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Cardiovascular Reactivity in a Simulated Job Interview: The Role of Gender Role Self-Concept

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This study investigated the relation of gender role self-concept (G-SC) to cardiovascular and emotional reactions to an ecologically relevant stressor in a sample of graduating male and female university students. Thirty-seven men and 37 women completed the Personal Attribute Questionnaire and worked on four tasks designed to reflect common features of a job interview. Blood pressure and heart rate were measured at baseline, during, and after each task; subjective stress was measured at baseline and after each task. Subjective and objective stress scores were averaged across tasks and analyzed by sex and G-SC (i.e., instrumentality, expressiveness). Results indicated that women as a group demonstrated greater emotional reactivity, but did not differ in their physiological reactions when compared to men. Regardless of sex, participants' instrumentality scores contributed significantly to the variation in subjective stress response: those scoring high on instrumentality reported less stress, but evidenced greater blood pressure reactivity than those scoring low on instrumentality. These results suggest that gender roles, particularly an instrumental self-concept, may play an important role in both subjective and objective reactions to an ecologically relevant stressor.

Key words: cardiovascular reactivity, gender role self-concept, instrumentality, psychosocial stress

Exaggerated cardiovascular reactivity (CVR) in response to stress has been implicated in the development of cardiovascular disease (CVD; al'Absi et al., 2002; Light, Dolan, Davis, & Sherwood, 1992; Linden, Gerin, & Davidson, 2003; Weidner & Messina, 1998). Light and her colleagues (1999) found that excessive blood pressure responses to stress predicted elevated blood pressure among initially normotensive young men with a familial history of hypertension more than 10 years later. Excessive cardiovascular responses to stress have also been implicated in the progression of intima media thickness of the carotid arteries in the Kuopio Heart Study, a population study of middle-aged men in Eastern Finland (Kamarck et al., 1997). There is some indication that women react stronger emotionally, whereas men react stronger physiologically, especially to achievement-related stress (e.g., Allen, Stoney, Owens, & Matthews, 1993; Davis & Matthews, 1996; Kohlmann, Weidner, & Messina, 1996, Weidner & Messina, 1995). Men's enhanced cardiovascular stress reactivity has been proposed as a possible contributor to their excess risk of coronary heart disease (Davis & Matthews, 1996; Matthews, 1989). However, several authors (e.g., Collins & Frankenhaeuser, 1978; Lundberg, 1998) postulated that sex differences in stress responses are not only biologically determined but might be associated with learned gender-role patterns and gendered life conditions. In a study with male and female engineering students, Collins and Frankenhaeuser (1978) tested the hypothesis that women who choose a male-dominated career would be more similar in their stress reactions in comparison to "average" women. Although there still were stronger increases in both adrenaline and cortisol excretion in the men, the sex differences were markedly smaller than in previous experiments with "average" women. In a series of subsequent studies, Frankenhaeuser and colleagues compared women who had entered traditional male occupations with their male colleagues. They found that "on the whole, these groups of 'nontraditional women' tended to respond to achievement demands with an increase in epinephrine as large as their male counterparts" (Franken-

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haeuser, 1991, p. 200; Lundberg & Frankenhaeuser, 1999). The investigators speculated that nontraditional women might have become more like men in their value judgments and attitudes.

In a similar vein, Weidner (1994) suggested that "embracing the male gender role stereotype may be unhealthy for both women and men" (p. 70). Gender stereotypes consist of multiple facets like values, physical appearance, behaviors, and personal attributes. Most research has concentrated on gender-related personal attributes, which are core elements of gender stereotypes. The gender role self-concept (G-SC) can be defined as a person's identification with personal attributes that are seen as appropriate for a typical man or woman in a given society. The G-SC is operationalized usually by self-description scales, such as the Personal Attributes Questionnaire (PAQ; Spence & Helmreich, 1978) or the Bem Sex Role Inventory (BSRI; Bem, 1974). Both questionnaires comprise two main scales assessing personal attributes which are seen as more typical for men (i.e. "self-confident" or "feels superior") or for women (i.e., "warm in relations with others" or "kind").

The former labels of the scales as measures of "masculinity" and "femininity" were replaced by the more precise labels *instrumentality* (self-assertive traits) and *expressiveness* (interpersonally oriented traits; Spence, 1984). Instrumentality and expressiveness are independent dimensions of the self-concept and show strong variations among the two sexes. Although on average men describe themselves as more instrumental and women describe themselves as more expressive, there is a substantial overlap between the sexes. Individuals (regardless of biological sex) who score high on both scales are called "androgynous;" those who score high on instrumentality and low on expressiveness are called "masculine." Persons with high scores on expressiveness and low scores on instrumentality are described as "feminine," and those who score low on both scales are called "undifferentiated." The instrumentality and expressiveness scales are often used in studies on G-SC and psychological well-being. Most find a positive relation between instrumentality and (self-reported) mental health, whereas expressiveness appears to be related to relationship satisfaction. However, instrumentality in self-concept has also been linked to increased Type A behavior, poor health care, and behavioral problems, and unmitigated expressiveness to increased psychological distress (reviewed by Helgeson, 1994).

