



ELSEVIER

Biological Psychology 60 (2002) 37–49

www.elsevier.com/locate/biopsycho

---

---

BIOLOGICAL  
PSYCHOLOGY

---

---

# Anticipatory autonomic response to a public speaking task in women The role of trait anxiety

Esperanza Gonzalez-Bono <sup>a</sup>, Luis Moya-Albiol <sup>a</sup>,  
Alicia Salvador <sup>a,\*</sup>, Eduvigis Carrillo <sup>b</sup>, Jorge Ricarte <sup>b</sup>,  
Jesus Gomez-Amor <sup>b</sup>

<sup>a</sup> *Departamento de Psicobiología y Psicología Social, Facultad de Psicología, Universidad de Valencia, Area de Psicobiología, Apartado 22109, 46071 Valencia, Spain*

<sup>b</sup> *Departamento de Ciencias Morfológicas y Psicobiología, Facultad de Psicología, Universidad de Murcia, Area de Psicobiología, Campus Universitario de Espinardo, 30100 Murcia, Spain*

Received 27 November 2001; accepted 18 February 2002

---

## Abstract

The aim of this research was to study anticipatory autonomic responses their relationship to trait anxiety. Twenty-three women prepared an evaluated speech (S-condition) and 22 women an evaluated essay (W-condition). Heart rate (HR), finger pulse volume (FPV) and skin conductance were recorded before, during and after preparation of the task and during task performance; state-anxiety was evaluated before and after the task. In the total sample, state-anxiety was higher in the S- than in W-condition and this anxiety increase was accompanied by FPV reductions. However, when the sample was split according to trait anxiety scores, HR during preparation and increases of state-anxiety were greater in S- than W-condition in only in high-anxious women. Results suggest that specificity of anticipatory HR response to a public speaking task in women is moderated by cognitive anxiety. © 2002 Elsevier Science B.V. All rights reserved.

*Keywords:* Anticipatory response; Cardiovascular; Skin conductance; Public speaking tasks; Evaluative threat

---

\* Corresponding author. Tel.: +34-6-3864420; fax: +34-6-3864668.

E-mail address: [alicia.salvador@uv.es](mailto:alicia.salvador@uv.es) (A. Salvador).

## 1. Introduction

Anticipatory response to stress has been considered to be a preparatory mechanism for the defense of the organism to threat stimuli on the basis of flight-fight mechanisms (Canon, 1929). However, most of the studies that have dealt with this theme have aimed to establish criteria for valid baseline measurement rather than elucidate the anticipatory activation *per se* (Gregg et al., 1999). Due to this methodological focus, the impact of these anticipatory responses on the subsequent response to the task are unclear.

In previous studies, we have found that psychosocial stress elicited by sports competitions produced an anticipatory response on certain hormonal axes when physical exertion was controlled (González-Bono et al., 1999; Suay et al., 1999). A widely employed psychosocial stressor in the laboratory is public speaking. Tasks involving public speaking provoke reliable neuroendocrine (Kirschbaum et al., 1993), metabolic (Kirschbaum et al., 1997), immunological (Ackerman et al., 1996), as well as cardiovascular and electrodermal responses (Knight and Borden, 1979; Puigcerver et al., 1989; Fichera and Andreassi, 2000). Typically, laboratory stressors involve mental effort, psychomotor skills, some psychological or physical threat, and social evaluation, with greater responses in public speaking tasks being attributed to the presence of this latter component (Fichera and Andreassi, 2000). In fact, evaluation has been considered to be one of the common uncontrolled features in many studies that alter the magnitude of the autonomic response (Smith et al., 1997); evaluation generally enhances anxiety and negative affect in general. A speech, even when simulated, elicits greater elevations in anxiety than an attention task (Palma et al., 1994).

A typical public speaking task usually includes an explicit, preparatory phase that makes it a useful tool to study anticipatory response. Enhanced cardiovascular activity during the preparation of a speech is often described (Saab et al., 1992; Tardy and Allen, 1998; Smith et al., 1997; Gregg et al., 1999). The magnitude of the response in anticipation to speech was found by Al'Absi et al. (1997) to be greater than the anticipation to other evaluated tasks. However, little is known about the factors that affect or moderate this anticipatory activation.

