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The Varied Impact of Social Support on Cardiovascular Reactivity

Clayton J. Hilmert, James A. Kulik, and Nicholas Christenfeld

Department of Psychology
University of California, San Diego

Two experiments examine the hypothesis that the effect of social support on cardiovascular reactivity depends on participants' evaluative concerns and their motivation for task performance. In both experiments, heart rate and blood pressure were recorded while participants gave a speech to either a supportive or nonsupportive audience, with the experimenter either present or absent. Experiment 1 showed that support decreased performer reactivity relative to nonsupport when the experimenter was present, whereas support increased reactivity when the experimenter was absent. Experiment 2 replicated this pattern and helped clarify interpretation of the results. The results may help resolve inconsistencies in previous support and reactivity literature, and suggest that social support may not always improve health by lowering cardiovascular reactivity.

Research has indicated that there are important, health-related advantages to having strong social relationships and access to social networks. These advantages include reduced risk of coronary heart disease (CHD) and essential hypertension (EH; Berkman & Syme, 1994; Blumenthal, Burg, Barefoot, & Williams, 1987; Cohen, 1988; House, Landis, & Umberson, 1988; House, Strecher, Metzner, & Robbins, 1986; Orth-Gomer & Unden, 1987, 1990; Seeman & Syme, 1987; Welin, Larsson, Svardsudd, & Tibblin, 1992). However, the mechanisms by which social support benefits an individual's health are not well understood. One suggestion has been that social support influences individuals at a physiological level. Considerable effort has been devoted to investigating the possibility that social support attenuates cardiovascular reactivity (CVR) to stressful stimuli. According to the "reactivity hypothesis," an excessive frequency of large magnitude, acute CVR episodes may contribute to the development of EH and CHD (Krantz & Manuck, 1984; Lovallo & Wilson, 1992; Manuck, Kamarck, Kasprowicz, & Waldstein, 1993; Pickering & Gerin, 1990), and so reducing these responses can reduce the risk of cardiovascular disease (Uchino, Cacioppo, & Kiecolt-Glaser, 1996).

Requests for reprints should be sent to Clayton J. Hilmert or James A. Kulik, Department of Psychology, 9500 Gilman Drive, University of California, San Diego, La Jolla, California 92093–0109. E-mail chilmert@ucsd.edu or jkulik@ucsd.edu

In social support and CVR research, social support is commonly operationalized in the form of verbal and nonverbal agreement, the latter conveyed by nodding, smiling, and frequent eye contact. CVR is typically defined in terms of the magnitude of blood pressure (BP) and heart rate (HR) increases experienced during a stressful task. Most of this research has found that participants who receive social support (usually from confederates) during a stressful episode exhibit less CVR than participants who do not receive support. For example, Gerin, Pieper, Levy, and Pickering (1992) found that female participants who were verbally attacked by two confederates during a debate showed less CVR when a third confederate supported their view than when the third confederate sat silently in the room. Lepore, Allen, and Evans (1993) also demonstrated that the presence of a supportive other reduced CVR to a speech task relative to performing the task alone or in the presence of a nonsupportive confederate. Other researchers have found that the presence of a supportive friend can reduce CVR to a task relative to performing the task alone or in the presence of a stranger (Christenfeld et al., 1997; Kamarck, Manuck, & Jennings, 1990; see Uchino et al., 1996, for a review).

Although a considerable number of studies suggest that support can reduce CVR to a stressful task, the results are not completely consistent. Some researchers, for example, have failed to find evidence that participants experience less reactivity when facing a stressor in the presence of a friend rather than alone (Edens, Larkin, & Abel, 1992;

Sheffield & Carroll, 1994). More recently, others have found that social support can actually increase CVR. Both Anderson and Lawler (1998) and Christenfeld, Glynn, Kulik, and Gerin (1999) reported that participants revealed greater BP and HR reactivity to a discussion task when they received support compared to when they did not receive such support. Raynor, Cerrone, Finney, Pro, and Kamarck (1996) also found increases in reactivity during a speech task when friends or strangers were supportive relative to when they were nonsupportive. Allen, Blascovich, Tomaka, and Kelsey (1991) even reported greater reactivity in a friend support versus alone condition. Finally, Hilmert, Christenfeld, and Kulik (2002) showed that both high and low self-efficacy participants who received support from two confederates during a speech task experienced greater CVR than participants who performed the same task alone or in the presence of two nonsupportive confederates.

One possible explanation for the inconsistencies in CVR and social support findings is that identical social support can be comforting in some situations and motivating in others, depending on the evaluative nature of the setting. It is reasonably well established that evaluative situations can create anxiety in the form of fear of embarrassment, and that such evaluation apprehension often motivates active coping, that is, effortful attempts to exert control over outcomes (e.g., Smith et al., 1989; see also Baumeister, 1982; Geen, 1991; Seta & Seta, 1983; Wright, Tunstall, Williams, Goodwin, & Harmon-Jones, 1995). Research also has demonstrated that both active coping and evaluation apprehension can increase CVR (Light & Obrist, 1983; Obrist et al., 1978; Smith et al., 1989; Smith, Houston, & Stucky, 1985; Smith, Nealey, Kircher, & Limon, 1997; Wright et al., 1995). Smith and his colleagues (1989), for example, found that when rewards were contingent on task success, participants put forth more effort and displayed significantly greater reactivity than when incentives were low or when incentives were guaranteed. Wright et al. (1995) also found that in a public (and therefore evaluative) situation, participants were more task engaged and experienced greater CVR than when the task was performed in a private situation. We hypothesize that when people believe that their performance on a given task is being evaluated, and anxiety and motivation to avoid embarrassment therefore are high, social support can reduce anxiety, provide comfort, and ultimately reduce CVR. In comparison, when people are less concerned about performance evaluation, it is likely that both anxiety and motivation are low; social support may then motivate the participants to expend greater effort in performing the task, thus increasing CVR.