Tests of the hypothesis that a "masculine" (instrumental) self-concept is associated with a heightened cardiovascular reactivity for men and women have yielded inconsistent results. One of the first studies dealing with this issue was conducted by Frankenhaueser and colleagues (Myrsten et al., 1984). A significant relation of a masculine self-concept to heightened diastolic blood pressure (DBP) was evident among men, but not among women. In a sample of women, Saab and colleagues (Saab, Matthews, Stoney, & McDonald, 1989) found a positive relation between a masculine self-concept and heightened heart-rate-reactivity in postmenopausal, but not in premenopausal, women. Even in studies that have manipulated task characteristics in terms of their gender relevance, the results were not clear-cut (e.g., Allen et al., 1993; Davis & Matthews, 1996; Weidner & Messina, 1995). One reason for these inconsistencies could be that the tasks employed in these studies were not of immediate relevance to the participants' lives (e.g. mirror image tracing, anagram tasks, serial subtraction, isometric handgrip). The statement by Schwartz and colleagues (Schwartz et al., 2003) that the ecological validity of many commonly used laboratory tasks is questionable might also apply for this domain of stress research (see also al'Absi et al., 1997).

The purpose of this study was to examine the role of the G-SC in stress reactivity using a task of high relevance to the participants' current life situation. Specifically, to increase the ecological validity of the task, we chose a simulated job interview in a sample of men and women who were about to enter the job market.

A job interview situation places heavy emphasis on achievement, traditionally labeled as a "masculine" stressor, because coping with achievement demands tangles a traditional area of male competency (Davis & Matthews, 1996; Frankenhaeuser, 1983). Our assumption was that in such an achievement situation, the instrumental dimension of the G-SC would be the more relevant factor, whereas we didn't expect the expressive dimension to be influential. Thus, our hypothesis was that high instrumentality in the G-SC (measured by PAQ) will be associated with enhanced cardiovascular stress reactivity. A further assumption was that compared to biological sex, the G-SC will be more important in predicting stress reactivity.

Method

Overview

An interview situation was simulated in the laboratory; participants were told that their performance would be evaluated by external personnel experts. Each of the 74 men and women who participated in the study was asked to complete a written test, a preparation of a speech on their professional qualifications, a verbal self-presentation of his or her professional qualifications (speech), and a personal interview. Along with the participants' self-reports of emotional stress during the various phases of the investigation, the physiological parameters of heart rate (HR), systolic blood pressure (SBP), and DBP were recorded. The self-presentations and personal interviews were videotaped.

Participants

The study participants were 37 men and 37 women with similar education. They were all university students at the Freie Universität Berlin, Germany, who would be facing the job market in the near future. The majority of participants were about to complete their studies (graduates of the German university system generally hold a master's degree). Four men and seven women had just graduated, 32 majored in the physiological or biological sciences, and 42 in the social sciences or humanities. Participants were between 22 and 34 years of age ($M = 26.4$, $SD = 2.7$). They were of normal weight, had no heart or circulation disorders, spoke German as their native language, and were right-handed. All participants were normotensive. They received 15 Euros (about $18) as compensation for their participation in this study.

Procedure

Participants were recruited via bulletin boards from different faculties of the Freie Universität of Berlin, Germany. Individuals who were interested in participating were first contacted by telephone to check whether they fulfilled the conditions of participation, to prepare them for the experiment, and to schedule their session. The investigation was conducted in the laboratory of the Institute for Medical Psychology at the Freie Universität of Berlin. The interview situation lasted about 1 ¾ hr and was carried out individually by a female experimenter (B. v. V.). The experiment took place in a 6 m × 3.5 m room, divided in two by a partition. The participant was seated in a comfortable chair. The experimenter, who operated the equipment, sat behind the partition. The instructions were prerecorded and played by a cassette player.

Participants were told that one goal of the study was to check various methods for determining individual job suitability. At the beginning of the experiment, participants were informed that their performance in the tasks would later be evaluated by external judges. They were told that a second goal of the study was to investigate psychological and physical aspects of an interview situation; the data (both the questionnaire and the physiological data) were to be evaluated at the Institute for Medical Psychology, and not given to the personnel experts. Participants were questioned at the start of the experiment about their professional goals; they were asked to indicate what they would regard as an attractive position for which they would like to apply. They were then requested to conduct themselves during the experiment as if they were applying for this position.

Once the physiological sensors were attached, the participants filled out several questionnaires, followed by the initial relaxation period; in these 5 min, participants were requested to lean back, close their eyes, and to relax as much as possible. The experiment continued with the following interview tasks, each separated by a relaxation period of 5 min: a written test under time pressure (compiled from intelligence and concentration tests, 10 min), the mental preparation of a verbal self-presentation (speech) on professional goals and qualifications (5 min), the speech delivery phase (5 min), and a personal interview (10 min). Following these tasks, the participants were asked to write an essay (10 min), and the experiment concluded with a final relaxation period (5 min). At this point, the physiological sensors were removed and participants were asked about their experiences during the various segments of the investigation in a postexperimental written questionnaire.

To standardize the conditions of the experiment and to eliminate social interaction effects, a cassette (with a male voice) was used to play the questions for the personal interview. Participants had 1 min to answer each question. A total of 10 questions were asked that are typical for job interviews, especially for stressful interviews (for example, "What actually makes you qualified for this position?" "Name something you are too good for?" "What are your weaknesses?"). In both the speech on professional qualifications and the personal interview, participants were to imagine that they had been invited to a job interview on the basis of a written application they had sent in for a position they would like to have. They were now sitting opposite an interview committee. Both their professional self-presentation and their answers in the personal interview were recorded on video.

