed and processed.

The current theory further suggests that recipient processing is a function of the ability and motivation to attend to message content. Past research testing the dual-process theory of supportive message outcomes has found that as the severity of a hypothetically induced stressful event increases, so too does the linear trend for VPC (Burleson, 2008, Study 3; Holmstrom et al., 2011), and that stressor severity is strongly related to processing motivation (Bodie, in press-b). The theory also specifies, however, that individuals asked to perform a task likely to produce high levels of stress may be unable to attend to and process information (Eysenck, Derakshan, Santos, & Calvo, 2007). Thus, when individuals are highly stressed they should be less able to process support messages. As a result, the potential for messages to buffer the effects of a stressful task on CR also decreases. Indeed, my colleagues and I recently found this predicted curvilinear function for emotional upset on processing using both hypothetically induced stress and retrospective recall of a past stressor (Bodie et al., 2011). A similar result is expected to materialize for task-related stress:

H4: Task stressfulness will moderate the buffering effect of VPC on CR. Specifically, VPC will buffer CR in response to a moderately stressful task; however, when task-related stress is either relatively low (low motivation) or relatively high (low ability) VPC will not buffer the impact of task-related stress on CR.

METHOD

This experiment utilized a 3 (task stress: high, moderate, low) \times 3 (message content: HPC, LPC, no support) factorial design. Five female confederates were recruited to act as the support providers and were trained in six one-hour sessions. Participants were blocked by confederate to assess any random error produced by confederate. No significant effects were found when treating confederate as a random factor (analyses available upon request).

Participants

One hundred and seventy-nine undergraduate students (68 female, 111 male; mean age = 19.80, SD = 3.18) at a large Midwestern university enrolled in public speaking courses were recruited through an online experiment site. The experimental groups contained 119 participants (low

stress, $n = 40$, moderate stress, $n = 40$, high stress, $n = 39$), while 60 individuals were randomly assigned to the control groups (20 in each the low, moderate, and high stress conditions). Freshman ($n = 102$, 57%), sophomore ($n = 37$, 20.7%), junior ($n = 24$, 13.4%), and senior ($n = 15$, 8.4%) participants received a small amount of course or extra credit and \$10.00 to participate in the study. The majority of students reported their race as Caucasian ($n = 119$, 66.5%), and various colleges and schools were represented ($n = 12$).

General Procedure

Participants were asked to refrain from eating, drinking, smoking, or exercising for 1 hour prior to their session to reduce external influences on cardiovascular reactivity. After signing an initial consent form, participants completed the Trait Anxiety Inventory–Form A (TAI-A) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) modified to assess trait-level apprehension about public speaking ($\alpha = .90$) and were asked to stand behind a tabletop podium. A research assistant then placed a wrist cuff from a Fusion blood pressure monitor on the participant's nondominant wrist, and participants stood behind the podium for 5 minutes, ensuring a stable and accurate baseline (Berntson, Quigley, & Lozano, 2007). Then participants were seated in front of a computer and given a set of speech instructions, selected at random by the confederate, which served as the stress manipulation. Each speaker was asked to spend 15 minutes preparing and then to present a 4- to 6-minute speech with the goal of persuading his or her audience that the recently instituted city-wide smoking ban “is harmful and should be repealed.”

Each condition contained increasing levels of seven primary situational variables found to contribute to state speaking anxiety (for details see Bodie & Morgan, 2010). These elements were manipulated in narratives that participants read and are available upon request. After the participant read his or her speech instructions, the confederate requested the completion of Spielberger's State Anxiety Inventory (SAI)–Form Y (Spielberger et al., 1983) modified to refer to the current speaking situation. Imbedded within this scale was a measure of motivation to control emotional experience and emotional expression as the result of the public speech. The confederate then introduced herself following a standard script and subsequently sent the first of two standard messages corresponding to condition (i.e., LPC, HPC, control) using AOL Instant Messenger from a computer located in a room adjacent to the laboratory (see Appendix). After 15 minutes, the confederate sent the second standard instant message (IM; see appendix). The choice to send messages through an IM system was made primarily in order to control the manipulation of VPC. By sending the same experimental message to all participants, concerns about variation in message content or about potential confounds regarding how confederates delivered the messages were controlled.