Previous research has not tested specifically whether the evaluative nature of the setting can moderate the effect of support on CVR. However, it appears possible that in past social support research, unintentional variations in the degree to which settings were evaluative may have contributed to the mixed effects of support on CVR. For instance, research resulting in a CVR-attenuating effect of social support has often either had the experimenter present during the performance of a task, (Christenfeld et al., 1997; Gerin, Pieper, Levy, et al., 1992; Kamarck et al., 1990), or the experimenter has told the participants that they would be observed by means of a video-camera (Gerin, Deich, Litt, & Pickering, 1995; Lepore, 1995). These seemingly minor elements could add to the level of evaluation apprehension and motivation in the setting. In comparison, a number of studies that have found the reverse effect of support (increased CVR) either have indicated the experimenter was absent during the task (Hilmert et al., in press), were not explicit about the whereabouts of the experimenter (Sheffield & Carroll, 1994), or had participants perform a task in a relatively familiar setting (viz., their home; Allen et al., 1991).[1]

Because we cannot be certain from the existing data that the presence or absence of the experimenter can neatly explain past social support findings, this article tests this hypothesis. That is, we propose that when the experimenter is present during the task, participants will be motivated to try to avoid embarrassment, and social support from others therefore will be comforting and serve to reduce CVR. In contrast, when the experimenter is absent, participants will not be so motivated; however, in this situation, the receipt of social support from others may encourage task engagement and thus increase CVR.

We will report two experiments. The first experiment compares the effects of support on CVR during a speech task when the experimenter is either present or absent. The second experiment was designed to replicate the results of the first study and to remove some interpretational ambiguities.

EXPERIMENT 1

While giving a speech, participants witnessed either supportive or nonsupportive behavior from a confederate. The audience member was trained to offer emotional support by nodding, smiling, and verbally agreeing with the participant or to act nonsupportively by seeming uninterested, maintaining little eye contact, and not responding positively to comments made by the speaker. Participants performed the speech task in either an experimenter-absent or experimenter-present condi-

[1]In an investigation preliminary to those reported here, we had 37 participants perform a speech task in front of two confederates who had been trained to respond in a supportive or nonsupportive fashion. The experimenter left the room prior to the speech. Results indicated that although participants perceived the supportive audience as more supportive than the nonsupportive audience, $t(35) = 11.35$, $p < .001$, $\eta^2 = .79$ (η^2 is an effect size index interpreted as the proportion of variance accounted for by a given factor; Rosenthal & Rosnow, 1991), support participants experienced greater reactivity than nonsupport participants, both in terms of systolic ($t[34] = 2.40$, $p < .05$, $\eta^2 = .14$) and diastolic BP ($t[35] = 2.07$, $p < .05$, $\eta^2 = .11$).

tion.[2] BP and HR readings were continuously recorded during the entire experimental session, and change scores for BP and HR were derived by subtracting mean resting baseline measures from mean levels obtained during the speech task.

Our primary prediction was that under experimenter-present conditions (i.e., high evaluation apprehension), a supportive audience would attenuate performer CVR relative to a nonsupportive audience; conversely, and consistent with our preliminary study (see Footnote 1), we anticipated that when the experimenter was absent during the task (i.e., low evaluation apprehension), the same supportive behavior from an audience instead would elicit greater performer CVR than would nonsupportive behavior.

Method

Participants

Sixty-two undergraduate females signed up to participate in a study of "opinions" for class credit. One person in the experimenter-present, nonsupportive condition was dropped because she was hypertensive (resting BP > 140/90). In addition, 1 participant in the experimenter-absent, supportive condition and 2 in the experimenter-absent, nonsupportive condition were dropped, because during debrief they revealed that they had been suspicious that the other participant was a confederate.

Cardiovascular Recording Apparatus

BP and HR were continuously measured during the experimental session by an Ohmeda Finapres 2300 Blood Pressure Monitor. This apparatus takes beat-to-beat measures of SBP, DBP, and HR noninvasively via a finger cuff on the third finger of the nondominant hand. Several authors have described the method of operation of the Finapres and its acceptable reliability for detecting responsivity (Gerin, Pieper, Marchese, & Pickering, 1992; Kurki, Smith, Head, Dec-Silver, & Quinn, 1987; Smith, Wesseling, & DeWitt, 1985; Wesseling et al., 1985).

Procedure

When a participant arrived at the laboratory, the male experimenter (the same in both of the reported experiments) told her that they could get started once a second participant (actually a confederate) arrived. While waiting, the participant was given magazines to read. Soon thereafter, the confederate arrived and was invited into the lab by the experimenter. The participant and confederate were seated across a 1.5-meter table from one another.

The experimenter explained that the study involved taking measurements of BP and HR during different tasks, and that they would be randomly assigned either to have their BP recorded while performing a task, or to be an observer while the other participant performed the task. After the apparatus was explained and consent forms had been signed, the experimenter, by means of a rigged coin toss, randomly assigned the participant to perform the task and the confederate to be the observer. The performer then was fitted with the finger cuff, and a barricade was placed between the participant and confederate to reduce distractions. The barricade remained in place until just before the speech was given. A 5-min resting baseline was then recorded with the experimenter present in the room.

After the baseline period, the experimenter explained that the participant was going to perform a speech task. The participant was told that the topic of the speech would be assigned and that she would have a 5-min preparation period during which she could take some notes. Participants were also told that the speech would be recorded by an audio tape recorder that sat on the table in front of them. Participants in the *experimenter-absent condition* were told that the experimenter would leave the room during the speech, whereas those in *experimenter-present condition* were told that he would stand in a corner of the room during the speech.

The experimenter then informed the participant that it was time to begin the speech preparation period, and that the speech topic would involve the participant's views on abortion. Participants were provided with two lists of arguments, one for and one against legal abortion. They were told that they could use the supplied arguments as is or use them to develop new arguments. The experimenter recommended that the participant use the 5-min preparation period to "jot down an outline" of what she intended to include in the speech.

