Audience Status Moderates the Effects of Social Support and Self-Efficacy on Cardiovascular Reactivity During Public Speaking

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ABSTRACT

Exaggerated blood pressure responses to stress are implicated in the development of cardiovascular disease, and an effort has been made to identify factors associated with such responses. One situational factor that impacts cardiovascular responses to stress is the presence of other people and their behavior. Here, we manipulated the status of the audience during a stressful public speaking task to explore its impact on reactivity and its possible role in moderating the effects of the speaker's confidence and the audience's response during the speech. Sixty-four normotensive female undergraduates, classified as having high or low self-efficacy for public speaking, gave a 5-min speech to an audience that responded positively or negatively. Half of the audiences were presented as public speaking experts and half as novices. Cardiovascular reactivity was greater for low-efficacy speakers and for those receiving positive feedback. Reactivity was also greater facing an expert audience. Furthermore, the effects of both self-efficacy and audience feedback were intensified before an expert audience. To understand social support effects, we must attend not only to characteristics of the recipient but also to those of the provider.

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INTRODUCTION

The reactivity hypothesis suggests that unusually large or frequent blood pressure responses to stress are associated with later cardiovascular disease (1,2). The bulk of the research exploring this notion is concerned with individual differences, identifying the people who show excessive reactivity and are thus at elevated risk of later disease. Work in this vein has suggested that the people who show the largest responses to a standardized stressor are more likely to develop hypertension (3,4) and are also more likely to have a family history of hypertension (5). In addition to linking excessive reactivity to later disease, or to markers of later disease, the individual-difference approach has sought to identify factors that are predictive of excessive reactivity. For example, people high in hostility may show greater reactivity, especially to anger-relevant provocation (6–8). Similarly, people with low self-efficacy for a given task can show higher levels of reactivity when performing that task (9,10).

The other major line of work based on the reactivity hypothesis explores the situations, rather than individual differences, that are associated with unusually large cardiovascular responses. This work also examines manipulations or interventions that buffer the cardiovascular response. Along these lines, people have examined the cardiovascular consequences of high-stress jobs (11,12) and low levels of task control (13–17).

One situational factor that has received significant attention for its influence on reactivity is the presence of other people. Kamarck, Manuck, and Jennings (18) showed that the presence of a friend can reduce the reactivity of a person performing mental arithmetic and concept-formation tasks. This finding suggests possible mechanisms for the robust benefits of social support uncovered in the epidemiological literature, where the presence of social support has been reliably linked to decreases in cardiovascular disease, hypertension, and mortality (19,20). Therefore, people who are frequently in the presence of friends and family may show reduced cardiovascular reactivity to stress, and thus be less likely to suffer later cardiovascular disease. Since the Kamarck et al. (18) findings, researchers have investigated the factors that moderate this social support effect. Not surprisingly, one important factor is the behavior of the person serving as the audience, with positive responses reducing reactivity more than negative responses (21). Other, less obvious factors also appear to moderate social support effects. For example, support from a woman seems to buffer reactivity, compared to nonsupport, but identical behavior from a man does not (22). This finding also fits with the epidemiological evidence suggesting that having a wife provides greater health benefits than having a husband (23–26).

Recently, we identified another situational factor that appears to moderate the effects of social support on cardiovascular reactivity and suggested that an important component may be a performer's effort. Supportive behaviors from an audience, compared to neutral feedback, reduced the reactivity of a person giving an impromptu speech only when the experimenter was present during the speech task (27). When the experimenter was absent, exactly the same supportive behaviors from the audience increased reactivity. In other words, the usual cardiovascular-dampening effects of a supportive audience only emerged when a potentially evaluative experimenter was present. We hypothesize that, in the absence of an evaluative experimenter, the supportive behaviors served instead to motivate the speaker to greater effort, and this effort was reflected in greater reactivity. Without an evaluative experimenter, and with the audience appearing relatively neutral and disinterested, the speaker may not have been trying very hard, with relatively low reactivity the result.

Another factor that may affect how much effort speakers put into the task, and that may moderate social support effects, is the status of the audience. In this experiment we explore the role

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that this characteristic of the audience can play on reactivity. Based on our previous work (27), and other work showing that an increase in the potential for evaluation can increase reactivity (28–30), we expect that an audience composed of public speaking experts might engender greater reactivity in a speaker than would an audience of novices. In addition to this effect, it is possible that the expertise of the audience could interact with, or moderate other factors that influence reactivity during a stressful task. Two other possible factors are considered: (a) a situational manipulation—the supportiveness of the audience and (b) an individual difference—the self-efficacy of the speaker.