Two minutes after sending the last IM, the blood pressure cuff was reattached, and participants were asked to stand still while the confederate set up the remaining equipment. After a 2-minute prespeech baseline, enough time for the Fusion to adequately register and for the confederate to begin recording the speech, participants gave their speech, after which they filled out a series of self-report measures and were debriefed following IRB protocol.

Primary Variables

Cardiovascular reactivity. Studies that have assessed the utility of social support in buffering cardiovascular reactivity have employed measures of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR). When SBP and DBP are highly correlated, mean arterial pressure (MAP) is a useful combined measure of blood pressure (Andreassi, 2000). These measures of CR are sensitive to changes based on supportive stimuli (Lepore, 1995; Lepore et al., 1993; Uchino & Garvey, 1997). Thus, each measure was employed in the present study as related, but distinct measures of CR.

The Medwave Fusion (formerly the Vasotrac APM 205) captured continuous arterial pressure data (15-second intervals), and the two-slot BioNex mainframe (model 50-3711-02) manufactured by MindWare Technologies was used to convert this data into second-by-second waveform trends of HR (as assessed via the inter-beat interval, IBI), SBP, DBP, and MAP. The Fusion operates via continuous nonocclusive compression and decompression of the radial artery, has been shown to provide valid and reliable estimations of CR in clinical (Belani et al., 1999) as well as behavioral research (Friedman, Christie, Sargent, & Weaver, 2004), and has been cleared for research by the Food and Drug Administration (FDA) (“Medwave's Fusion (TM) granted 510(k) clearance by FDA,” 2006).

To control for potential individual differences in reactivity, baseline values were obtained by averaging CR during the 5-minute resting period. Stimulus CR was defined as the average score across the first minute of speaking. Research shows CR is the highest at the confrontation stage of a public speech (for review see Bodie, 2010); thus, this point in the speech seems the most pragmatically important and theoretically interesting time to investigate whether support can buffer CR. The interest here is not with changes in CR or patterns of reaction over time but with the potential of particular message features to help mitigate the impact of a stressful experience. Using the first speaking minute as the primary dependent variable also allows for the comparison of these results with prior research exploring the impact of social support on CR.

Table 1 shows the descriptive statistics and correlations between CR readings at baseline. A series of one-way ANOVAs showed that baseline values did not differ based on speech condition (all F s < 1). In addition, trait speaking

TABLE 1
Descriptive Statistics for HR, SBP, and DBP at Baseline

	SBP Base	DBP Base	MAP Base	HR Base
<i>n</i>	175	175	175	174
Mean	129.81	67.26	88.11	88.58
Median	129.30	65.14	85.66	87.02
SD	13.58	11.20	11.77	12.32
Skewness	.48	.89	.76	.41
Kurtosis	.29	1.21	.86	.01
Minimum	101.00	46.00	65.88	61.33
Maximum	171.36	109.46	129.35	126.52
DBP Base	.92 ^c	—		
MAP Base	.97 ^c	.99 ^c		
HR Base	.17 ^a	.19 ^b	.19 ^b	—

Note. Significance indicated by ^a $p < .05$, ^b $p < .01$, ^c $p < .001$.

Resting SBP was in the “prehypertension” range (120–139), whereas baseline DBP was in the “normal” range (i.e., below 80) as defined by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (Chobanian, 2004).

anxiety was uncorrelated with all cardiovascular measures ($p > .24$). Given the near perfect correlation between SBP and DBP, MAP is reported for all subsequent analyses for clarity. All analyses for SBP and DBP are available upon request.

Manipulation Checks

Self-reported anxiety. The 20-item state version of the State-Trait Anxiety Inventory (STAI)–Form Y (Spielberger et al., 1983) was modified to measure speakers’ anxiety about this particular public speech. The scale was unidimensional and internally consistent ($\alpha = .95$; $M = 48.40$, $SD = 13.65$) as well as unimodal (35.00, $n = 11$, 6.1%) and normally distributed (skewness = .14, $SE = .18$; kurtosis = $-.76$, $SE = .36$). The contrast specifying self-report anxiety would increase as the task became more stressful (-3 , $+1$, $+2$) was statistically significant, $F(1, 176) = 30.54$, $p < .001$, $r_{contrast} = .84$, $r_{effect\ size}^2 = .15$ (see Table 2 for descriptive statistics).