After the preparation period, the experimenter told the participant that it was time to give her speech. The barricade was removed and the audience was asked "just to sit and listen to her (the participant) give her speech, as if you were listening to anyone give a speech." Once the participant and confederate said they understood the procedure, and after the participant was reminded to speak for 5 min and to try not to move, the experimenter began the audio recorder and a timer that was visible only to the confederate. The confederate used the timer to keep the frequency of supportive and nonsupportive responses consistent across participants (see the following discussion). The experimenter then left the room in experimenter-absent condi-

[2]Experimenter-present and experimenter-absent conditions were run in separate, consecutive quarters. Participants in these conditions were drawn from the same participant pool and the procedures (support manipulation, experimenter, dependent measures) were otherwise identical. Thus, although we doubt that any differences between experimenter-present and experimenter-absent conditions are likely to be due to differences in when participants participated, we note that participants technically were not randomly assigned to this factor.

tions or moved to a corner of the room just outside the participant's peripheral vision in experimenter-present conditions. In experimenter-present conditions, the experimenter pretended to take notes on a clipboard during the 5-min speech in case the participant turned around to look at him.

After the speech task was completed, the participant was asked to fill out a posttask questionnaire in private that included manipulation checks and stress ratings (described later). After they had completed the questionnaire, participants were debriefed and thanked for their participation.

Social Support Conditions

Participants were randomly assigned to one of two social support conditions. A female confederate was trained to respond to the participant's speech in either a supportive or a nonsupportive manner. The confederate remained neutral until the participant stated her position concerning abortion (i.e., prolife, prochoice, neither). In the *support condition,* the confederate established an open body posture once the participant stated her position. The supportive audience also exhibited verbal and nonverbal agreement with the points made and appeared interested and entertained by the speech. The confederate verbally displayed approval of content and performance by making comments such as, "good point," or "that's right" when appropriate. In contrast, the confederate in the *nonsupport condition* leaned back in her chair, folded her arms, and appeared relatively bored, uninterested, and unresponsive to the participant's speech. The experimenter was blind to the social support condition of participants prior to the speeches.

Dependent Measures

Social support manipulation checks. Participants were asked to indicate on separate 5-point scales, ranging from 1 (*not at all*) to 5 (*very much*), their impressions of how well the audience attended to the speech, how emotionally supportive and friendly the audience was, and how much the audience approved of the performance and content of the speech. Cronbach's alpha revealed high internal consistency for these items ($\alpha = .90$); therefore the items were scaled and summed to form an overall index, with higher values indicating greater perceived social support from the audience.

Self-reported anxiety. Four items on the posttask questionnaire asked the participant to rate on separate 5-point scales, ranging from 1 (*not at all*) to 5 (*very much*), how pleasant the speech task was, how stressful the speech task was, how nervous, and how calm she felt while giving the speech. In addition, participants were asked to complete the sentence, "The presence of the audience made me …" by using a 5-point scale, ranging from 1 (*much more nervous*) to 5 (*much less nervous*). Cronbach's alpha (.82) was acceptable, and these 5 items therefore were summed so that higher values indicate greater reported anxiety during the task.

Reactivity measures. SBP reactivity was our primary dependent variable, because previous work has shown it to be the most responsive measure of CVR (Uchino et al., 1996). However, DBP and HR reactivity also were assessed. Consistent with past studies of CVR and social support (Gerin, Pieper, Levy, et al., 1992; Kamarck et al., 1990; Lepore, 1995), CVR was indexed by subtracting average baseline levels of SBP, DBP, and HR from corresponding mean levels taken during the speech.

Results

Manipulation Check

A 2 (Supportive vs. Nonsupportive Audience) × 2 (Experimenter-Present vs. Absent) analysis of variance (ANOVA) was performed on the perceived support index. The results indicated a significant effect of social support condition, with much higher ratings of audience support and approval in the support conditions ($M = 20.88$) than in the nonsupport conditions ($M = 12.79$), $F(1, 58) = 122.27$, $MSE = 2.88$, $p < .0001$, $\eta^2 = .68$. No other effects were significant, all Fs$(1, 58) \leq 1.76$, ps $> .05$, $\eta^2 < .03$. Therefore, the social support manipulation appears to have been successful.

Primary Analyses

Table 1 reports the relations among the primary dependent measures. Separate 2 × 2 ANOVAs performed on the baseline physiological measures revealed no significant differences between conditions, all Fs$(1, 58) \leq 1.86$, ps $> .05$, $\eta^2 < .04$. Therefore, the primary analyses involve mean BP and HR change scores (task M – baseline M).

Reactivity. A 2 × 2 ANOVA performed on SBP reactivity revealed no significant main effects, Fs$(1, 58) \leq 1.68$, ps $> .05$, $\eta^2 < .03$. However, the predicted interaction of support and experimenter-presence was significant, $F(1, 58) = 11.00$, $MSE = 14.58$, $p < .01$, $\eta^2 = .16$. Figure 1 shows mean SBP changes for all four conditions. Paired comparisons revealed that participants in experimenter-absent conditions had significantly greater SBP reactivity when the audience was supportive relative to nonsupportive (Ms = 44.81 mmHg vs. 33.48 mmHg, $t[35] = 2.37$, $p < .05$,

TABLE 1
Experiment 1: Means, Standard Deviations, and Partial Correlations Among the Dependent Measures

Variable	*M*	*SD*	*DBP Reactivity*	*HR Reactivity*	*Self-Reported Anxiety*
SBP reactivity	42.05 mmHg	15.53	.79*	.42*	–.17
DBP reactivity	27.31 mmHg	7.05		.35*	–.14
HR reactivity	14.21 bpm	9.73			–.14
Self-reported anxiety	16.84	4.45			

Note. DBP = diastolic blood pressure; *df* = 59; HR = heart rate SBP = systolic blood pressure. The analyses control for social support and experimenter presence condition.
*$p < .01$.

$\eta^2 = .14$). In contrast, when the experimenter was present during the speech, participants experienced less SBP reactivity in the supportive relative to nonsupportive condition, (*M*s = 37.15 mmHg vs. 50.95 mmHg, $t[23] = 2.33$, $p < .05$, $\eta^2 = .19$). Viewed another way, additional *t* tests revealed that within the nonsupportive condition, participants showed significantly greater SBP reactivity in the experimenter-present condition (*M* = 50.95 mmHg) relative to the experimenter-absent condition (*M* = 33.48 mmHg), $t(27) = 2.89$, $p < .01$, $\eta^2 = .24$, whereas reactivity in the support conditions was nonsignificantly greater when the experimenter was absent (*M* = 44.81 mmHg) than when he was present (*M* = 37.15 mmHg), $t(31) = 1.63$, $p > .05$, $\eta^2 = .08$.