Psychological Measures

G-SC. The Instrumentality scale and the Expressiveness scale of the PAQ (Spence & Helmreich, 1978) were used to assess the G-SC of the participants. The Instrumentality scale contains eight items that are considered to be socially desirable characteristics for both sexes but that men are believed to possess in greater abundance than women. In the German version of the PAQ (Runge, Frey, Gollwitzer, Helmreich, & Spence, 1981), the Instrumentality scale comprises only seven items as the item "competitive" had to be dropped. (Contrary to the evaluations in the United States, the trait "competitive" is not consistently evaluated as socially desirable by German students.) The remaining seven items of the Instrumentality scale are as follows: "independent," "active," "self-confident," "can make decisions easily," "never gives up easily," "stands up well under pressure," and "feels superior."

The Expressiveness scale contains items considered to be socially desirable in both sexes but that women are believed to possess to a greater degree than men. The items are as follows: “kind,” “aware of feelings of others,” “understanding of others,” “able to devote self completely to others,” “gentle,” “helpful to others,” “warm in relations with others,” and “emotional.” Participants were asked to rate how well each attribute describes themselves as they normally are on a 5-point-scale from 0 (*not at all*) to 4 (*very much so*). Here the summed scale scores were divided by the number of items to obtain an “Instrumentality” and “Expressiveness” score. For exploratory reasons, participants were also categorized into one of four G-SC types on the basis of median dichotomization on the two scales. The median values for the Instrumentality scale (2.35) and for the Expressiveness scale (2.9) were the same as the values which were reported for the normative German student sample by Runge et al. (1981). The scales were filled out at the beginning of the study. Contrary to most other studies investigating gender role influences on stress reactivity (i.e., Davis & Matthews, 1996), participants were not preselected on the basis of their G-SCs. This is a more conservative method to test the influence of self-concept variables than the preselection of individuals with extreme scores.

Self-report of stress. A short questionnaire on subjective emotional state (adapted from Wallbott & Scherer, 1991) was filled out after the first and last relaxation period, as well as after each task. Participants had to indicate on 13 different 10-point scales (from 0 = *not at all* to 9 = *very much*) how well each of the following adjectives described their state during the preceding task period: active, calm, aroused, tired, relaxed, depressed, balanced, sensitive, stressed, nervous, anxious, successful, and physically well. Six of these adjectives were combined into an overall indicator for subjective stress: aroused, stressed, nervous, and—negatively scored—balanced, calm, relaxed; the internal consistency (Cronbach’s Alpha) of this short scale is .88.

Physiological Measures

The physiological data were registered on a psycho-physiological system (PARON-online-system) manufactured by the company PAR-Elektronik (Berlin, Germany). The data were fed directly into a PC. The cardiovascular parameters of HR, SBP, and DBP were recorded. Blood pressure was measured oscillometrically with a cuff attached to the upper left arm. The electrocardiogram was attached in a bipolar configuration on opposite sides of the participant’s chest and recorded continuously throughout the session. At defined intervals, blood-pressure measurements were triggered by the experimenter over the computer keyboard. Blood pressure was taken twice during the personal interview, and once during the other phases of the investigation (3 ½ min after the beginning of the task or relaxation period). HR was calculated from the electrocardiogram data and given for each phase of the experiment.

Cardiovascular reactivity (CVR) was defined as the difference between the values from the various task phases and the corresponding baseline values. The values from the first relaxation period served as baseline. The reactivity scores were averaged across the four tasks to yield a total reactivity score for HR, SBP, and DBP. Stress reactivity scores which are aggregated across different tasks are assumed to have higher reliability and validity than reactivity scores in single tasks (Kamarck, 1992; Kamarck & Lovallo, 2003; Swain & Suls, 1996). The values from the final relaxation period at the end of the experiment were taken as poststress recovery responses.

Data Reduction and Statistical Analyses

The emotional and physiological effects of the experiment were evaluated first by determining whether measures obtained during the tasks were, on average, different from those obtained during baseline. Reactivity scores were averaged across the four tasks and these average reactivity scores were compared to baseline values by paired t tests. We also compared recovery scores with baseline scores by paired t tests.

We then analyzed whether the stress reactions varied as a function of the sex of participants and the task. First the baseline values of men and women were compared using t tests. Then the emotional and cardiovascular stress reactions were analyzed with 2 × 4 (sex × task) analyses of variance (ANOVAs) for repeated measures, consisting of one between-subject factor (sex) and one within-subject factor (experimental task: test, preparation of speech, speech delivery, interview). Baselines were entered as covariates when the assumptions of analysis of covariance were met. In the repeated measure analyses, significance levels were determined using ε-corrected degrees of freedom (Huynh & Feldt, 1976).

The extent to which sex and the G-SC of the participants were related to stress reactivity was calculated by multiple regression analyses. For the emotional and cardiovascular stress reactivity, change scores from baseline, averaged across the four tasks, were the dependent variables. Predictors of emotional and CVR were entered (forced entry): at the first step, the baseline scores were entered; at the second step, biological sex; at the third step, the Instrumentality (I) and Expressiveness (E) scores; at the fourth step, the two-way interactions Instrumentality × Expressiveness, I × sex,

Table 1. *Emotional and Cardiovascular Parameters at Baseline and Across Task Periods for Men (m) and Women (w)*

	Baseline		Test		Speech Preparation		Speech		Interview		Recovery	
	m	*w*	*m*	*w*	*m*	*w*	*m*	*w*	*m*	*w*	*m*	*w*
Subjective Stress[a]												
M	2.6	2.6	4.9	6.0	4.8	6.2	5.4	6.9	4.5	6.1	2.2	2.8
SD	1.6	1.7	1.6	1.6	2.2	1.9	1.9	1.6	1.8	1.8	1.4	1.6
SBP[b]												
M	119	110	126	117	124	118	139	126	137	126	119	111
SD	9.2	8.2	10.4	11.8	10.8	12.2	13.4	14.0	11.4	13.7	10.4	7.4
DBP[c]												
M	75	75	82	80	81	81	91	85	89	86	77	76
SD	6.2	7.7	7.5	7.8	7.6	8.2	8.5	12.1	8.7	11.3	6.9	5.6
HR[d]												
M	70	74	78	82	76	83	83	90	76	81	69	70
SD	10.1	12.6	13.3	13.1	11.5	13.8	12.5	16.2	10.2	12.7	8.4	10.0