Motivation. Six items were written to measure the degree to which participants were motivated to control emotional experience and expression (e.g., “Right now, I

TABLE 2
Descriptive Statistics for Manipulation Checks

	Low Stress		Moderate Stress		High Stress	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Anxiety	41.48	10.89	49.38	13.85	54.44	12.99
Motivation	2.92	.85	3.19	.82	3.43	.66
Ability	4.11	1.21	3.14	1.39	2.97	1.27

Note. Means for MAP and HR are estimated marginal means controlling for baseline values (MAP = 88.07; HR = 88.87); numbers under SD for MAP and HR are standard errors.

want to get over any anxiety I feel”; “I don’t want anyone to see my anxiety I feel.”) and imbedded within the STAI (1 = *not at all*, 4 = *very much so*). These items were unidimensional and formed a reliable ($\alpha = .92$), normally distributed (skewness = $-.55$, $SE = .18$; kurtosis = $-.83$, $SE = .36$), and unimodal scale (4.00, $n = 58$, 32.4%) with a mean of 3.18 ($SD = .80$). The contrast (-3 , $+1$, $+2$) specifying that motivation would increase in a linear fashion as the task become more stressful was significant, $F(1, 176) = 12.09$, $p < .001$, $r_{contrast} = .67$, $r_{effect\ size}^2 = .06$ (see Table 2 for descriptive statistics).

Ability. After the speech was presented, participants were asked to complete a measure assessing the degree to which the stress they experienced interfered with their ability to think during speech preparation and presentation. These six items (e.g., “Because of the stress I experienced, I was concerned about not being able to think [mind going blank]”; 7-point Likert scale) were unidimensional and achieved adequate reliability ($\alpha = .87$). Higher numbers indicate a higher ability to think during the speech preparation and presentation. Scores were normally distributed (skewness = .32, $SE = .18$; kurtosis = $-.61$, $SE = .36$) and unimodal (3.17, $n = 13$, 7.3%) with a mean of 3.41 ($SD = 1.38$). The contrast ($+2$, $+1$, -3) specifying ability would decrease as a function of increasing task stressfulness was statistically significant, $F(1, 176) = 27.13$, $p < .001$, $r_{contrast} = .90$, $r_{effect\ size}^2 = .13$, indicating that the more stressful the task became, the less able were participants to think during speech preparation (see Table 2).

Message person centeredness. To assess whether the messages accurately reflected the concept of person centeredness, eight experts were asked to read the messages (see Appendix) and assess their level of person centeredness. Since the concern was with the theoretical substantiation of VPC rather than participant evaluation of messages, experts were utilized rather than participant reports. Extensive research has already determined that HPC comforting is evaluated as more helpful than LPC comforting, and the messages used in this study were created using standard definitions found in Burleson (1994). For instance, as seen in the appendix, the LPC message before preparation condemned (e.g., “Although you might be feeling a little nervous right now . . . it’s just not that big of a deal”), ignored (e.g., “Just ignore your feelings and get busy preparing”), and challenged the legitimacy of (e.g., “it’s only a little speech”) the speakers’ feelings. There was 100% agreement among the eight expert raters. Thus, the messages used in this study contained reliable features shown to impact a variety of other outcomes in past research.

RESULTS

Given that all hypotheses were directional and based on sound theoretical principles, contrast analysis was used in

their analysis (Rosenthal, Rosnow, & Rubin, 2000). Where appropriate, specific contrast values and estimates of effect size (Furr, 2004) are provided along with statistical significance and power.

Tests of Hypotheses

H1 predicted that individuals exposed to HPC messages would experience less CR than those exposed to LPC messages. With $n = 111$ and alpha set at .05, power to detect small ($d = .20$), moderate ($d = .50$), and large ($d = .80$) effects was .18, .74, and .99, respectively. Providing no support for H1, the contrast comparing LPC (+1) to HPC (-1) messages was not significant for MAP, $F(1, 109) = .11$, $p = .74$, or HR, $F(1, 109) = .10$, $p = .75$. The upper portion of Table 3 provides the mean levels of MAP and HR controlling for the baseline values.