In a recent study comparing social phobic and control subjects in anticipation of a speech, the phobic group showed higher heart rate (HR) and greater right-sided anterior cortical activation than controls. These physiological changes were accompanied by greater increases in situational anxiety and negative affect (Davidson et al., 2000). Evidence as to whether people who report being anxious have greater cardiovascular responses to the evaluated speaking task is contradictory, with some studies failing to find significant differences in HR and skin conductance levels between high- and low-speech-anxious subjects (Knight and Borden, 1979; Baggett et al., 1996). Methodological differences in the evaluation trait anxiety (total trait anxiety, specific speech anxiety, etc.) could explain, at least in part, these inconsistencies. In spite of the fact that it has been suggested that interactions between characteristics of the person and features of the situation enhance the predictive utility of psychophysiological dimensions (Mischel and Shoda, 1995), little research

has been devoted to personality factors as moderators of cardiovascular reactivity in women (Lawler et al., 1990; Fichera and Andreassi, 2000).

Bearing all this in mind, the first aim of the present study was to characterize the cardiovascular and electrodermal activation that occurs prior to public speaking and differentiate these responses from those that occur in situations with similar evaluative threat and mental effort but when no public speaking is anticipated. To this end, participants were randomly assigned to one of two groups according to the instructions received in the preparatory period; one group believed that they had to speak and the other believed that they had to write. Both groups knew that their performance would be evaluated. All subjects actually performed the same task (speech) in order to assess whether activation of the preparatory period could influence reactivity during the posterior task period. With this strategy, differences between groups in the cardiovascular and/or electrodermal responses measured in the preparatory period would affirm that they were due to anticipation of the speech itself and not to the associated evaluative threat and mental effort. A lack of group differences would indicate that the anticipatory response was likely due to the evaluative threat and/or cognitive aspects common to both tasks. Additionally, differences during the task period would suggest the influence of preparatory activation on reactivity during task performance because all the subjects performed the same task and similar responses should be expected. In the light of previously described results, we hypothesized greater HR and lower FPV, when preparing and performing a speech than when preparing and writing an essay. Formulation of hypothesis regarding electrodermal activity is limited due to the fact that the scarce studies on public speaking tasks do not compare speech with other evaluated tasks (Knight and Borden, 1979; Puigcerver et al., 1989). In order to determine whether autonomic differences were associated with different emotional impacts, changes in state-anxiety were also assessed. As has been suggested in previous studies, greater increases in situational anxiety would be found in speech rather than in writing.

The second aim of this study was to evaluate the role of trait anxiety on cardiovascular and electrodermal responses induced by anticipation of the evaluative public speaking task. Greater reactivity of HR and FPV in preparation to speech was expected in high-anxious compared to low-anxious women. In the light of the previously reported studies, no differences in function of anxiety would be expected in skin conductance. As potential moderating factors of the anticipatory response, total trait anxiety evaluated along with somatic, behavioral, and cognitive components in accordance with Lang's three-system model (Lang, 1968; Lang et al., 1993).

## **2. Method**

### *2.1. Participants*

The sample was composed of 45 undergraduate women who volunteered to participate in the study. All of them were right-handed, drug-free (including oral

contraceptives) and healthy. Women were aged  $21.5 \pm 0.4$  years and their body mass index was of  $21.5 \pm 0.3$  kg/m<sup>2</sup>. These variables were used to counterbalance subjects by conditions. They were initially screened using a brief questionnaire in which aspects such as habits, health and drug intake were covered. The absence of physical activity during the 12-h prior to testing was checked. All subjects signed a written consent that included that non-invasive measurements would be taken.

## 2.2. *Equipment and physiological recording*

Non-specific skin conductance responses (NSR) were obtained by two Ag/AgCl electrodes (TSD103A) with a contact area of 6 mm diameter located on the middle phalanxes of the fore and index fingers of the non-dominant hand by means of adhesive collars. Hypoallergenic gel (G100) was used as the contact medium between skin and electrode. A photoelectric transducer (TS100A) attached by an adhesive collar onto the distal phalanx of the index finger of the dominant hand detected changes in FPV.

A skin conductance module (GSR100A) amplified the electrical signal by a circuit of constant voltage (0.5 V). The signal from the photoplethysmograph was amplified by a PPG100A amplifier. Both modules were a part of a physiological recording system composed of 16 modules (BIOPAC Systems, Inc., Santa Barbara, CA 93117). This system was connected to a signal pre-amplifier UIM100 (Universal Interface Module), and this in turn to a computer (PC-486) which contained hardware adapted to the acquisition of data (MP100) and software (AcqKnowledge for Windows) prepared for storing.