Analysis of DBP reactivity (Figure 1) likewise revealed evidence of a significant Support × Experimenter-Presence effect, $F(1, 58) = 4.77$, $MSE = 6.96$, $p < .05$, $\eta^2 = .08$. As with SBP reactivity, when the experimenter was absent, participants exhibited more DBP reactivity when the audience was supportive compared to nonsupportive (*M*s = 28.33 mmHg vs. 24.44 mmHg, respectively), whereas when the experimenter was present, participants exhibited less DBP reactivity with a supportive compared to nonsupportive audience (*M*s = 25.84 mmHg vs. 29.84 mmHg, respectively). Separate *t* tests were not significant in this case (*t*s < 1.80, *p*s > .05, $\eta^2 < .08$), and there where were no other DBP effects, *F*s(1, 58) ≤ 0.65, *p*s > .05 , $\eta^2 < .01$.

Finally, a 2 × 2 ANOVA performed on mean HR change scores revealed a tendency for greater HR reactivity when the experimenter was present (*M* = 16.95 bpm) compared to absent (*M* = 12.04 bpm) during the speech, $F(1, 58) = 3.81$, $MSE = 9.38$, $p = .06$, $\eta^2 = .06$. The Support × Experimenter-Presence effect did not reach significance, $F(1, 58) = 2.34$, $p > .05$, $\eta^2 = .04$ (Figure 1). We note, however, that when the experimenter was present during the speech, there was some tendency for participants to exhibit less HR reactivity if the audience was supportive compared to nonsupportive (*M*s = 13.05 bpm vs. 20.56 bpm), $t(23) = 1.56$, $p > .05$, $\eta^2 = .10$. When the experimenter was absent, however, HR changes were virtually identical across support conditions (*M*s = 12.06 bpm vs. 12.03 bpm), $t(35) = 0.02$, $p > .05$, $\eta^2 < .01$.

Self-reported anxiety. A 2 × 2 ANOVA that was performed on the self-reported anxiety index indicated that participants experienced less anxiety when the audience was supportive (*M* = 15.52) compared to nonsupportive (*M* = 18.31), $F(1, 57) = 7.99$, $MSE = 4.12$, $p < .01$, $\eta^2 = .12$. The interaction between support and experimenter-presence conditions also approached significance, $F(1, 57) = 3.86$, $MSE = 4.12$, $p = .05$, $\eta^2 = .06$. Inspection of the means revealed a pattern quite similar to that for HR: With the experimenter present, participants reported less anxiety when the audience was supportive compared to nonsupportive (*M*s = 15.18 vs. 20.38; $t[22] = 2.69$, $p < .05$, $\eta^2 = .25$), whereas participant anxiety did not differ as a function of support when the experimenter was absent (*M*s = 15.69 vs. 16.63; $t[35] = 0.76$, $p > .05$, $\eta^2 = .02$.

Discussion

In this experiment, we were able to replicate the frequently-reported CVR-attenuating effect of social support, in addition to a reverse, CVR-increasing effect of social support. The effect of support depended on whether the experimenter was present during the participant's task performance. As predicted, when the experimenter was present, participants who gave their speech to a supportive audience exhibited less reactivity, as indexed by smaller SBP and DBP changes (and to a lesser extent, { nonsupportive audience; when, however, the experimenter was absent from the room during the task, the same support from the audience served to increase SBP and DBP reactivity relative to when the audience was nonsupportive.

We also found that participants reported that they had been less anxious during the task if the audience was supportive compared to nonsupportive. It is important to note that support and reactivity research has sometimes found such an effect of support on self-perceived emotions and sometimes not (Christenfeld et al., 1997; Gerin, Pieper, Levy, et al., 1992; Kamarck et al., 1990; Uchino et al., 1996). Given this inconsistency in the literature, it is of some interest that we also found in this study a tendency

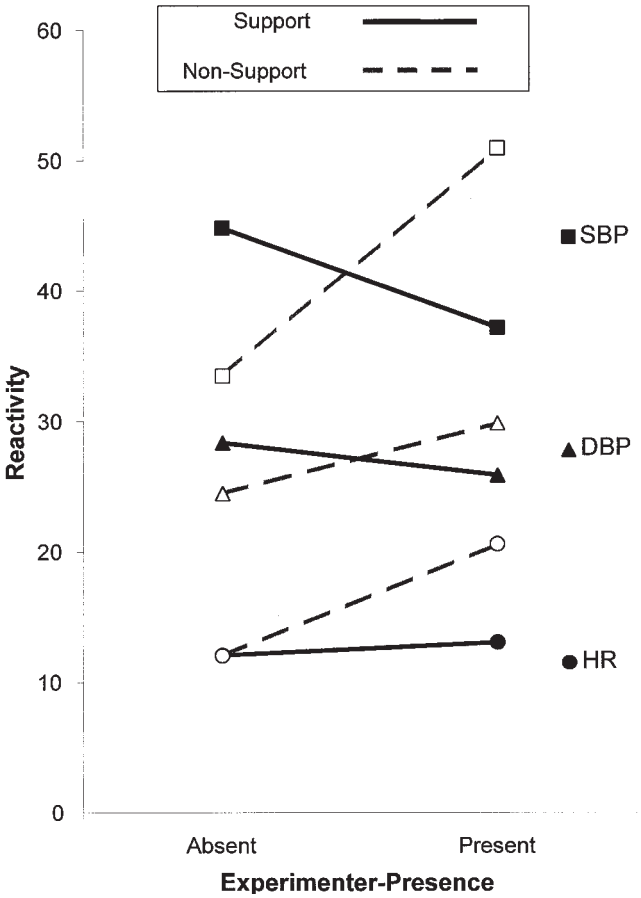

FIGURE 1 Experiment 1: SBP (mmHg), DBP (mmHg) and HR (bpm) reactivity by social support and experimenter-presence conditions.

for the effect of support on participants' phenomenological experiences to depend on whether the experimenter was present during the task. That is, when the experimenter was absent during the task, we saw no indication that a supportive versus nonsupportive audience produced different self-reported emotional reactions (despite differences in reactivity). When the experimenter was present, however, we found some tendency for participants to find the task less aversive if the audience was supportive compared to nonsupportive.