When compared to a no-support control group, H2 predicted individuals exposed to HPC messages would experience less CR, whereas H3 predicted individuals exposed to LPC messages would experience heightened CR. Power to detect significant effects for these two orthogonal contrasts ($[1]\lambda_{LPC} = 0; \lambda_{HPC} = -1; \lambda_c = +1$; $[2] (\lambda_{LPC} = +1; \lambda_{HPC} = 0; \lambda_c = -1)$) was similar to that reported for H1. As seen in

TABLE 3
Means and Standard Deviations for CR Variables by Stress
Magnitude and VPC

Stressor Magnitude	VPC	<i>M</i>	<i>SE</i>	<i>n</i>
<i>DV = MAP Change</i>				
Combined stress conditions	LPC	102.65	1.48	57
	HPC	102.36	1.52	54
	Control	102.81	1.53	53
Low stress	LPC	95.65	2.32	18
	HPC	96.65	2.37	18
	Control	100.53	2.51	16
Moderate stress	LPC	108.29	2.73	19
	HPC	102.10	2.74	19
	Control	104.78	2.87	18
High stress	LPC	103.72	2.33	20
	HPC	103.51	2.53	17
	Control	108.51	2.38	19
<i>DV = HR Change</i>				
Combined stress conditions	LPC	103.61	2.10	57
	HPC	102.28	2.16	54
	Control	101.16	2.18	53
Low stress	LPC	95.57	2.86	18
	HPC	96.67	2.81	18
	Control	95.66	2.99	16
Moderate stress	LPC	104.61	2.94	19
	HPC	97.57	2.93	19
	Control	97.53	3.08	18
High stress	LPC	109.72	4.38	20
	HPC	113.51	4.77	17
	Control	109.36	4.50	19

Note. Means are estimated marginal means to control for baseline values; MAP Baseline = 88.01; HR Baseline = 88.87.

Table 3 (combined stress conditions), there were no statistically significant differences in MAP or HR as a function of HPC or LPC messages when compared to the no-support control condition (all $ps > .80$).

H4 predicted that the severity of the stressor moderates the impact of VPC on CR such that VPC would have an impact only when stress was relatively moderate. To test this hypothesis, the same contrasts used above in the analysis of H1–H3 were run separately at each level of task-related stress.

For MAP, participants in the moderately stressful task condition and exposed to HPC messages showed less reactivity during the first speaking minute than participants exposed to LPC messages, $F(1, 36) = 4.54$, $p = .04$, $r_{contrast} = .60$, $r_{effect\ size}^2 = .11$. Neither LPC, $F(1, 53) = 1.41$, $p = .24$, nor HPC, $F(1, 53) = .14$, $p = .72$, messages, however, produced significantly different reactivity as compared to the no-support control group. Moreover, and consistent with the dual-process framework, none of the specified contrasts were statistically significant in either the low or high stress conditions (all $ps > .30$).

For HR, participants in the moderately stressful task condition and exposed to LPC messages had higher reactivity than those exposed to either HPC messages, $F(1, 36) = 2.79$, $p = .10$, $r_{contrast} = .13$, $r_{effect\ size}^2 = .07$, or to no support, $F(1, 53) = 4.00$, $p = .05$, $r_{contrast} = .48$, $r_{effect\ size}^2 = .07$; the contrast specifying lower reactivity for HPC messages compared to the no-support controls did not reach significance, $F(1, 53) = .09$, $p = .77$. Moreover, and consistent with the dual-process framework, none of the specified contrasts were statistically significant in either the low or high stress conditions (all $ps > .24$).