Note. $N = 74$.
[a]Possible scores from 0 to 9; high scores indicate greater distress; [b]SBP = systolic blood pressure (mmHg), [c]DBP = diastolic blood pressure (mmHg), [d]HR = heart rate (bpm).

and E × sex; and at the last step, the three-way-interaction of I, E, and sex. In the case of a significant interaction involving sex, analyses were rerun by sex.

All analyses were also rerun controlling for possible confounding variables, which could have biased the findings: age, field of study (physiological or biological sciences versus social sciences and humanities), smoking status, and exercise habits. Because the main findings did not differ as a result of these analyses,[1] they are not reported in the result section.

Results

Effectiveness of the Stressors

Measures both of subjective stress and cardiovascular reactions increased significantly from baseline to tasks indicating that the tasks were effective in inducing subjective and cardiovascular arousal. The mean levels of emotional and cardiovascular parameters across the periods by sex are shown in Table 1. The index for subjective stress increased from $M = 2.6$ ($SD = 1.6$) during baseline to $M = 5.6$ ($SD = 1.7$) during tasks (averaged across all tasks), $t(73) = 13.8$, $p < .001$. SBP increased from $M = 114.5$ mmHg ($SD = 9.9$) during baseline to $M = 126.7$ mmHg ($SD = 11.4$) during tasks, $t(73) = 12.9$, $p < .001$; DBP increased from $M = 75.0$ mmHg ($SD = 7.0$) to $M = 84.5$ mmHg ($SD = 7.2$), $t(73) = 11.5$, $p < .001$. HR increased from $M = 71.8$ beats per minute (bpm; $SD = 11.5$) during baseline to $M = 81.0$ ($SD = 12.6$) during tasks, $t(73) = 11.2$, $p < .01$. These findings indicate that the tasks were emotionally and physiologically stressful. During poststress recovery, the variables subjective stress and SBP reached their respective baseline levels, DBP remained somewhat elevated, $t(73) = -1.95$, $p = 0.055$, and HR was significantly reduced, $t(73) = 3.40$, $p < .01$.

Stress-Reactivity as a Function of Sex and Task

Comparison of baseline values. Consistent with prior research (i.e., Allen et al., 1993; Kohlmann et al., 1996; Weidner & Messina, 1995), men had higher SBP levels at baseline ($M = 119.2$ mmHg, $SD = 9.2$) than women ($M = 109.7$ mmHg, $SD = 8.2$); $t(73) = 4.65$, $p < .001$. There were no baseline sex differences in DBP (men: $M = 75.3$, $SD = 6.2$; women: $M = 74.6$, $SD = 7.7$), HR (men: $M = 70.0$ bpm, $SD = 10.1$; women: $M = 73.5$ bpm, $SD = 12.6$), or in self-reported stress (men: $M = 2.6$, $SD = 1.6$; women: $M = 2.6$, $SD = 1.7$).

In the ANOVAs of the emotional and cardiovascular reactions, the baseline scores were significantly related to the task scores: self-reported stress, $F(1, 71) = 15.1$, $p < .001$; SBP, $F(1, 71) = 4.4$, $p < .05$; DBP, $F(1, 71) = 23.0$, $p < .001$; HR, $F(1, 71) = 3.4$, $p = .070$, so the baseline scores were included as covariates. Results of the 2 × 4 ANOVAS indicated significant task effects for subjective stress and all CVR scores. The four tasks provoked clearly different high cardiovascular reactions (see Table 2): The tasks which included speaking and social evaluation—the delivery of the speech and the interview—caused blood pressure reactivity which was significantly higher than the paper-and-pencil test and the inner preparation of the speech. Subjective stress and HR-reactivity were significantly higher during speech delivery than in the other task periods (see Table 2). With regard to SBP, the ANOVA revealed a

[1]The sample was rather homogenous and health-oriented. Only a minority ($n = 14$) of the participants were smokers. Most participants ($n = 50$) were exercising regularly (at least once a week); only 24 participants were not exercising regularly (less than once a week). Neither smoking status nor exercise habits were associated with G-SC.

Table 2. *Emotional and Cardiovascular Reactivity as a Function of Task: Mean Change Scores*[a]

	Test	Speech Preparation	Speech Delivery	Interview	Task Main Effect[b]
Subjective stress[c]	2.8^{d} (2.0)	2.8^{d} (2.3)	3.5^{e} (2.1)	2.7^{d} (2.0)	$F(3,70) = 10.0$
SBP (mmHg)	6.9^{d} (9.8)	6.9^{d} (10.3)	17.8^{e} (11.3)	17.4^{e} (10.4)	$F(3,70) = 42.5$
DBP (mmHg)	6.3^{d} (7.2)	6.1^{d} (7.7)	12.6^{e} (11.3)	12.8^{e} (9.8)	$F(3,70) = 18.4$
HR (bpm)	8.1^{d} (6.9)	6.8^{d} (8.7)	13.8^{e} (11.7)	5.9^{d} (8.4)	$F(3,70) = 46.4$

SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; entries show mean (SD). [a]Task values minus baseline values. [b]All *p*s < .001. [c]Possible scores from 0 to 9. [de]Within a row, means that differ from each other are indicated by different superscripts.

significant interaction sex × task, $F(3, 216) = 2.76$, $\varepsilon = .92$, $p < .05$. Women showed somewhat stronger SBP reactions in the written test and in the preparation of the speech, whereas men reacted stronger during speech delivery and personal interview (see Table 1). For self-reported stress, there was a main effect of sex: $F(1, 71) = 18.69$, $p < .001$. Women reported a higher stress level for all tasks as compared to men (see Table 1). This result is consistent with prior research (Holt–Lunstad, Clayton, & Uchino, 2001).