In this experiment, we again focus on social support in the absence of the experimenter, in an effort both to replicate the previously reported "backwards" social support effect (where, with the experimenter absent, support is associated with increased reactivity) and to examine its possible interaction with audience expertise. One possibility is that an audience of public speaking experts is simply more important than one made up of those with no public speaking experience, and so any effect of an audience would be magnified. In this case, we should find that the increase in reactivity that accompanies support should be greater with an expert audience. In other words, people should show more effort when they get positive feedback and care more about the feedback of experts; they should show an especially large increase when the experts seem to be approving. Another possibility is that, although disinterest from novices could cause speakers to reduce their effort, similar feedback from experts would be highly motivating. Impressing experts may be more important, and so evidence that one is not yet successful could spur renewed effort and, thus, heighten reactivity. In this case, one might find that with a novice audience, positive feedback produces high reactivity, but with experts, it is the negative feedback that engenders greater reactivity. Another possibility, of course, is that the behavior of the audience and the status of that audience will exert independent effects on a speaker's cardiovascular response.

We also examine whether a characteristic of the audience, in this case expertise, interacts with an individual-difference dimension, in this case self-efficacy. Several studies have shown that people's reactivity while performing stressful tasks is influenced by their subjective impressions of their own competence at that task (9,10,31,32). In a study by Gerin, Litt, Deich, and Pickering (31), for example, they found that low self-efficacy for a mathematics task was associated with greater reactivity, but this effect was only apparent when participants could control the timing of the mathematics problems. In other words, the potential cost of being a person with low self-efficacy, in terms of suffering greater cardiovascular reactivity, may be amplified in some situations, in this case, by having greater control over outcomes.

One situational factor that could amplify the effects of having low efficacy for public speaking is facing an audience of public speaking experts. Just as we can test whether the expertise of the audience amplifies the effects of that audience's feedback, we can also explore whether it amplifies the effects of a speaker's confidence. In this case, the greater reactivity of those with low self-efficacy should be especially pronounced before an audience of experts. In this situation, such heightened reactivity may be due to increased anxiety, increased effort, or some combination of the two, as the relation between emotion, motivation, and cardiovascular reactivity is anything but simple (19,30,33,34). Another possible outcome could be that, for someone with low confidence in speaking ability, any audience is frightening, but confident speakers only get nervous in front of experts. In this case, we might find the effects of self-efficacy on reactivity would only be visible in front of a novice audience. And, again, it is possible that any effects of self-efficacy and this particular characteristic of the situation would be independent, with audience expertise playing no moderating role.

Overall, this work aims to extend our knowledge of the factors that influence the cardiovascular response of a person under stress, by exploring a new situational factor that might also serve to moderate other documented influences on reactivity. Specifically, the effects of both social feedback and self-efficacy on the reactivity of a speaker may be greater when public speaking experts are the audience for that performance. To explore these possibilities, we examined the cardiovascular response of people giving an impromptu speech to a 2-person audience. Half of the speakers were categorized, based on self-report assessment, as having high self-efficacy for public speaking and half as having low self-efficacy. For half of the speakers, the audience behaved in an encouraging, supportive manner, and for half, the audience was more disapproving and disinterested. Finally, half of the speakers were lead to believe that the 2 people listening to the speech were expert and experienced public speakers, and half believed that the audience had no particular public speaking skill or experience. In all cases, the experimenter remained out of the room, and out of earshot of the speech itself.

METHOD

Participants

Sixty-four undergraduate women students attending the University of California, San Diego, participated for class credit. All participants were normotensive (resting blood pressure less than 140/90).

Cardiovascular Recording

Blood pressure and heart rate were continuously assessed using an Ohmeda Finapres 2300 Blood Pressure Monitor (Ohmeda, Louisville, CO). This apparatus takes beat-to-beat measures of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) noninvasively, using a finger cuff worn on the third finger of the nondominant hand. Several authors have described the method of operation of the Finapres and its reliability, especially for tracking rapid cardiovascular changes (35–37).

Procedure

Participants were told that the study concerned blood pressure and heart rate changes while performing a task. Once the operation of the Finapres was described, the participant signed a consent form and she was fitted with a finger cuff. The participant then was informed she would perform a short speech. She was told that the topic of the speech would be assigned, that she would have a 5-min preparation period, and that the speech would be given into a microphone and to an audience of two student volunteers recruited by the experimenter's advisor.

The participant then spent 5 min preparing her speech. She was supplied with a pen and paper and was instructed that her speech should agree or disagree with the statement "College is a valuable asset" and that she should outline some ideas concerning what she wanted to say. The experimenter left the room for the preparation period.

After 5 min, the experimenter returned and asked the participant to complete a self-efficacy questionnaire (described later in this article). Once this was completed, the experimenter casually described the two people who would be serving as the audience. They were described either as public speaking experts or novices, depending on condition (described later in this article). The participant was then asked to sit as still as possible while baseline measures of HR and blood pressure were taken, and the experimenter left the room for 3 min. This is shorter than traditional resting baselines. However, because participants had plenty of time to become accustomed to the laboratory before the baseline was assessed, and because of the very high number of readings provided by the Finpres, 3 min should be sufficient to provide a highly stable measure (37).