We believe that when the experimenter is present during the task, evaluation concerns and engagement in the task are apt to be relatively high. Under such circumstances, a supportive audience may be especially likely to reduce the aversiveness of the experience and to reduce CVR relative to a nonsupportive audience. In comparison, when the experimenter is absent during the task, evaluation concerns and engagement in the task are apt to be relatively low. Here a supportive audience may serve instead to increase task engagement, thereby increasing CVR (Light & Obrist, 1983; Obrist et al., 1978; Smith et al., 1989, 1997; Smith, Houston, et al., 1985; Wright et al., 1995). Because the task is relatively benign when the experimenter is absent, a supportive audience may not as readily lower the stressfulness of the task relative to when the experimenter is present. Our second experiment was designed to examine further the plausibility of these ideas.

EXPERIMENT 2

In this experiment we wanted first to see if the opposing effects of social support on reactivity would replicate when the presence or absence of the experimenter was completely randomized (see Footnote 2). Second, we wanted to determine whether self-reported evaluation apprehension and anxiety are affected by the experimenter-presence manipulation. Finally, we wanted to determine whether we could find more direct evidence that participants' effort varies as a function of social support when the experimenter is absent (i.e., when evaluation apprehension is presumably low).

Our primary prediction was that we again would find a crossover interaction between experimenter-presence and social support on CVR, indicated primarily in terms of SBP reactivity and, secondarily, DBP reactivity. We expected that a supportive audience would attenuate a performer's SBP and DBP reactivity relative to a nonsupportive audience when the experimenter was present during the task, but would increase such reactivity when the experimenter was absent. In keeping with the supposition that evaluation apprehension is the key moderating variable that is influenced by the presence versus absence of the experimenter, we also expected reports of evaluation apprehension and anxiety about the experimenter to be greater in experimenter-present than experimenter-absent conditions. Finally, we anticipated that participants would report greater task effort when an audience was supportive compared to nonsupportive, and that this difference would be greater when the experimenter was absent.

Method

Participants

Sixty-one normotensive undergraduate females volunteered to participate in a study concerning "opinions" for class credit. Two participants in the experimenter-present, nonsupportive condition were dropped because during debrief they expressed suspicions concerning the confederate.

Procedure

The basic procedure was the same as in the first experiment. Before arriving at the laboratory, participants were assigned

to an experimenter-presence condition and to a social support condition. The experimenter again was present for the 5-min baseline measures in all conditions, and participants were given a 5-min speech-preparation period prior to making their 5-min speeches. BP and HR were measured continuously with an Ohmeda Finapres 2300.

When the speech task was completed, participants were asked to complete a posttask questionnaire. The questionnaire included manipulation check items relevant both to social support and evaluation apprehension, questions concerning the anxiety and stress produced by the task in general and by the absence–presence of the experimenter specifically, and a question that asked how much effort the participant had put forth during the task (described in the following discussion). After they had completed the questionnaire, participants were debriefed and thanked for their participation.

Dependent Measures

Manipulation checks. The same 5 questions used in the first experiment were used to check the social support manipulation. As a supplement, participants also were asked to judge on a 5-point scale—ranging from 1 (*not at all*) to 5 (*very much*)—(a) how positively the audience reacted; (b) how negatively the audience reacted (reverse scored); and (c) to what extent the audience smiled. Because these 8 items were highly interrelated ($\alpha = .93$), they were first reverse scored as needed and then summed to create a social support index. Higher values on this index indicate greater perceived support.

To check on the manipulation of evaluation apprehension, all participants were asked on separate 5-point scales, ranging from 1 (*not at all*) to 5 (*very much*), the extent to which (a) "During my speech, I was concerned with how the experimenter would evaluate it"; (b) the "experimenter's presence–absence made me less nervous than if he had been absent–present during the speech"; and (c) the "experimenter's presence–absence made me more nervous than if he had been absent–present during the speech." Because these items proved to be only modestly interrelated (*r*s ranged from –.24 to .30), they were analyzed separately.

Self-reported anxiety. The posttask questionnaire included four items that asked participants to rate on separate 5-point scales, ranging from 1 (*not at all*) to 5 (*very much*), the pleasantness of the speech task, the stressfulness of the speech task, how nervous the participant felt while giving the speech, and how nervous the presence of the audience made the participant. These items were summed to create an anxiety index ($\alpha = .80$), with higher values indicating greater anxiety during the speech task.

Effort. One additional question asked participants to rate how much effort they put into the speech task on a 5-point scale, ranging from 1 (*no effort*) to 5 (*a lot*).

Reactivity measures. As in the previous experiment, mean baseline levels of BP and HR were computed and subtracted from corresponding mean BP and HR measures taken during the speech. These change scores were used to index reactivity.

Results

Manipulation Checks

A 2 (Experimenter-Presence) × 2 (Support) ANOVA performed on the social support index revealed the expected main effect of support condition, $F(1, 55) = 148.42$, $MSE = 2.99$, $p < .01$, $\eta^2 = .73$. Participants rated the audience as more supportive in the support conditions ($M = 21.70$) relative to the nonsupport conditions ($M = 12.21$). There were no other significant effects, Fs$(1, 55) \leq 0.91$, ps $> .05$, $\eta^2 < .01$.

T tests were performed on the 3 evaluation apprehension items. Results indicated that when participants were asked if the experimenter's presence or absence (depending on condition) made them more nervous during the speech, participants in the experimenter-present condition more strongly agreed with the statement than did participants in the experimenter-absent condition, Ms = 2.44 versus 1.22; $t(56) = 4.71$, $p < .01$, $\eta^2 = .28$. Likewise, when participants were asked if the experimenter's presence or absence made them less nervous during the speech, participants reported stronger agreement in experimenter-absent ($M = 4.15$) relative to experimenter-present ($M = 2.04$) conditions, $t(57) = 6.35$, $p < .01$, $\eta^2 = .41$. In other words, the presence of the experimenter made participants more nervous than did his absence. Participants did not report significantly greater concern with how the experimenter evaluated their speech in the experimenter-present versus experimenter-absent conditions, $t(57) = 0.27$, $p > .05$, $\eta^2 < .01$.