Effects of Sex and G-SC on Subjective and Cardiovascular Reactivity

Subjective stress reactivity. The regression analyses revealed that controlling for emotionality at baseline, being women, and scoring low on instrumentality predicted greater emotional stress reactivity to the tasks (Table 3). Thus, the higher emotional stress responses of women cannot be fully explained by self-concept differences.

Blood pressure reactivity. Confirming our hypothesis, the G-SC (i.e., instrumentality) was a more important predictor of blood pressure reactivity in comparison to biological sex. Controlling for baseline values, a significant three-way-interaction of sex × instrumentality × expressiveness was found for SBP. This interaction was followed by analyses run separately by sex. Among men, scoring high on both desirable male and female attributes predicted enhanced SBP reactivity (controlled for baseline levels of SBP). Among women, scoring high on desirable male gender role attributes (instrumentality) accounted for 23 % of the variance in SBP reactivity (controlled for baseline levels of SBP; Table 4).

To explore the unexpected interaction effect among men, we compared the SBP reactivity of androgynous (high expressive and high instrumental, $n = 10$) and masculine men (low expressive, high instrumental, $n = 16$), operationalized via median-dichotomization on the Instrumentality and Expressiveness scales (Spence & Helmreich, 1978). The androgynous men showed higher increases in SBP ($M = 16.7$ mmHg, $SD = 7.7$) than the masculine men ($M = 9.3$ mmHg, $SD = 8.2$), $t(24) = 2.24$, $p < .05$.

With regard to DBP, the hypothesis could be confirmed. Regardless of sex, high instrumentality predicted DBP reactivity to the tasks (Table 5).

To illustrate this effect, the sample was divided by median-dichotomization (the sample median was 2.35) on the Instrumentality scale in two subgroups. As is illustrated in Figure 1, the high-instrumental individuals reacted ($n = 37$) with much higher increases in DBP during the four tasks than did the low-instrumental individuals ($n = 37$).

With regard to heart rate, none of the variables (not even the baseline values) could predict reactivity.

Table 3. *Hierarchical Regression Predicting Change in Subjective Stress*

Step	Predictor	R^2Cum	Beta	t
1	Baseline stress	.30	–.64	-6.9^{***}
2	Sex[a]	.45	.27	2.9^{**}
3	Instrumentality	.51	–.28	-2.9^{**}
	Expressiveness			< 1

Note. Method is forced entry.
[a]Codification of sex: 1 male, 2 female; change scores were averaged across the four tasks; for regression, *Beta* and *t* are at final step; R^2 reflects increment in R^2 at time of entry;
$^{**}p < .01$. $^{***}p < .001$.

Discussion

The job interview simulation could demonstrate a significant influence of the G-SC not only on self-reported stress, but also on cardiovascular stress reactivity. As hypothesized, instrumentality in self-concept played the key role. A high instrumental self-concept was associated with lower subjective stress reactivity; biological sex also remained significant after G-SC was considered. Women evaluated themselves in all task sessions as more distressed than men (Table 1), although the physiologic measures did not indicate sex differences in arousal. To explain the lower self-ratings in stress of the male participants, additional factors (to G-SC) should be recognized: for example, a higher

Table 4. *Hierarchical Regression Predicting Change in Systolic Blood Pressure Among Men and Women*

	Step	Predictor	R^2Cum	Beta	t
Men					
	1	Baseline systolic blood pressure	.17	–.39	–3.0**
	2	Instrumentality	.26		1.7
		Expressiveness			–1.0
	3	Instrumentality × Expressiveness	.46	.67	3.4**
Women					
	1	Baseline systolic blood pressure	.00		< 1
	2	Instrumentality	.23	.48	3.1**
		Expressiveness			< 1

Note. Method is forced entry.
Change scores were averaged across the four tasks; for regression, *Beta* and *t* are at final step; R^2 reflects increment in R^2 at time of entry.
$^{**}p < .01$.

cognitive avoidance coping style in men (Kohlmann et al., 1996) or gender-specific coping or display rules (Weidner & Collins, 1993).

More important than the expected relation between G-SC and subjective stress reactions is the finding that the G-SC affected cardiovascular stress reactions. Contrary to the majority of studies, men did not show stronger blood pressure reactivity than women. CVR varied more within each sex dependent on G-SC than between the sexes. This result is in congruence with Frankenhaeuser's (1991) observation that the differences between the physiological stress reactions are diminishing as many differences between gender roles are disappearing.