After the experimenter returned, two women confederates knocked on the laboratory door and were greeted by the experimenter. Once the audience was seated, the experimenter told them that they were just to listen to the speech as if they were listening to anyone giving a talk. Then the participant was reminded that her speech had to last 5 min and that it was important that she keep her nondominant arm, with the finger cuff, as still as possible. After the participant said she understood, the experimenter began the audiotape recorder, unobtrusively started a timer that was visible to the audience but not the participant, and told the participant to begin. The confederates used the timer to coordinate responses to the speech (as described later in this article). The experimenter then left the room for 5 min.

After 5 min, the experimenter returned, excused the audience members, and removed the blood pressure cuff. The participant then completed the posttask questionnaire, which consisted of 12 Likert-type questions and included manipulation checks and ratings of stress during the speech task (described later in this article).

After the posttask questionnaire was completed, the participant was debriefed and thanked for her participation.

Experimental Manipulations

Audience expertise. The expertise manipulation was implemented while the participant and experimenter were waiting for the two audience members to arrive. The experimenter, apparently just filling time, casually mentioned his advisor's description of the two people who would be listening to the speech. In expert-audience conditions, the experimenter said that his advisor had mentioned that the audience was very experienced in public speaking, that both had been on speech teams in high school, that one of them was currently coaching debate at a local high school, and that "We are very lucky to have them help us today." In novice-audience conditions, the participant was told that the audience had very little experience in public speaking and was just made up of two undergraduate psychology majors who were nice enough to volunteer their time. The audience members themselves remained blind to the expert or novice condition.

Feedback. Participants were randomly placed into one of two feedback conditions. In the positive-feedback condition, both confederates remained neutral but attentive for the first 45 sec and then started to indicate interest and approval, with one confederate playing a more active role. Both confederates leaned forward with an open body posture, smiling and nodding in agreement with the participant's speech. The more active audience member occasionally gave verbal approval of the speech by making comments such as "good point," or "that's right," and the other audience member would agree with such comments. Approximately 2 min into the speech, the confederates looked at each other and smiled in agreement that the participant's speech was impressive. For the remaining 3 min of the speech, the confederates continued to nod, smile, and express verbal agreement with points made by the speaker.

In the negative-feedback condition, confederates began responding 45 sec into the speech by leaning back in their chairs and folding their arms. The more active confederate was attentive but appeared to question the speaker's conclusions by furrowing her brow occasionally, whereas the other confederate glanced around the room and showed little interest in the speech. Two minutes into the speech, the confederates turned to each other and conveyed, by shaking their heads slightly and sighing, that neither was very interested in the speech. During the remaining 3 min, the confederates showed very little facial expression and glanced periodically around the room. Additionally, at 3 min one confederate looked at her watch, and at 4 min the other stifled a yawn. The experimenter remained blind to feedback condition throughout the experiment.

Measures

Self-efficacy. The self-efficacy questionnaire asked the participant a total of 16 questions about her confidence in public speaking. Half of the questions asked about her confidence that she could deliver a speech calmly, and half asked whether she could deliver one that was well organized. Additionally, half asked about speeches on a topic of her own choosing, and half asked specifically about her confidence giving a speech on whether college was a valuable asset (the topic of the upcoming talk). Finally, within each sort of question, she was asked about her confidence delivering the speech to four different sorts of audiences: a friend, a stranger, 5 to 10 people, and 25 to 50 people. There were thus 16 permutations of these questions, with each one rated on a 10-point scale from 1 (*not at all confident*) to 10 (*very confident*). For example, participants were asked to rate how confident they were that they could calmly deliver a speech about whether college was a valuable asset to an audience of 5 to 10 people. This format is similar to those used by Bandura (38) and Gerin et al. (31) to assess self-efficacy. High reliability was found for the self-efficacy questionnaire items ($\alpha = .96$). The self-efficacy ratings were therefore summed to create a self-efficacy index, with higher values indicating greater self-efficacy. Scores ranged from 32 to 142 with a standard deviation of 28. Participants were classified as having high self-efficacy if they fell above the median of 88 and low if they fell below it. The 2 participants who had self-efficacy scores of 88 were randomly assigned a low- or high-self-efficacy classification (1 low and 1 high).

Self-reported anxiety. Four items on the posttask questionnaire asked the participant to rate how pleasant and how stressful the speech task had been and how nervous and how calm she had felt on a scale from 1 (*not at all*) to 5 (*very much*). The four items were reverse scored when appropriate and summed to create an anxiety index ($\alpha = .90$). Higher values on the self-reported anxiety index indicate greater anxiety.

Manipulation checks. Participants rated their impressions of the audience's expertise in public speaking on a 5-point scale ranging from 1 (*not at all*) to 5 (*very much*). However, comments during debriefing led us to suspect there were interpretation problems with this item. Therefore, for the final 16 participants, three questions were added to the posttask questionnaire, which asked specifically for ratings of the audience's previous knowledge, training, and experience in public speaking (using the same 5-point scales). A total "perceived audience expertise" index was computed by summing these items ($\alpha = .91$). Higher values indicate that the participants perceived the audience as having more public speaking expertise.