## 2.3. *Procedure*

Subsequent to informed consent, subjects filled in questionnaires and performed the task while electrophysiological variables were acquired. Experimental sessions were carried out from 09.00 to 13.00 h throughout 10 consecutive days. Calibration of the equipment was controlled daily by the experimenter, according to the recommendations of Fowles et al. (1981).

Subjects were accommodated in a first room where they filled in state-anxiety inventory (STAI-S). After washing their hands, they were taken to an adjacent room where the recording phase would be performed. This room was sound attenuated, temperature-controlled within 2 °C at 21 °C and light was kept constant throughout the 20 min experimental session. Electrodes were attached and subjects were encouraged to be comfortable and relaxed. They remained in this situation during 10 min with the last 5 min recorded as the baseline estimate (Rest period). The first 5 min were used to simply adapt the subjects to the experimental setting (Jennings et al., 1992). Following the baseline recording, the experimenter gave a short set of instructions. For 23 subjects (S-condition) the instructions were: “You have 2.5 min to prepare a speech of 2.5 min of duration on this topic (the experimenter gave them a paper where aspects about evaluation of their academic education were listed), which will be evaluated by a teacher according to its

consistency, adequacy and argumentative structure. Your performance will be considered for your academic qualification". For 22 subjects (W-condition) the instructions were systematically the same as in S-condition but the experimenter asked the subject to prepare a written narration. When the 2.5 min finished (Preparation period), recording was briefly interrupted while the evaluator (female university teacher, known by all students) went into the experimental room and sat in front of the subject. The experimenter told women of S-condition that they could start, and informed W-condition that they had to perform a speech instead of a written task. No sign of frustration, surprise or discomfort was shown by subjects after these instructions. The need to speak for the entire 2.5-min period was strongly emphasized. Tape- and video-recording apparatus were switched on in sight of the subject at this moment to enhance the stress of the situation. The evaluator took notes during the speeches but did not speak or provide any facial expression. After these 2.5 min (Task-period), the evaluator left the room and the subject remained another 5 min without stimulation (Recovery period). During the 20 min that the experimental session lasted, data were continuously recorded and monitored out of sight of the subject. The subject remained seated during the entire recording period and was then taken back into the first room where they completed the STAI-T and ISRA for trait anxiety evaluation.

## *2.4. Psychological measures*

### *2.4.1. State self-reports*

State-anxiety was evaluated by the Spanish version of STAI-S (Spielberger et al., 1970). This inventory is composed of 20 items ranked by means of a 4-point Likert scale.

### *2.4.2. Trait self-reports*

Trait anxiety was evaluated by means of both the Spanish version of STAI-T (Spielberger et al., 1970) and ISRA (Inventory of Anxious Situations and Responses; Miguel-Tobal and Cano-Vindel, 1988). The latter self-report instrument considers, following Lang's model (Lang, 1968), different components of anxiety such as cognitive, physiological and motor anxiety by means of three scales of 23 items each. A total score is obtained by simply adding the three component subscales. Analyses of reliability and validity have been reported previously and correlation coefficient between total scores in both STAI and ISRA of 0.61 has been reported (Miguel-Tobal and Cano-Vindel, 1988).

### *2.4.3. Situational appraisal*

A self-report elaborated by ourselves and based on previous studies on the topic (Baggett et al., 1996) was used. It was composed of nine questions ranked by a 5-point Likert scale which screened the following aspects: internal and external attribution, frustration, motivation, perception of effort required, degree of stress perceived, the difficulty of the task, valuation of own performance, and expected outcome of the evaluation (although no feedback was received).

## 2.5. Data reduction and analyses

The computer sampled each raw physiological variable 10 times per second throughout the experiment. After the elimination of the artifacts, mean values in each period were calculated using AcqKnowledge software. Any artifact-free change in skin conductance equal to or higher than  $0.05 \mu\Omega$  was considered a response. Frequency of NSRs was expressed in responses per minute. SCR amplitude was expressed in microhms, FPV in volts and HR in beats per minute, with the latter being extrapolated from FPV data by AcqKnowledge software. HR was calculated from the interbeat interval (IBI), i.e. the difference in the time of the peak voltage between one finger pulse and the peak voltage of the next. The data were converted from beat-to-beat values of IBI to HR in beats per minute.