The effects of G-SC on blood pressure reactivity were somewhat clearer than in former studies. As hypothesized, instrumentality accounted for a significant amount of variance in blood pressure reactivity in both sexes. For women, high instrumentality was associated with higher increases in SBP as well as DBP. For men, the same applied for DBP reactivity. The prediction of SBP reactivity of men was further improved by expressiveness. Men who scored high on both scales (androgynous men) had the highest SBP responses to the task. To further explore this finding, sociodemographic data of the masculine and androgynous men were compared. A significant difference in age was found: the androgynous men were, on average, 2 years older than the masculine men ($M = 27.7$, $SD = 1.9$, $n = 10$, versus $M = 25.7$, $SD = 1.9$, $n = 16$), $t(24) = 2.61$, $p < .05$. Thus, it is possible that the situation (applying for a job) was closer and psychologically more relevant for the androgynous men. Another explanation for this finding may be related to the quality of expressive personal attributes. A high expressive person who is "very aware of the feelings of others" and "very understanding of others" (Spence & Helmreich, 1978) might also feel more stressed by the fact that his or her performance will be evaluated by personnel experts. Low and colleagues (2001) assumed that concerns about social evaluation in socially stressful tasks could be particularly salient predictors of cardiovascular endpoints in women. It may be that this holds true for androgynous men as well. Interestingly, several remarks of men during the postexperimental debriefing period appeared to corroborate such an assumption. Although some of the "masculine" men underlined the artificiality of the job interview situation, "one is always conscious of the artificiality of the situation" (participant #1203), androgynous (high expressive

Table 5. *Hierarchical Regression Predicting Change in Diastolic Blood Pressure*

Step	Predictor	R^2cum	*Beta*	*t*
1	Baseline DBP	.23	–.46	–4.6**
2	Sex[a]	.26		< 1
3	Instrumentality	.34	.28	2.6*
	Expressiveness			< 1

Note. Method is forced entry.
[a]Codification of sex: 1 male, 2 female; change scores were averaged across the four tasks; for regression, Beta and t are at final step; R^2 reflects increment in R^2 at time of entry;
$^{*}p < .05$. $^{**}p < .01$.

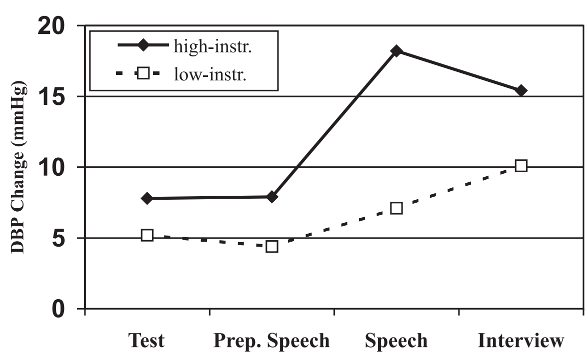

Figure 1. Diastolic blood pressure (DBP) change scores during tasks as a function of instrumentality in self-concept. High-instrumental participants (*n* = 37) scored above the median; low-instrumental participants (*n* = 37) scored below the median of the Instrumentality scale.

and high instrumental) men seemed more concerned about the evaluation process: "I wonder whether the interviewer likes me" (participant #1205); I try to avoid thinking about others seeing this film" (participant #1102).

Our study also showed significant differences in stress reactivity dependent on the stressor. The tasks which included speaking (speech delivery and interview) provoked higher stress reactions than the tasks without speaking (paper-and-pencil test and inner preparation of speech). al'Absi and colleagues (1997) compared physiological and emotional adjustment to public speaking and mental arithmetic stressors. They found that public speaking produced greater cardiovascular responses than did mental arithmetic. Additionally, responses across systems (e.g., cardiovascular, endocrine, and emotional) were only correlated for public speaking. They concluded that public speaking stressors seem to be a useful and ecologically valid experimental paradigm to study effects of acute mental stress. Another argument for public speaking is that it is considered to be equally relevant for both sexes. Public speaking stressors were already used in the studies by Saab et al. (1989) and Davis and Matthews (1996). Therefore, further studies examining the relation of G-SC to cardiovascular stress reactivity may benefit from using life-relevant stressors rather than stressors infrequently encountered in daily life and lacking social interaction (e.g., Mirror Image Tracing, Serial Subtraction, Postural Tilt; see also Schwartz et al., 2003).

This study focused on acute responses to mental stress. There is growing evidence that recovery is an important component of the stress process as well; delayed or poststress recovery responses appear to be associated with heigthened disease risk (especially hypertension; Hocking Schuler & O'Brien, 1997; Llabre, Spitzer, Saab, & Schneiderman, 2001; Schwartz et al., 2003; Steptoe, Willemsen, Kunz–Ebrecht, & Owen, 2003). For exploratory reasons,[2] we analyzed whether sex and G-SC influenced the poststress recovery responses (change scores from baseline values) in 2 (sex) × 2 (above and below median on Instrumentality scale) ANOVAs. Regarding DBP recovery, a significant interaction of sex × instrumentality emerged, $F(1, 70) = 5.5$, $p < .05$. In the subgroup of female participants, more complete recovery was found among low instrumental participants ($n = 26$, $M = –0.6$ mmHg, $SD = 5.9$) than among high instrumental participants ($n = 11$, $M = 5.2$ mmHg, $SD = 6.6$). In the subgroup of male participants, high instrumental men ($n = 26$) showed somewhat better DBP recovery ($M = 1.3$ mmHg, $SD = 6.7$) than low instrumental men ($M = 2.8$ mmHg, $SD = 4.5$). This result supports the main finding of the study that instrumentality appears to play a central role in BP responding, especially in women. Further studies might benefit from analyzing recovery processes in a more differentiated manner (Schwartz et al., 2003).

One limitation of the study is that participants didn't interact with a concrete person; they answered the personal interview questions from tape and spoke into a video camera. This design was chosen to exclude uncontrollable effects of social interaction. Nevertheless, it cannot be ruled out, that the stress reactions measured in this study were not typical for real job-interview situations. It might also be that women and men react differently when they have to perform without a concrete person to whom they could relate.