To check the effectiveness of the audience-feedback manipulation, six posttask questions asked participants to rate their impressions of how well the audience attended to the speech, how emotionally supportive and friendly the audience was, how much the audience approved of the performance and content of the speech, and how nervous the audience's responses made the participant. Once again 5-point scales were used ranging from 1 (*not at all*) to 5 (*very much*). A total "perceived feedback" index was then computed by summing the 6 feedback-manipulation check answers ($\alpha = .90$). Higher values on this index indicate that participants felt that the audience offered more positive feedback.

Word production. Audiotapes of the speeches were transcribed, and the number of words uttered during each speech was counted.

Statistical Analyses

Cardiovascular reactivity was assessed by subtracting average levels of SBP, DBP, and HR during resting baseline from average levels during the participant's speech. Means were calculated using the pulse-based average (39).

Preliminary analyses involved a 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) analysis of variance (ANOVA) performed on baseline measures and Pearson correlations computed between change scores and baseline measures. If there were a significant relation between baseline and condition, or baseline and reactivity, then baseline would be used as a covariate in the primary analyses. When there was a significant relation, this procedure would statistically control for variations in reactivity due to baseline rather than the speech task (40).

The primary analyses used a 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) multivariate analysis of covariance (MANCOVA) to examine the effects of experimental conditions on SBP, DBP, and HR reactivity simultaneously. Because previous literature has suggested that simply talking can raise blood pressure (41,42), word production was incorporated into the analyses as a covariate. If the multivariate test suggested a significant effect, then paired comparisons were computed using one-way analysis of covariance (ANCOVA) procedures with word production as a covariate.

Self-reported measures, including manipulation checks and ratings of anxiety, were analyzed using 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) ANOVAs. Also, because word production can provide a measure of how much effort a participant put into the task, it was examined with a 2 × 2 × 2 ANOVA. In addition, mediation analyses were conducted to explore the possible role of effort, as indexed by word production, in mediating the effect of audience feedback. This analysis allows us to see if word production (i.e., effort) is able to account for the relation between the independent variable and cardiovascular reactivity (43).

RESULTS

Manipulation Checks

Audience expertise index. A 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) ANOVA performed on the initial audience-expertise manipulation check item confirmed our suspicions concerning the misinterpretation of the posttask question. We found only a main effect of feedback, $F(1, 56) = 8.16$, $p < .01$. Participants reported feeling more positively about the audience's public speaking knowledge when the audience was positive ($M = 3.0$) compared to negative ($M = 2.5$). Although this result indicates that participants were aware of the feedback manipulation, it does not tell us how their perception of audience expertise was affected.

Examination of the supplementary perceived expertise index (see Method section) did give us some indication that the expertise manipulation was effective. Because of the small number of participants who received the supplementary items ($n = 16$), a t test was used. This revealed a marginally significant result, with audiences rated as having more expertise in public speaking in the expert conditions ($M = 9.5$) than in the novice conditions ($M = 7.0$), $t(14) = 1.96$, $p = .07$. Separate t tests revealed no other significant effects (ps > .08). Thus, the audience expertise manipulation appears to have been effective. Further evidence of this was found when we examined the perceived feedback index.

Perceived feedback index. A 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) ANOVA was performed on the perceived feedback index. The results indicated a highly significant feedback condition effect, with higher (more positive) ratings in positive-feedback conditions ($M = 24$) relative to negative conditions ($M = 15.3$), $F(1, 56) = 78.81$, $p < .001$. The feedback manipulation appears to have been effective.

The ANOVA also showed a significant difference between expertise conditions. The perceived feedback index was sensitive enough to indicate that, overall, an expert audience was perceived as less positive than a novice audience (*M*s = 18.4 vs. 20.8), $F(1, 56) = 4.55$, $p < .05$. Because the confederates were blind to expertise condition, this cannot reflect actual differences in audience behavior but does provide additional evidence that the participant attended to the audience expertise manipulation.

Preliminary Analyses

Separate 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) ANOVAs were performed on mean SBP, DBP, and HR baseline measures. Although participants were already aware of the nature of the task and the expertise of their audience, and a difference in anticipatory reactivity could have been expected, no condition differences were found (all *p*s > .10). Correlations also were computed between baseline physiological measures and reactivity measures. Because there were no significant correlations between baseline and reactivity measures (*p*s > .30), and because a lack of association between baseline and reactivity is common in studies involving normotensive participants (44), none of the primary analyses used baseline as a covariate. Reactivity in the primary analyses was determined by subtracting baseline means from corresponding task means.

Primary Analyses

A 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) MANCOVA was performed on SBP, DBP, and HR reactivity, using word production as the covariate. The results indicated first that word production showed significant positive associations with SBP reactivity and DBP reactivity, $Fs(1, 55) = 13.63$ and 16.30, respectively, *p*s < .001 but not with HR reactivity, $F(1, 55) = 1.85$, $p > .05$.