Primary Analyses

Table 2 reports the relations among the primary dependent measures. Separate 2 (Experimenter-Presence) × 2 (Support) ANOVAs performed on mean baseline physiological measures indicated no initial differences between conditions, Fs$(1, 55) \leq 2.20$, ps $> .05$, $\eta^2 < .04$.

Reactivity. A 2 × 2 ANOVA performed on SBP reactivity indicated that there was a tendency for participants in the experimenter-present condition to exhibit greater reactivity than those in the experimenter-absent conditions (Ms = 49.00 mmHg versus 41.71 mmHg), $F(1, 55) = 3.03$, $MSE = 16.20$, $p = .09$, $\eta^2 = .05$. More important, the predicted interaction between support and experimenter-presence condition was significant, $F(1, 55) = 5.13$, $MSE = 16.20$, $p < .05$, $\eta^2 =$

TABLE 2
Experiment 2: Means, Standard Deviations, and Partial Correlations Among the Dependent Measures

Variable	*M*	*SD*	*DBP Reactivity*	*HR Reactivity*	*Self-Reported Anxiety*	*Self-Reported Effort*
SBP reactivity	45.15 mmHg	16.93	.73**	.24*	.23*	.09
DBP reactivity	26.60 mmHg	8.27		.37**	.21	.09
HR reactivity	14.33 bpm	10.90			.08	.22
Self-reported anxiety	13.20	3.64				–.18
Self-reported effort	3.35	.59				

Note. DBP = diastolic blood pressure; $df = 55$; HR = heart rate; SBP = systolic blood pressure. The analyses control for social support and experimenter presence condition.
*$p < .05$. **$p < .01$.

.09 (see Figure 2). As expected, when the experimenter was absent during the task, a supportive audience produced greater reactivity than did a nonsupportive audience (*M*s = 45.97 vs. 37.87 mmHg); conversely, when the experimenter was present, participants exhibited less reactivity when an audience was supportive compared to nonsupportive (*M*s = 44.77 vs. 53.70 mmHg). Paired comparisons indicated that the differences between support conditions were significant when the experimenter was absent ($t[29] = 2.25$, $p < .05$, $\eta^2 = .15$) but not when the experimenter was present ($t[26] = 1.15$, $p > .05$, $\eta^2 = .05$).[3] Viewed the other way, *t* tests also showed that when the audience was not supportive, participants in the experimenter-absent condition had less reactivity than those in the experimenter-present condition (*M*s = 36.36 vs. 53.30 mmHg, $t[27] = 2.38$, $p < .05$, $\eta^2 = .17$); whereas, the presence or absence of the experimenter made little difference when the audience was supportive (*M*s = 45.21 vs. 47.43 mmHg, $t[28] = 0.47$, $p > .05$, $\eta^2 = .01$).

A 2 × 2 ANOVA performed on DBP reactivity resulted in no significant effects, all Fs$(1, 55) \leq 1.55$, ps $> .05$, $\eta^2 < .03$, (see Figure 2). A parallel analysis of HR changes indicated only that participants experienced greater HR reactivity when the experimenter was present ($M = 19.11$ bpm) compared to absent ($M = 10.02$ bpm) during the task, $F(1, 55) = 12.57$, $MSE = 10.01$, $p < .01$, $\eta^2 = .19$, (see Figure 2).

Self-reported anxiety. There were no effects involving support or experimenter-presence conditions on reports of anxiety, Fs$(1, 55) \leq 1.01$, ps $> .05$, $\eta^2 < .02$.

Self-reported effort. A Support × Experimenter-Presence ANOVA performed on participants' ratings of their task effort indicated that participants who gave their speeches to a supportive audience felt they had put forth more effort than did those who had a nonsupportive audience, *M*s = 3.53 versus 3.16; $F(1, 55) = 7.41$, $MSE = 0.56$, $p < .01$, $\eta^2 = .12$. Neither the main effect of experimenter-presence nor the interaction with support was significant, Fs$(1, 55) \leq 2.06$, ps $> .05$, $\eta^2 < .04$.

Discussion

Consistent with the first experiment, participants in this experiment clearly felt they had received more support from a supportive audience than a nonsupportive audience. We also found evidence that the experimenter's presence during the task made participants more nervous than did his absence, a finding that is consistent with our suggestion that evaluation concerns are likely greater when performing with the experimenter present. A similar effect of experimenter-presence was found on HR reactivity, in that participants also experienced greater HR reactivity when the experimenter was present relative to when he was absent.

Most important, we replicated the social support by experimenter-presence crossover interaction found in Experiment 1, this time with a complete randomization of conditions (see Footnote 2). When the experimenter was absent during the participant's speech, an observer's social support significantly increased the participant's SBP reactivity relative to when the observer was nonsupportive. Conversely, when the experimenter was present, support tended to decrease SBP reactivity relative to when there was nonsupport (although the difference in this case did not reach significance). Self-reported anxiety was not related to condition, but participants did report putting forth more effort when an audience was supportive rather than nonsupportive.

The observed relation between social support and effort is consistent with our belief that, when the experimenter is absent, support may serve to increase task involvement and effort (i.e., active coping), and may thereby increase reactivity (Light & Obrist, 1983; Obrist et al., 1978; Smith et

[3]Because the paradigms in Experiments 1 and 2 were basically identical, and because resulting means were all very similar, we decided to examine the combined probability of the Support × Experimenter Presence effects on SBP reactivity of these independent experiments (Rosenthal, 1984). The formula for combining probabilities is $P = [(\Sigma p^n) / N!]$, where N is the number of studies. Using this formula, the combined probability for the Support × Experimenter Presence effect on SBP reactivity is highly significant ($p < .001$). In addition, combined probabilities for paired comparisons indicate that support, relative to no-support, increased SBP when the experimenter was absent ($p < .001$) and decreased SBP reactivity when he was present ($p = .039$).