Post Hoc Analyses

Inspection of estimated marginal means in Table 3 led to the development of two additional contrast tests. The first tested whether MAP reactivity was lower when any message was provided as compared to the no-support control group in both the low and high stress conditions. Finding support for this contrast would suggest that when motivation or ability to process are relatively low message content serves to activate some low elaboration affect change mechanism (see Burleson, 2009). That contrast ($\lambda_{LPC} = -1$; $\lambda_{HPC} = -1$; $\lambda_c = +2$) approached significance for low stress participants, $F(1, 49) = 2.65$, $p = .11$, $r_{contrast} = .35$, $r_{effect\ size}^2 = .05$, but was equivalent to zero for high stress participants, $F(1, 53) = .76$, $p = .39$. Thus, it appears that message content is primarily acting as an element of the support situation that is processed more extensively when stress is moderate, but may act as a heuristic cue when stress is low.

The second contrast tested whether HR reactivity was greater for highly stressed participants exposed to HPC messages as compared to both LPC messages and no message. Support for that contrast would contradict the

dual-process framework. That contrast ($\lambda_{LPC} = -1$; $\lambda_{HPC} = +2$; $\lambda_c = -1$) did not reach a conventional level of significance, $F(1, 53) = .31, p = .58$.

DISCUSSION

This article reports a study that sought to address three primary limitations in the research linking support to cardiovascular reactivity. First, the study addressed the lack of attention afforded to investigating the impact of supportive message content when individuals are faced with a real and immediate stressor by investigating the impact of VPC on measures of CR while participants were engaged in a public speaking task. Inconsistent with past research investigating the role of VPC in the management of stress, message person centeredness did not have a direct linear effect on cardiovascular reactivity (i.e., mean arterial pressure, heart rate) (H1). This is the first study to date that has failed to find such an effect for VPC, suggesting the need for future replication attempts using a variety of experimental stressors (e.g., mental arithmetic; see Tardy, Allen, Thompson, & Leary, 1991). Indeed, if VPC has only a small effect on CR, this study was underpowered to detect such an effect. This limitation is, however, at least partially mitigated by the fact that the impact of VPC on CR was found to be significant in the moderately stressful condition, a finding in line with a recently developed dual-process theory of supportive message outcomes.

Second, the current study investigated the impact of LPC and HPC messages on CR and compared the relative impact of these messages to a condition where participants received no support as they prepared for their speech. Since helpers are prone to attempt to comfort others under stress, it is both theoretically and practically important to discover whether what we say matters or whether we should remain verbally silent yet nonverbally available (Jones, 2004). When message type was modeled irrespective of stress severity (H2 and H3), there were no statistically significant differences in MAP or HR. When, however, stress severity was included as a factor in the analyses, differences did emerge. These differences are consistent with the dual-process theory of supportive message outcomes (Bodie & Burleson, 2008), which posits that message content should have its greatest impact when participants are motivated and able to attend to that content. In the study reported here, the motivation and ability to attend to message content were manipulated by creating three public speaking tasks that served to increase experienced anxiety. Results from the manipulation checks suggested that motivation to experience and express relevant emotions increased as a function of the task and that the ability to think in the face of stress was also impacted. Thus, the moderately stressful speaking task represented high motivation and high ability, whereas motivation was low and ability was low in the low and high stress conditions, respectively.

More importantly, and in support of H4, the severity of the public speaking task influenced whether message content impacted CR. Specifically, for both MAP and HR, when felt anxiety was moderate HPC messages produced significantly less reactivity than LPC messages. This finding is consistent with past research on VPC comfort (Burleson et al., 2005) and suggests that VPC comfort has the potential to impact more than just self-reports of comforting quality and affective improvement. Unfortunately, the data here also showed that HPC messages were no more effective at mitigating reactivity than messages that simply told the participants to start and stop their speech preparation. This suggests that HPC messages may not reduce CR when a task produces stress relatively moderate in magnitude, but they are certainly better than their LPC counterparts. Practically speaking, it appears that words can hurt, especially if they are inconsiderate and attempt to tell the other how she or he *should* act and feel.

The fact that HPC messages did not improve CR is not inconsistent with past work on feeling-centered talk. Although in this study HPC messages did not hurt, this study, along with research by Priem and Solomon (2009) and others (Derlega et al., 1994; Tardy, 1994), suggests that the potential benefits of feeling-centered talk may not be realized in all types of stressful experiences. This speculation, although seemingly backed by a range of studies utilizing several types of message content, should be explored in future research that explores the relative impact of VPC support with that of known variants of good and bad advice, esteem support, and support of other types (see MacGeorge et al., 2011).