Consistent with previous reports on self-efficacy (9,10), Figure 1a shows that people who were low in self-efficacy showed higher cardiovascular responses overall during the task than those with high self-efficacy, $F(3, 53) = 4.92$, $p < .005$. Separate analyses indicated that the low self-efficacy group was higher than the high self-efficacy group for SBP reactivity, $F(1, 55) = 10.80$, $p < .005$, and for DBP reactivity, $F(1, 55) = 13.88$, $p < .001$. The means for HR reactivity were similar in direction but did not differ significantly, $F(1, 55) = 1.15$, $p > .05$.

Figure 1b shows that the expertise of the audience also had an effect on the speaker's reactivity that was significant across all three measures, $F(3, 53) = 5.88$, $p < .005$. Separate analyses indicated that participants talking to an audience that they be-

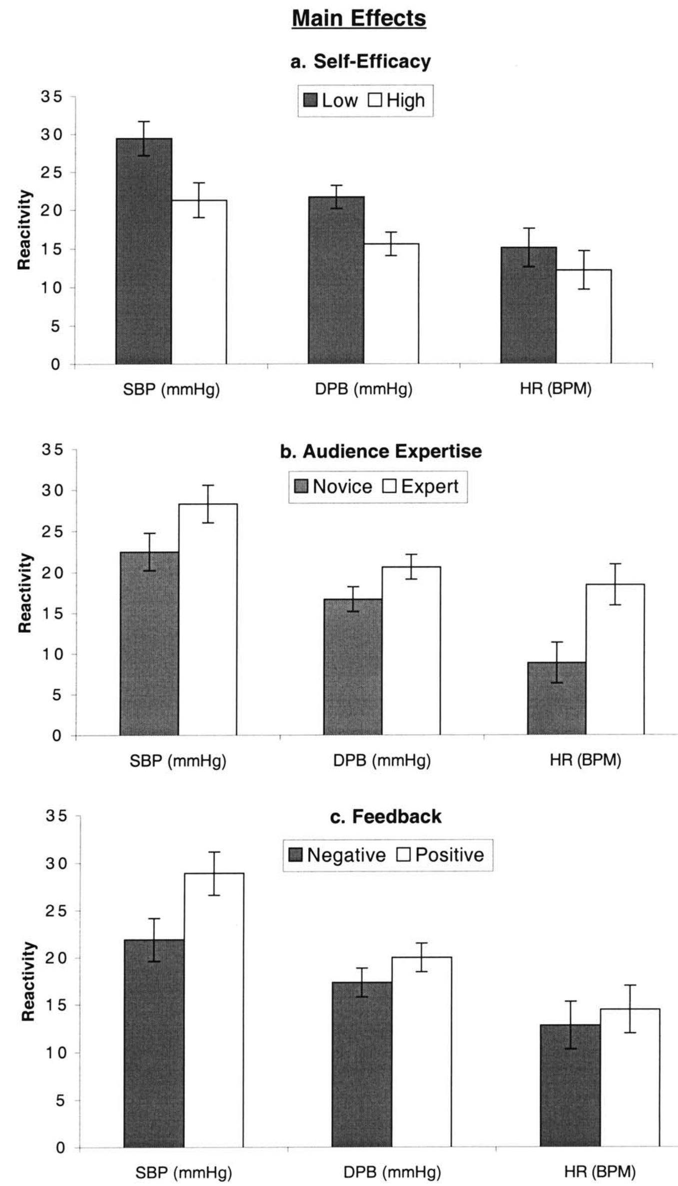

FIGURE 1 Main effects of a) self-efficacy, b) audience expertise, and c) feedback on systolic blood pressure reactivity (mmHg), diastolic blood pressure reactivity (mmHg), and heart rate reactivity (BPM). Error bars indicate standard error of the mean with the covariate incorporated.

lieved to be experts showed a greater increase in SBP than did those speaking to an audience believed to be novices, $F(1, 55) = 5.49$, $p < .05$. The increase in DBP while talking to experts likewise exceeded that produced by talking to novices, $F(1, 55) = 5.72$, $p < .05$, as did the increase in HR, $F(1, 55) = 12.45$, $p < .001$.

Consistent with our previous finding on the effects of social support when the experimenter is not present during the speech (27), it can be seen in Figure 1c there was an overall tendency for greater reactivity among speakers who received positive relative to negative feedback, $F(3, 53) = 2.49$, $p = .07$. In separate analyses, the effect was significant for SBP, $F(1, 55) = 7.38$, $p < .01$. For DBP, the same pattern was present, though it did not quite reach significance, $F(1, 55) = 2.43$, $p = .12$. HR reactivity was in the same direction, though it did not approach significance, $F(1, 55) = .35$, $p > .20$.