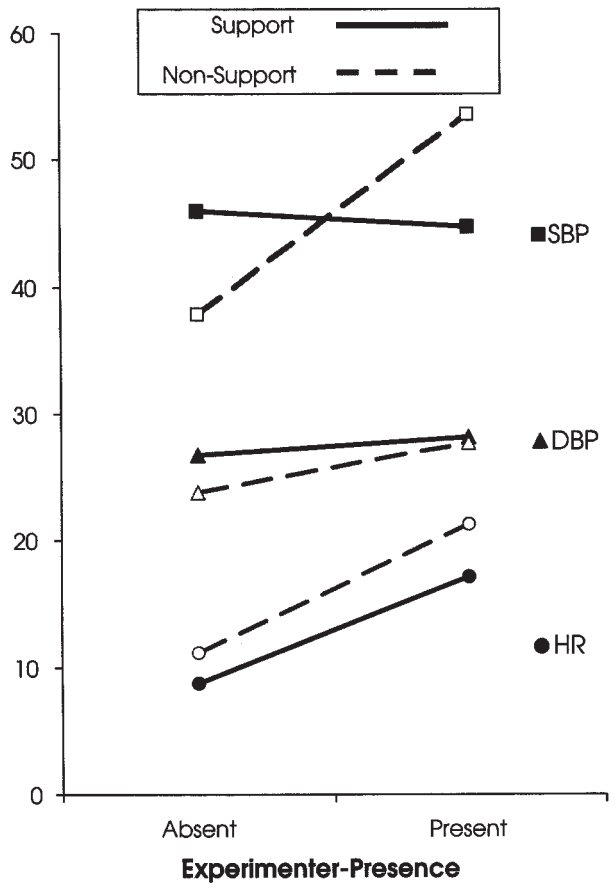

FIGURE 2 Experiment 2: SBP (mmHg), DBP (mmHg) and HR (bpm) reactivity by social support and experimenter-presence conditions.

al., 1989, 1997; Smith, Houston, et al., 1985; Tomaka, Blascovich, Kelsey, & Leitten, 1993; Wright et al., 1995). However, we also had anticipated that the effect of support on effort would be weaker when the experimenter was present, and we found no such evidence. It may be that our single-item measure of effort lacked the sensitivity needed to detect such an interaction. It should be noted, however, that other researchers have found a lack of a congruity between SBP reactivity and self-reported effort (e.g., Wright, Shaw, & Jones, 1990), and therefore, it may be that people find it difficult to report accurately their effort. It may also be that the effect of a supportive audience on effort is generally positive. If so, and if effort normally translates into greater reactivity, the finding that a supportive audience dampened reactivity when the experimenter was present becomes in some respects more impressive. That is, even as participants in the experimenter-present condition who received support may have exerted more effort on the task, something additional about the received support was able nevertheless to net the performer less reactivity compared to when support was absent. We believe the countervailing force that lowered reactivity may have been the removal or lowering of the evaluation apprehension that performers felt when the experimenter was present. We consider these issues in more detail in the general discussion.

GENERAL DISCUSSION

Previous experimental studies of support and reactivity have indicated mostly that social support attenuates CVR during the performance of a difficult task (see Uchino et al., 1996 for review). As noted in the introduction, however, several recent studies have found that support can increase CVR during task performance (Allen et al., 1991; Anderson & Lawler, 1998; Christenfeld et al., 1999; Hilmert et al., in press; Raynor et al., 1996). It is difficult, if not impossible, to interpret such a pattern so long as the different effects occur in different studies. Our results are noteworthy, therefore, because for the first time within the same paradigm, there is evidence of social support both attenuating and augmenting CVR during task performance. In the narrowest terms, we found that there were different effects of support on CVR, particularly systolic reactivity, depending on whether the experimenter was present or absent during the speech task. When the experimenter was absent, both experiments found that support increased arousal relative to when the performer faced a nonsupportive audience (see also Footnote 1). Both experiments also demonstrated that when the experimenter was present, audience support tended instead to decrease reactivity relative to when there was no support. An interesting possibility suggested by our results, therefore, is that some of the previously reported inconsistencies in the support and reactivity literature may be attributable to procedural differences with respect to the evaluative nature of the setting, or more specifically, to the experimenter's presence or absence. Regardless of whether this is a viable explanation for the literature's inconsistencies, the results of the experiments presented here provide the strongest evidence to date that the same support from strangers can either augment or dampen CVR, depending on the context in which the task is performed.

Theoretical Considerations

Why does the presence or absence of the experimenter during task performance moderate the effect of support on reactivity? We believe that a key issue may center on the differential goals that performers are likely to have when an important evaluator is or is not present in the situation. A classroom instructor might well feel increased motivation, and expend extra effort to avoid embarrassment and deliver a good lecture, when a couple of colleagues decide to sit in on the performance. In a similar way, we propose, participants may experience more evaluation apprehension, anxiety, and motivation to avoid embarrassment and to do a good job when an experimenter is present during the speech task. Such feelings may generally motivate active coping; that is, serve to increase task engagement and efforts to exert control over outcomes (Smith

et al., 1989; see also Baumeister, 1982; Geen, 1991; Seta & Seta, 1983; Wright et al., 1995), which in turn has been associated with increased CVR (Obrist, 1976, 1981; Smith et al., 1989, 1997; Wright et al., 1995). A supportive audience in such a context may serve to convey that the performer is achieving her goal of avoiding embarrassment and performing well; if so, the performer psychologically and perhaps behaviorally may be more able to relax relative to when an audience's reaction is not supportive. When the audience is nonsupportive, because the performer presumably cares about what the special evaluator thinks, a combination of distress (humiliation in front of the special evaluator) and sustained or increased effort to win over the audience is more likely, with the result that CVR is relatively elevated.