To conclude, the most important predictor of CVR was instrumentality in self-concept. Those scoring high on instrumentality reported less stress, but evidenced greater blood pressure reactivity than those scoring low on instrumentality. Although there are many questions regarding the relation between CVR and cardiovascular disease (e.g., see special issue on this topic; Linden et al., 2003), exaggerated CVR is often seen as playing an important role in the etiology of hypertension and coronary heart disease (especially among men). Whether the same applies to women remains unclear.

In her extensive studies of CVD mortality trends and changes in health behaviors and risk factors in many countries over several decades, Waldron (2002) observed that sex mortality ratios in coronary heart disease have tended to decrease in the United States and some Western European countries (primarily due to declining rates among men). Because trends in CVD mortality are influenced by trends in multiple behaviors, risk factors, and medical care, mortality trends generally do not show consistent relations with trends in any single causal factor (Waldron, 2002). For example, sex mortality ratios for coronary heart disease in the United States and Italy during certain time periods increased, despite decreasing gender differences in current and recent smoking (Waldron, 1995). Thus, enhanced CVR to stress among relatively young and healthy university students scoring high on instrumentality may not be of much prognostic value without considering the multitude of other risk factors over a longer period of time.

In sum, the findings from this study suggest that gender roles, particularly an instrumental self-concept, may play an important role in both subjective and objective reactions to an ecologically relevant stressor. Whether these reactions will translate into an elevated cardiovascular risk, however, will require further investigation, preferably conducted in the natural environment (Shapiro, Goldstein, & Jamner, 2002), taking into account interactions between individual predispositions and environmental stress exposures, and focusing on prolonged pathogenic exposures and responses (Schwartz et al., 2003).

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References

al'Absi, M., Bongard, S., Buchanan, T., Pincomb, G. A., Licinio, J., & Lovallo, W. R. (1997). Cardiovascular and neuroendocrine adjustment to public speaking and mental arithmetic stressors. *Psychophysiology, 34,* 266–275.

al'Absi, M., Devereux, R. B., Lewis, C. E., Kitzman, D. W., Rao, D. C., Hopkins, P., et al. (2002). Blood pressure responses to acute stress and left ventricular mass (The Hypertension Genetic Epidemiology Network Study). *American Journal of Cardiology, 89,* 536–540.

Allen, M. T., Stoney, C. M., Owens, J. F., & Matthews, K. A. (1993). Hemodynamic adjustments to laboratory stress: The influence of gender and personality. *Psychosomatic Medicine, 55,* 505–517.

Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42,* 155–162.

Collins, A., & Frankenhaeuser, M. (1978). Stress responses in male and female engineering students. *Journal of Human Stress, 4,* 43–48.

Davis, M. C., & Matthews, K. A. (1996). Do gender-relevant characteristics determine cardiovascular reactivity? Match versus mismatch of traits and situation. *Journal of Personality and Social Psychology, 71,* 527–535.

Frankenhaeuser, M. (1983). The sympathetic-adrenal and pituitary-adrenal response to challenge: Comparison between the sexes. In T. M. Dembroski, T. H. Schmidt, & G. Blumchen (Eds.), *Biobehavioral bases of coronary heart disease* (pp. 91–105). Basel, Switzerland: Karger.

Frankenhaeuser, M. (1991). The psychophysiology of workload, stress, and health: Comparison between the sexes. *Annals of Behavioral Medicine, 13,* 197–204.

Helgeson, V. S. (1994). Relation of agency and communion to well-being: Evidence and potential explanations. *Psychological Bulletin, 116,* 412–428.

Hocking Schuler, J. L., & O'Brien, W. H. (1997). Cardiovascular recovery from stress and hypertension risk factors: A meta-analytic review. *Psychophysiology, 34,* 649–659.

Holt–Lunstad, J., Clayton, C. J., & Uchino, B. N. (2001). Gender differences in cardiovascular reactivity to competitive stress: The impact of gender of competitor and competition outcome. *International Journal of Behavioral Medicine, 8,* 91–102.

Huynh. H., & Feldt, L. S. (1976). Estimation of the Box correction for degrees of freedom from sample data in randomized block and splitplot designs. *Journal of Educational Statistics, 1,* 69–82.

Kamarck, T. W. (1992). Recent developments in the study of cardiovascular reactivity: Contribution from psychometric theory and social psychology. *Psychophysiology, 29,* 491–503.

Kamarck, T. W., Everson, S. A., Kaplan, G. A., Manuck, S. B., Jennings, J., Salonen, R., et al. (1997). Exaggerated blood pressure responses during mental stress are associated with enhanced carotid atherosclerosis in middle-aged Finnish men: Findings from the Kuopio Ischemic Heart Disease Study. *Circulation, 96,* 3842–3848.

Kamarck, T. W., & Lovallo, W. R. (2003). Cardiovascular reactivity to psychological challenge: Conceptual and measurement considerations. *Psychosomatic Medicine, 65,* 9–21.

Kohlmann, C.-W., Weidner, G., & Messina, C. R. (1996). Avoidant coping style and verbal-cardiovascular response dissociation. *Psychology and Health, 11,* 371–384.

Llabre, M. M., Spitzer, S. B., Saab, P. G., & Schneiderman, N. (2001). Piecewise latent growth curve modeling of systolic blood pressure reactivity and recovery from the cold pressor test. *Psychophysiology, 38,* 951–960.

Light, K. C., Dolan, C. A., Davis, M. D., & Sherwood, A. (1992). Cardiovascular responses to an active coping challenge as predictors of blood pressure patterns 10 to 15 years later. *Psychosomatic Medicine, 54,* 217–230.