An additional result relevant to the dual-process theory was reported in the post hoc analyses. Specifically, when stress is relatively mild both HPC and LPC messages seem to confer an advantage (albeit only approaching statistical significance) on MAP reactivity over receiving no support. In the language of the current theory, since low stress conditions should not motivate recipients to put much effort into attending to and processing the content of supportive messages that content should, thus, have minimal effect on outcomes. The finding that participants in this condition showed less reactivity when exposed to a message of any sort than their no-support counterparts can be explained as the message serving as some sort of heuristic or associative cue that, perhaps, conveyed a sense of caring or warmth regardless of the actual words used. This explanation would be in line with other dual-process accounts that assert messages, and other variables, can serve a variety of functions. Of course, this explanation is speculative at best and should be tested more fully in future research. Moreover, future research should continue to investigate whether this result is specific to task-related stress such as public speaking or can be extended to other types of stressors. Certainly, various lay and professional helpers would be interested in whether spending time crafting the ideal supportive message was

going to pay dividends or whether that time should be spent being co-present and available when needed.

In addition to this one unexpected result, several results were also inconsistent across CR measures. Specifically, results comparing LPC messages to no support were dependent on the specific measure of reactivity. For the HR data, participants exposed to LPC messages had greater reactivity than participants who received no support suggesting that LPC messages may exacerbate the deleterious effects of stress, a finding that would be consistent with H3 (albeit moderated by stress severity). Although the means displayed in Table 3 are in the same direction, there was not a statistically significant difference for MAP between LPC messages and the no support messages. Certainly, variability in the impact of sympathetic nervous system activation is not without precedence. For example, differences in neurotransmitter and/or receptors that carry information from cranial and sacral regions of the central nervous system or from the thoracic and lumbar spinal regions may account for the differences in MAP and HR results (Blascovich & Kelsey, 1990). Since data were not collected to help explain this difference, future research will need to be better equipped to propose and test why such differences may emerge. It is also possible that the effect of message type on MAP is smaller in magnitude as compared to the effect of message type on HR. Since the study was not sufficiently powered to detect small effect sizes, future research should be designed to do so.

It is important to note that the effect sizes for VPC found in this study are much less than found in studies treating VPC as a repeated measure and assessing message evaluations (Jones & Burleson, 1997). The effect sizes reported in this study are within the range of effect sizes found by Jones (Jones, 2004; Jones & Guerrero, 2001) on reported affect improvement (7%) and evaluations of comforting quality (13%) in the context of a 5-minute conversation about a past stressor. In the current study, when speakers were engaged with a moderately stressful speaking task, effect sizes for message type (LPC, HPC, no message) ranged between 7 and 11% of the variance in the CR measures. Since the research investigating the impact of VPC is vast and has explored a variety of outcomes, the current study certainly adds to the growing evidence that the impact of VPC varies based on the outcome under question (see Bodie, Burleson, & Jones, *in press*). Particularly relevant to the health context, this study provides the first evidence that VPC can buffer the negative impact of stress, a known determinant of later cardiovascular illness and disease.

Limitations and Direction for Future Research

In addition to the aforementioned limitations, several other limitations are worth noting. First, the supportive messages were transmitted through an instant messaging system. Although this choice allowed for strict control of

message content, communication through instant messaging (or other forms of computer-mediated communication) has a vastly different set of rules, guidelines, and expectations than does communicating through more interpersonally based means, like face-to-face comforting (Walther & Parks, 2002). Perhaps IM comforting is governed by different rules, which may help explain some of the results that were found (and not found) in the present study (Bambina, 2007). For example, most IM messages tend to be very brief—just a sentence or two—while the messages employed in the current study were several sentences in length, which may have been experienced as unusual by those familiar with the norms of IM communication. Thus, the results found here may have been (unintentionally) influenced by the technology used to transmit support as opposed to the character of the supportive messages themselves.