In contrast, when the experimenter is absent, we have proposed that participants are apt to feel less evaluation apprehension, anxiety, and motivation to perform the task. It may be a bit daunting to give an extemporaneous talk, but it is less so if no significant evaluative figure is present during the talk. The goal here, therefore, may be more to do an adequate job, and less to avoid embarrassment or to achieve stellar results. With low evaluation concerns, support from the audience may serve to stimulate additional effort, much as a lecturer who receives positive feedback from his class may become inspired to put forth even more effort. However, a nonsupportive audience may be relatively unlikely to stimulate active coping when evaluation concerns are low. Like the lecturer faced with a nonresponsive class, the goal may become less one of actively winning the audience over, and more one of just getting through the experience; that is, the strategy may shift to passive coping (cf. Smith et al., 1989). Thus, with evaluation concerns lower, the upshot is that a supportive audience will produce greater CVR than a nonsupportive audience.[4]

Our efforts to find direct evidence for some of the foregoing processes were partially successful. There are two sorts of self-reports that are relevant: self-reports of how the support from the audience and the presence of the experimenter affected apprehension and effort, and self-reports of anxiety during the task. In the second experiment, for example, we found evidence consistent with the notion that the presence of the experimenter caused participants to experience greater apprehension and nervousness. However, responses to an item asking specifically about concern with how the experimenter would evaluate their performances did not differ reliably by condition. We also found evidence in the second experiment consistent with the notion that support increases effort, although we did not find evidence for our prediction that support would increase effort particularly when the experimenter was absent.

Finally, like others before us, we found scant evidence of reliable effects of support on overall self-reported anxiety during the task (Christenfeld et al., 1997; Gerin, Pieper, Levy, et al., 1992; Kamarck et al., 1990). Only Experiment 1 provided evidence that support might affect overall anxiety in the manner we hypothesized; participants reported less overall anxiety during the task in supportive conditions, and, more interesting, there was some indication that support was calming primarily when the experimenter was present. This pattern fits with our thinking, in that we would expect any calming effect of support to be more detectable when anxiety and apprehensions are high rather than low. Therefore, if anxiety and apprehension are higher when the experimenter is present, as we propose, this is when the effect of support on anxiety should be more pronounced. We note, however, that the relation between anxiety and CVR is anything but simple (Fowles, 1983; Fowles, Fisher, & Tranel, 1982; Wright et al., 1995), and that unlike in Experiment 1, support did not significantly affect self-reported anxiety in Experiment 2. Because we have no ready explanation for the divergent results, we must consider the interpretation of the self-reported anxiety results of Experiment 1 with caution.

In summary, we believe that the presence or absence of the experimenter is important from a psychological standpoint primarily because it influences the evaluative nature of the setting. This can then determine whether receiving support from an audience is on balance motivating or comforting, and whether it increases or decreases CVR. Further research is needed to establish this moderating role of evaluation apprehension. One question is whether alternative manipulations of evaluation apprehension would interact with social support in the same way as experimenter-presence/absence. Evaluation apprehension could be manipulated perhaps by altering the size of the audience, its expertise, or by including videotaped and nonvideotaped conditions. A second question worth investigating is whether stressors other than our speech task would also reveal the interaction between social support and evaluation apprehension on CVR. Finally, it would be interesting to see if other variables related to anxiety and active coping can also moderate the effects of social support. It is possible, for example, that a monetary incentive could motivate participants and make them more nervous about their performance. With such an incentive, then, support might be calming; whereas without such an incentive, the same support could increase effort and be arousing. On the other

[4]We note that our operationalization of nonsupport, like those in virtually all support and reactivity studies (see Uchino et al., 1996), involves a degree of inattentiveness by the audience. As one reviewer noted, it is conceivable that the attentiveness of a nonsupportive audience may moderate the effects on CVR. Thus, inattentiveness in the nonsupport conditions, when combined with the absence of the experimenter, may have left participants feeling that there was no one to impress, resulting in lowered CVR. If an audience was nonsupportive, but always attentive, it is possible that participants would have felt more evaluative concern and therefore exhibited greater CVR. Even if further work were to show that an attentive, nonsupportive audience produced greater CVR than an inattentive, nonsupportive audience, we would suggest that the basis for this difference lies in differences in evaluative concern.

hand, it may be that evaluation apprehension does not simply increase motivation, but also increases the fear of embarrassment. The fear of embarrassing oneself could be relieved by social support, whereas the fear of failing to successfully complete a task might not.

Practical Considerations

The practical importance of social support and reactivity research depends on the reactivity hypothesis, which holds that an excessive frequency of large magnitude, acute CVR episodes can contribute to the development of cardiovascular disease (Krantz & Manuck, 1984; Lovallo & Wilson, 1992; Manuck et al., 1993; Pickering & Gerin, 1990). The prevailing view has been that social support may be beneficial because it dampens harmful, acute CVR reactions to stress. Our finding that support can either increase or decrease reactivity clearly challenges any presumption that there is a unidirectional, dampening effect of support on reactivity. However, this finding does not rule out the possibility that support benefits cardiovascular health through a reactivity mechanism. It remains possible that, in real-world settings, the CVR-attenuating effect of social support is significantly more prevalent than the CVR-increasing effect. If the sorts of situations that normally evoke support are the ones where anxiety and apprehension are already high, the more common effect of support will be to dampen reactivity, and this may benefit health.

It also is worth considering whether social support would necessarily be harmful in those situations where it does increase CVR. That is, even if the CVR-increasing effect of support is harmful from a reactivity standpoint, an interesting possibility is that there are concomitant effects of support that provide a net benefit for health. We have suggested, for example, that social support in a nonevaluative situation increases not only CVR but also task engagement and motivation. Research on constructs such as hardiness (Allred & Smith, 1989; Kobasa, 1979; Kobasa, Maddi, & Courington, 1981; Kobasa & Puccetti, 1983) and sense of coherence (Antonovsky, 1979) suggest there may be general health benefits to being actively engaged in the activities of one's life. More specifically, it may be that if support motivates individuals to actively cope rather than avoid certain situations that are controllable (e.g., exercising, visiting the doctor, asking for a raise), the benefits of these activities to the individual's health may outweigh any deleterious effects of immediate increased reactivity.

In summary, it is clear that further research is needed to establish the mechanisms by which social support promotes health. Our results do not challenge the viability of a reactivity mechanism per se but do suggest the need for a more complex, interactive view of the effect of support on CVR. Specifically, we have suggested that the evaluative nature of the setting moderates the effect of support on CVR. In a highly evaluative setting, support may be comforting and serve to reduce CVR. In less evaluative settings, support may instead be motivating and increase active coping and CVR. How such divergent effects of support on CVR ultimately impact health remains to be determined, but it is clear that any model presuming social support will always dampen CVR is too simple. The effect of support from an audience is likely to interact with one's goals in a situation, and it may be that one's goals can change as a result of receiving or not receiving support.

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