Light, K. C., Girdler, S. S., Sherwood, A., Bragdon, E. E., Brownley, K. A., West, S. G., et al. (1999). High stress responsivity predicts later blood pressure only in combination with positive family history and high life stress. *Hypertension, 33,* 1458–1464.

Linden, W., Gerin, W., & Davidson, K. (Eds.). (2003). Cardiovascular reactivity: Status quo and a research agenda for the new millenium [Special issue]. *Psychosomatic Medicine, 65*(1).

Low, K. G., Casey, G., Megroz, A., Leonard, K., McGuffie, K., & Brian, L. (2001). Hostility, oral contraceptive use, and cardiovascular reactivity in women. *Psychology and Health, 16,* 675–687.

Lundberg, U. (1998). Work and stress in women. In K. Orth–Gomer, M. A. Chesney, & N. K. Wenger (Eds.), *Women, stress, and heart disease* (pp. 41–56). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Lundberg, U., & Frankenhaeuser, M. (1999). Stress and workload of men and women in high-ranking positions. *Journal of Occupational Health Psychology, 4,* 142–151.

Matthews, K. (1989). Interactive effects of behavior and reproductive hormones on sex differences in risk for coronary heart disease. *Health Psychology, 8,* 373–388.

Myrsten, A. L., Lundberg, U., Frankenhaeuser, M., Ryan, G., Dolphin, C., & Cullen, J. (1984). Sex-role orientation as related to psychological and physiological responses during achievement and orthostatic stress. *Motivation and Emotion, 8,* 243–258.

Runge, T. E., Frey, D., Gollwitzer, P. M., Helmreich, R. L., & Spence, J. T. (1981). Masculine (instrumental) and feminine (expressive) traits. A comparison between students in the United States and West Germany. *Journal of Cross-Cultural Psychology, 12,* 142–162.

Saab, P. G., Matthews, K. A., Stoney, C. M., & McDonald, R. H. (1989). Premenopausal and postmenopausal women differ in their cardiovascular and neuroendocrine responses to behavioral stressors. *Psychophysiology, 26,* 270–280.

Schwartz, A. R., Gerin, W., Davidson, K. W., Pickering, T. G., Brosschot, J. F., Thayer, J. F., et al. (2003). Toward a causal model of cardiovascular responses to stress and the development of cardiovascular disease. *Psychosomatic Medicine, 65,* 22–35.

Shapiro, D., Goldstein, I., & Jamner, L. (2002). Blood pressure in everyday life: Interplay of biological, psychological, social, emotional, and situational factors. In G. Weidner, M. S. Kopp, & M. Kristenson (Eds.), *Heart disease: Environment, stress and gender* (NATO Science Series, Series I: Life and Behavioural Sciences; Vol. 327, pp. 314–327). Amsterdam: IOS Press.

Spence, J. T. (1984). Masculinity, femininity, and gender-related traits: A conceptual analysis and critique of current research. In B. A. Maher & W. B. Maher (Eds.), *Progress in experimental personality research* (Vol. 13, pp. 1–97). New York: Academic.

Spence, J. T., & Helmreich, R. L. (1978). *Masculinity & femininity. Their psychological dimensions, correlates & antecedents.* Austin: University of Texas Press.

Steptoe, A., Willemsen, G., Kunz–Ebrecht, S. R., & Owen, N. (2003). Socioeconomic status and hemodynamic recovery from mental stress. *Psychophysiology, 40,* 184–191.

Swain, A., & Suls, J. (1996). Reproducibility of blood pressure and heart rate reactivity: A meta-analysis. *Psychophysiology, 33,* 162–174.

Waldron, I. (1995). Contributions of biological and behavioural factors to changing sex differences in ischemic heart disease mortality. In A. Lopez, G. Caselli, & T. Valkonen (Eds.), *Adult mortality in developed countries: From description to explanation* (pp. 161–178). New York: Oxford University Press.

Waldron, I. (2002). Trends in gender differences in coronary heart disease mortality—Relationships to trends in health-related behavior and changing gender roles. In G. Weidner, M. S. Kopp, & M. Kristenson (Eds.), *Heart disease: Environment, stress and gender* (NATO Science Series, Series I: Life and Behavioural Sciences; Vol. 327, pp. 80–98). Amsterdam: IOS Press.

Wallbott, H. G., & Scherer, K. R. (1991). Stress specificities: Differential effects of coping style, gender, and type of stressor on autonomic arousal, facial expression, and subjective feeling. *Journal of Personality and Social Psychology, 61,* 147–156.

Weidner, G. (1994). Coronary risk in women. In V. J. Adesso, D. M. Reddy, & R. Fleming (Eds.), *Psychological perspectives in women's health* (pp. 57–81). Washington, DC: Taylor & Francis.

Weidner, G., & Collins, R. L. (1993). Gender, coping, and health. In H. W. Krohne (Ed.), *Attention and avoidance: Strategies in coping with aversiveness* (pp. 241–265). Seattle, Toronto, Göttingen, Bern: Hogrefe & Huber Publishers.

Weidner, G., & Messina, C. R. (1995). Effects of gender-typed tasks and gender roles on cardiovascular reactivity. *International Journal of Behavioral Medicine, 2,* 66–82.

Weidner, G., & Messina, C. R. (1998). Cardiovascular reactivity to mental stress and cardiovascular disease. In K. Orth–Gomer, M. A. Chesney, & N. K. Wenger (Eds.), *Women, stress, and heart disease* (pp. 219–236). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.