In addition to expecting the foregoing three main effects, we also expected that audience expertise might separately interact with the feedback manipulation and the self-efficacy classification. We found support for both hypotheses. First, the MANCOVA analysis indicated a significant overall Audience Expertise × Self-Efficacy effect on reactivity, $F(3, 53) = 2.89$, $p < .05$. As can be seen in Figure 2, across each measure, when participants were facing an expert audience, those with low self-efficacy for public speaking had greater reactivity than participants with high self-efficacy, whereas self-efficacy made little difference when performing in front of a novice audience. Separate analyses indicated that this interaction approached significance for SBP, $F(1, 55) = 3.53$, $p = .06$ and DBP reactivity, $F(1, 55) = 3.08$, $p = .08$, and reached significance for HR reactivity, $F(1, 55) = 5.90$, $p < .02$. Of more interest, simple effects analyzed with Fisher's least significant difference method (45) indicated that for each reactivity measure, reactivity was greater for low self-efficacy than high self-efficacy performers in front of an expert audience (all *p*s < .05); however, reactivity of high- and low-self-efficacy individuals did not differ in front of a novice audience (all *p*s > .10).

The MANCOVA results also indicated an overall tendency for the effect of feedback to vary as a function of audience expertise, $F(3, 53) = 2.51$, $p = .07$. As can be seen in Figure 3, when participants performed in front of an expert audience, positive feedback appeared generally to lead to greater reactivity than negative feedback, whereas when performing before a novice audience, the difference between positive and negative feedback was very slight. Individual analyses indicated this interactive effect was marginally significant for SBP, $F(1, 55) = 3.67$, $p = .06$, significant for DBP, $F(1, 55) = 5.61$, $p < .05$, and nonsignificant for HR, $F(1, 55) = 2.14$, $p > .10$. Simple effects analyzed with Fisher's least significant difference method revealed that in expert audience conditions, positive feedback caused greater SBP and DBP reactivity than negative feedback (*p*s < .01). In front of a novice audience, the effect of positive feedback on reactivity was no different from that of negative feedback (*p*s > .10). Because there was not a significant Expertise × Feedback effect on HR reactivity, simple effects were not analyzed. The other effects from the MANCOVA, the Feedback × Self-Efficacy interaction, and the three-way interaction did not approach significance, $F(3, 53) = 1.40$, $p > .25$, and $F(3, 53) = 1.23$, $p > .30$, respectively.

Self-Reported Anxiety

A 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) ANOVA was performed on the self-reported anxiety index. This indicated that low-self-efficacy participants reported experiencing more anxiety ($M = 14.2$) than did high-self-efficacy participants ($M = 12.2$), $F(1, 56) = 5.80$, $p < .05$. No other effect was significant (*p*s > .25).

Word Production

A 2 (self-efficacy classification) × 2 (audience expertise) × 2 (feedback) ANOVA was performed on the word production measure. The only significant effect was that people uttered

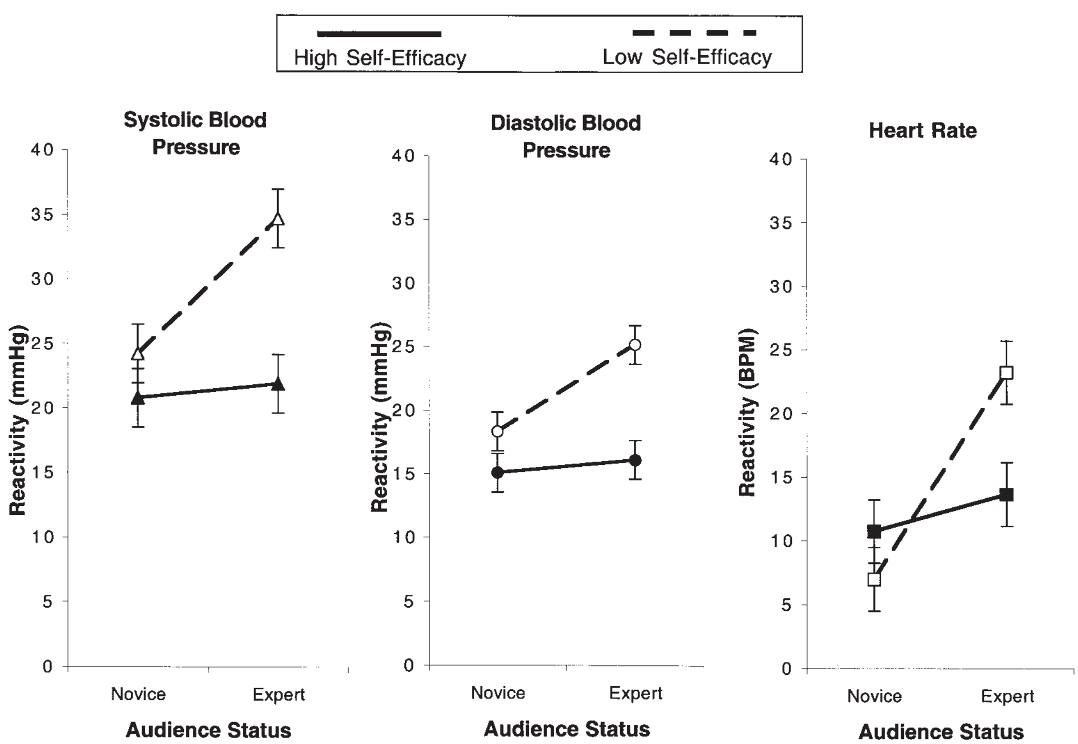

FIGURE 2 Mean systolic blood pressure reactivity (mmHg), diastolic blood pressure reactivity (mmHg), and heart rate reactivity (BPM) of high- and low-self-efficacy participants across audience status conditions. Error bars indicate standard error of the mean with the covariate incorporated.