In addition, it is certainly not the case that two IMs from a stranger while preparing for a speech that has little consequence on one's life in general in any way captures how support happens in real life with real relational partners. Whether similar results will be found when messages are sent in, for instance, the context of an ongoing, face-to-face conversation with a stranger (Jones, 2004; Jones & Guerrero, 2001) or when comfort is delivered through handwritten notes by close others (Lepore et al., 1993) constitutes a set of empirical questions for future research. Likewise, the results of the present study were garnered within a 1-hour laboratory session. Indeed, "emotional support is a discursive process that takes time, as does coming to grips with difficult thoughts and feelings" (Jones & Wirtz, 2006, p. 238). Future research ought to explore, in ways that preclude ethical dilemmas inherent in laboratory stress research, the long-term effects of person-centered support.

The second limitation is also related to the message manipulation. In particular, the role of moderately person-centered (MPC) comforting messages was not investigated. Although the impact of MPC messages was not evaluated in the current study, there is reason to believe that these message types might be beneficial, especially for mitigating stress during tasks such as public speaking. In particular, MPC messages are those that implicitly acknowledge participant feelings by attempting to distract or offer non-feeling centered explanations for the situation. Prior research shows that distraction can be a useful communicative strategy and can buffer the impact of task stress on self-reports of anxiety (Derlega et al., 1994) as well as salivary cortisol (Priem & Solomon, 2009). These speculations should prompt future research.

A similar limitation is that this study fails to fully appreciate the mechanisms that likely drive the relationship between VPC and CR. Indeed, these results should not be used to bolster a "magic bullet" model of support whereby simply choosing the "right words" can magically change recipient physiology (Burleson & Goldsmith, 1998). The dual-process theory of supportive message outcomes suggests that VPC

has its effects on outcomes through multiple mechanisms that are potentially acting and interacting in quite complex ways. Lepore (1998), for instance, forwarded two primary pathways through which social support might reduce the psychophysiological impact of stress, namely the direct dampening of neuroendocrine activation and facilitated coping through cognitive reappraisal. The specific mechanisms that are driving the relationship between VPC and CR should certainly be the focus of extensive research in the future, and within that research the dual-process framework seems likely to lend guidance to when and why certain mechanisms are operative at various points along the continuum of thinking about and processing supportive messages (Bodie, *in press-b*).

Finally, participants in the present study did not seek support, nor did they indicate they had any need for support. Perhaps in situations where social support is neither desired nor expected, message content has a relatively negligible effect on most outcomes as evidenced by the small to moderate effect sizes found in the current study. Research shows that unsolicited support can be perceived as unpleasant and as communicating that the recipient is incompetent (Smith & Goodnow, 1999). The extent to which this speculation is warranted and the extent to which situations that do not involve seeking, but do involve receiving, support are interesting avenues for future research.

Practical Implications

These limitations notwithstanding, this study stands to inform practice in several ways. Perhaps most obviously, given its use of a public speaking situation to induce task stress, these results have implications for how to provide comfort for those faced with this particular stressor. Research shows that most Americans are highly anxious about speaking in public and that particular remedies can decrease the tendency to become anxious during public speaking tasks (for review see Bodie, 2010). One such remedy is to create a warm, supportive environment so that the speaking situation is viewed as less threatening. Certainly, the use of HPC messages can aid in creating such an environment. Perhaps, then, instructors and students alike would benefit from training in how to produce HPC comforting and in other techniques when such comforting may have minimal or no effects (e.g., when the stressor is quite high). Moreover, to the extent that experiencing heightened CR to task-related stressors (which the public speaking task seems to resemble; Thorsteinsson & James, 1999) can be linked to damaging health consequences, results from this study combined with a program of research exploring other important stressors could be pragmatically fruitful for scholars and practitioners alike. Indeed, although public speaking seems to constitute a unique stressor, one that may or may not resemble stress found in other life circumstances, these findings are also likely to inform how support might

help or hinder stress reduction during other task-related stressors.

Certainly, research should investigate whether messages of different types sent by people of different ilks operate to reduce negative emotions produced by a variety of life stressors (Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). Although studying stress as it occurs may pose ethical and practical challenges to which other designs are better suited (see Burleson, 2003), the findings of the current research highlight the necessity of research that attempts to overcome these challenges and investigate the feeling better process as it occurs in real time. Indeed, results of this study add to the rather large empirical literature that shows the importance of attending to specific ways in which support can be communicated. In particular, this study shows that a theoretical property of messages, VPC, has the potential to benefit both short- and long-term health. Although the effect was small, that VPC had an effect of any magnitude on CR is important insofar as increased CR in response to threatening situations is potentially linked to an increased risk of cardiovascular disease (Krantz & McCeney, 2002). Although the specific ways in which support, CR, and health are linked are still a topic of academic debate (Schwartz et al., 2003) and are certainly far from resolved by this single study, for practical purposes the ability for supportive communication to help reduce a potential contributor to cardiovascular disease is promising.

This study also provides further evidence that the impact of supportive communication on outcomes is a function not only of message content but also of the severity of the stressor experienced. As predicted by the dual-process framework, the importance of support to helping mitigate the impact of reactivity is particularly important in those situations where individuals have the motivation and ability to attend to specific features of talk. Thus, both lay and professional helpers should be particularly mindful of what they say in situations that heighten recipient attention to and processing of supportive message content. Regardless of the specific examples that could be generated in the context of task-related stress, this study primarily contributes to generalizability by forwarding a strong theory of supportive message outcomes, one that recognizes the complexity of how supportive communication impacts outcomes. Results are promising and suggest that the dual-process theory of supportive message outcomes will have important insights for both theorists and practitioners.

ACKNOWLEDGMENTS

This article is part of the author's doctoral dissertation completed under the direction of Dr. Brant Burleson at Purdue University. Partial funding for the dissertation was provided by the Central States Communication Association Federation Prize and a Purdue University

Research Foundation Dissertation Grant, both of which were awarded to the author and his advisor. The author expresses his gratitude to Jim Tyler of Purdue University for obtaining the physiological equipment used in this study and to Drs. Erina MacGeorge, Melanie Morgan, and Duane Wegener for their insights as committee members. Thanks are also extended to Amanda Holmstrom for reading a previous version of this article, to Andy J. King for help with data collection, and to Lisa Hanasono, Jerilyn Mincy, Ashton Steffen, Laura Sivy, and Jacqueline McGlynn for serving as confederates.

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APPENDIX: SUPPORTIVE MESSAGE MANIPULATIONS

<i>Message Level</i>	<i>Message</i>
LPC, before preparation	Although you might be feeling a little nervous right now, you really shouldn't be. I mean, it's just not that big of a deal—it's only a little speech. And the speech you were assigned is not the hardest one people do—there are plenty of other speeches that would be harder and more stressful. If this is your first speech, then just trust me—it will be over soon, and you'll be OK. If you've done speeches before, you know it's not a big deal; you know, been there, done that. This won't be bad. Just ignore your feelings and get busy preparing.
LPC, before presentation	Well, it's just about time for you to give your speech. Remember that giving a speech is no big deal—it's nothing to worry about. It's not worth getting stressed about, not one little bit. Once you get up there to give the speech, don't let yourself get tight or tense. Just relax and let it flow. There's nothing to be anxious about; only a real chicken gets nervous about giving a little speech. Just chill out; just be calm and relaxed. You'll get through it, and it will be OK. Just go out there and do it.
HPC, before preparation	Now that you know about the circumstances in which you'll be giving your speech, you may be feeling a bit nervous; if so, that's pretty normal. Some people find preparing and presenting these kinds of speeches to be pretty challenging and not much fun. So, if you feel somewhat frustrated or nervous, that's pretty understandable. Do you know what you want to accomplish in this speech? Some people find that focusing on their purpose helps relax them. And others think about whatever they are feeling as emotional energy that can help them connect with an audience effectively. Well, it's time for you to prepare.
HPC, before presentation	Well, it's almost time for your speech. Some people feel a little anxious before giving a speech, but I think that's only normal. If you're feeling a little tense, that could mean that you just want to do well, and I'm confident that you will do well. Some people think about giving this speech as just an exercise because they don't see a lot riding on it. Others find it helpful to focus on their goals for the speech. Do you feel like your preparation went pretty well? If so, you might be feeling pretty confident right now.