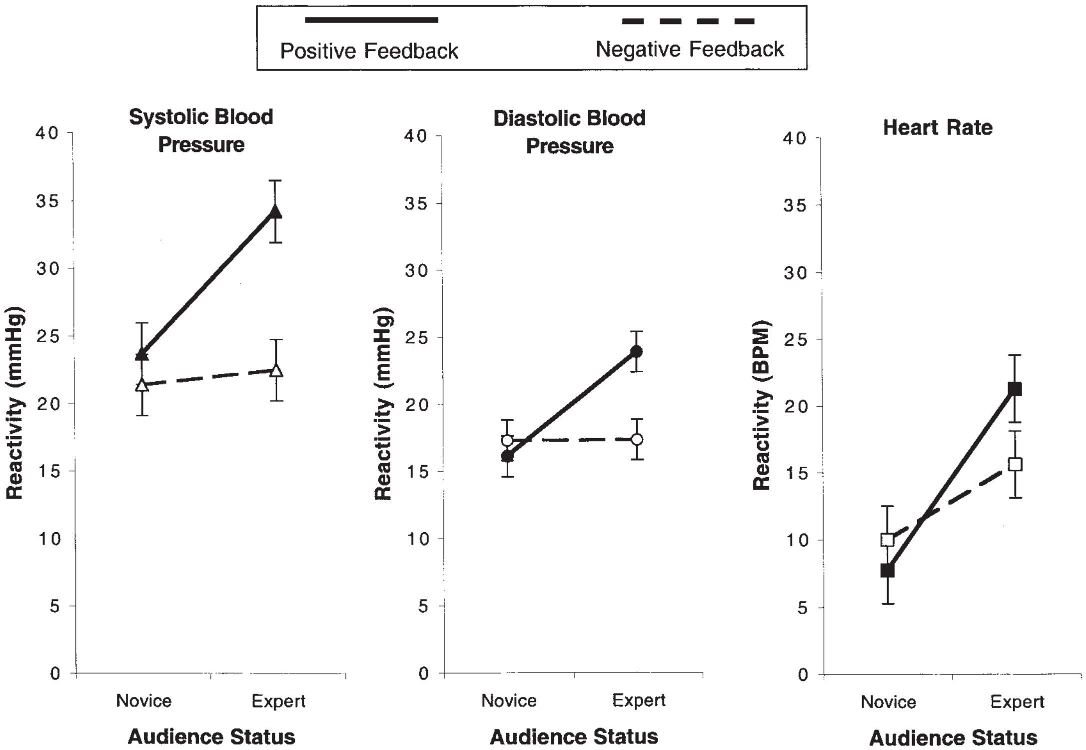

FIGURE 3 Mean systolic blood pressure reactivity (mmHg), diastolic blood pressure reactivity (mmHg), and heart rate reactivity (BPM) across feedback and audience status conditions. Error bars indicate standard error of the mean with the covariate incorporated.

more words when they received positive ($M = 802.2$) as opposed to negative ($M = 710.7$) feedback, $F(1, 56) = 6.13$, $p < .05$.

Consistent with our previous suggestion that when the experimenter is absent, social support increases reactivity by increasing effort (27), we found evidence that word production mediated the relation between feedback and reactivity. A variable is a mediator to the extent that it accounts for the relation between an independent and dependent variable. Baron and Kenny (43) suggest three conditions, tested with regressions, that must be satisfied: the independent variable (here, feedback) must significantly predict the mediator (here, word production); the independent variable must significantly predict the dependent variable (here, reactivity); and, when the independent variable and the mediator are entered in a multiple regression, the mediator must still predict the dependent variable and reduce the previously significant relation between the dependent and independent variable. In our regression analyses we found that (a) feedback predicted word production (β coefficient = .39, SE_b = 34.44, $p < .01$); (b) feedback predicted SBP reactivity (β coefficient = .34, SE_b = 2.66, $p < .01$); and (c) when SBP reactivity was regressed on both word production and feedback, word production was significantly related to reactivity (β coefficient = .34, SE_b = .01, $p < .01$) and the link between feedback and SBP reactivity was reduced (β coefficient = .21, SE_b = 2.75, $p = .10$).

Additional mediational analyses on HR and DBP reactivity revealed that word production and feedback were not significantly related to HR reactivity ($ps > .40$), which is not surprising given the ANCOVA results reported previously. However, analyses of DBP reactivity indicated a pattern similar to that found for SBP reactivity, with feedback marginally predicting DBP reactivity when entered alone (β coefficient = .22, SE_b = 1.80, p =.09) and having a considerably reduced effect (β coefficient = .08, SE_b = 1.86, $p > .50$) when entered with word production, which did predict DBP reactivity (β coefficient = .35, SE_b = .01, $p < .01$). These results support our previous suggestion (27) that with the experimenter absent, positive feedback increases reactivity, at least in part, by motivating participants to put forth more effort (i.e., produce more words).

DISCUSSION

The experiment replicates some previously reported effects and also suggests new variables that can influence cardiovascular responses to stress. As with previous reports (9,10) we found that people with high self-efficacy for a task can show smaller cardiovascular responses during that task than people with low efficacy. People who do not expect to succeed may find their task more threatening. We also replicated our previous finding that, with the experimenter out of the room during the speech, positive feedback from the audience can produce greater physiological responses than negative feedback. We also found evidence consistent with our suggestion that this counterintuitive finding, the opposite of the more common social support effect, may be due to positive feedback encouraging greater effort, or active coping on the part of the speaker, when evaluative concerns are otherwise relatively low (27). Mediational analyses revealed that the effect of positive feedback on reactivity in this experiment was partly accounted for by the number of words participants uttered. That is, positive feedback increased effort, indicated by word production, which in turn increased reactivity.

In addition to replicating feedback and self-efficacy effects, the experiment produced novel findings related to the status of the audience. Three fairly consistent effects emerged for this factor. First, overall, when people thought that they were talking to public speaking experts they showed higher cardiovascular responses than when they thought they were talking to people with no such expertise. More interestingly, the expertise of the audience also moderated the effect of self-efficacy. Thus, the effects of self-efficacy were exaggerated in front of an expert audience, relative to in front of novices. Third, the expertise of the audience moderated the effects of feedback from that audience. In front of experts, the difference between positive and negative feedback was greater than in front of novices.

Across all three effects, increasing the status of the audience intensified each effect on cardiovascular reactivity. This intensification operates both on an individual-difference variable —self-efficacy—and on a situational manipulation—the nature of the feedback. It may be that the speakers think that public speaking experts are going to be more evaluative than novices, and they therefore care more deeply about their performance when experts are watching. Experts have the means to be evaluative, and almost by definition, experts are better able to tell what is right or wrong, good or bad, in a situation. This may be particularly true when the performer is a novice and therefore relatively unable to make self-evaluations based on previous experience (46).

When the audience is presented as having no expertise in public speaking, it has comparatively little impact. It does not matter, at least in terms of the cardiovascular response, whether the speaker has high or low confidence in her speaking ability, perhaps because expecting to succeed or fail is not important in front of people who will not know the difference. It also appears not to matter very much whether an audience of novices approves or disapproves of the speech, perhaps because it is not as encouraging to see nods and smiles from people whose opinions are less important or less diagnostic.

The self-report measures of stress during the speaking task are not very illuminating, as is often the case with this sort of experiment (19). The only effect that emerged was for self-efficacy. This is not particularly surprising, because the classification was made on the basis of their self-reported confidence about public speaking, and the observed correlation was with self-reports of anxiety during a public speaking task. It is harder to explain why the other effects should not be present in the anxiety index. The effect of audience expertise, for example, was readily apparent in blood pressure and HR reactivity, and one might have expected that people would also be able to report more anxiety speaking to experts. It may be the case that people are not willing or able to report reliably on their internal states (19). It is also likely that the blood pressure response is not simply a marker of anxiety. For example, we believe that in this experiment, blood pressure is responding both to effort and to anxiety. Positive feedback may have some reassuring effect, but its dominant effect seems to have been to increase effort, as suggested both by the cardiovascular response and the measure of speech effort (number of words produced). It may be, though it is just speculative, that, in front of a novice audience, the reassuring and effort-encouraging effects more nearly cancel, but in front of experts the encouragement dominates. In addition, the fact that word production was not related to audience expertise or self-efficacy effects in this experiment suggests that these factors influence reactivity through something other than an effort mechanism alone.

We have shown that altering the expertise of other people present during a stressful experience can have both direct effects and also moderate other effects on reactivity. It could well be that the intensification due to high-status observers could apply to other factors, both individual difference and situational, as well. For example, it could be that the difference between people high and low in hostility (6–8) is exacerbated when people are provoked by, or in front of, a high-status audience. It would also be worth examining whether, in circumstances where positive regard reduces reactivity, increasing the status of the person providing feedback would increase the benefit. That is, if approval from a low-status person reduced reactivity, would the same approval from someone of high status reduce it even more?

Increasing the perceived expertise of the audience is just one way of increasing its status, and others are worth exploring. People who control real rewards, people of high social position, and attractive people might produce greater effects. This idea has been suggested as a possible explanation for the finding that positive feedback from a friend produces greater benefits than the same feedback from a stranger (47). In general, the effect of other people may be intensified when, for whatever reason, we care especially what those people think of us.

Although such conjectures remain to be investigated, it is clear that in understanding social support effects, we must attend to characteristics not only of the recipient but also of the provider. Understanding the circumstances that exaggerate cardiovascular responses may, ultimately, help with our understanding of the situations, individual attributes, and interactions between the two that put people at risk of later cardiovascular disease.

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