Effects of the experimental manipulations on physiological measures were compared using analyses of variance (ANOVAs) for repeated measures ( $4 \times 2$ ) with 'Period' (Rest, Preparation, Task and Recovery) as the within-subjects variable and with 'Condition' (S- and W-condition) as the between-subjects factor. Greenhouse–Geisser adjustments for degree of freedom were carried out and repeated measures ANOVAs (two levels) were performed as simple effect tests between periods. For state-anxiety, ANOVAs for repeated measures (pre-/post-) with 'Condition' as the between-subjects factor ( $2 \times 2$ ) were performed.

To examine the Preparation and Task periods more specifically, reactivity was calculated as the difference between Preparation levels minus Rest levels and the difference between Task minus Preparation levels, respectively. The position of baseline was varied in order to minimize carry over effects of preparation period and to isolate task reactivity as far as possible. Comparisons of appraisal scores and electrophysiological reactivity between conditions were performed by one-tailed *t*-test. Spearman rank correlation tests were carried out to examine relationships between variables.

For each trait anxiety scale, subjects who scored equal to or higher than the 66th percentile were placed in the 'high-anxiety' group, while subjects who scored equal to or lower than the 33rd percentile were included in the 'low-anxiety' group. To examine the moderation of reactivity by anxiety,  $2$  (high- vs. low-anxiety score)  $\times$   $2$  (preparation vs. task reactivity score) ANOVAs were conducted. All statistical analyses were performed with SPSS 8.0 for Windows and the alpha level for all comparisons was set at  $P < 0.05$ .

## 3. Results

The possible impact of the anticipation of a speech compared to the anticipation of a pencil-and-paper task lead us to expect higher HR and lower FPV in the preparation of S- than in W-condition. In the absence of arguments to the contrary, higher electrodermal activity in S- with respect to W-condition would be expected. With regards to trait anxiety, highly anxious women would show greater cardiovascular activation than less anxious persons, especially in the S-condition. In agree-

ment with previously described studies, no significant differences in electrodermal activity between highly and lowly anxious women would be expected.

### 3.1. Differences between conditions in electrophysiological and psychological measurements

Appraisal scores did not differ between conditions. As can be observed in Table 1, internal and external attribution of a hypothetical outcome of the task, frustration, motivation, effort, stress, task difficulty, own performance and sign of the evaluation were similarly perceived in both S- and W-conditions. No differences between conditions were found in total anxiety or any component of anxiety, mean scores of both conditions being in the lowest half of the normal range considering validation data referring to a non-pathological population.

The ANOVAs of raw scores produced no significant effects involving ‘Condition’ (Fig. 1), although a significant effect of ‘Period’ was found on all physiological variables ( $F(1.26, 54.05) = 37.61$ ,  $P < 0.001$ , for HR;  $F(1.87, 80.30) = 10.878$ ,  $P < 0.0001$ , for FPV;  $F(2.0, 86.1) = 53.42$ ,  $P < 0.001$ , for amplitude of NSR; and  $F(2.18, 93.85) = 206.49$ ,  $P < 0.0001$ , for frequency of NSR). Preparation elicited higher HR and NSR values than Rest, and Task higher values than Preparation (for all,  $P < 0.001$ ). FPV showed the same ‘arousal’ pattern of responses, with decreases in Preparation and Task (for both,  $P < 0.05$ ). All variables displayed similar or lower values in Recovery with respect to Rest.

STAI-S scores showed a significant effect of the ‘Condition  $\times$  Time’ interaction ( $F(1, 43) = 5.31$ ,  $P < 0.05$ ), with anxiety increasing in S-condition (from  $15.7 \pm 1.3$  to  $19.0 \pm 1.6$ ;  $F(1, 22) = 4.30$ ,  $P < 0.05$ ) and non-significant decreases in W-condition (from  $22.8 \pm 2.5$  to  $20.4 \pm 1.7$ ). Additionally, in the S-condition, anxiety before the application of the stressor was positively related with HR during all the recorded periods ( $r = 0.71, 0.70, 0.54$  and  $0.78$  for Rest, Preparation, Task and Recovery, respectively; for all,  $P < 0.01$ ), and with amplitude of NSR in Preparation ( $r = 0.41$ ,  $P < 0.05$ ). In this condition, anxiety after stressor had ended was also associated with cardiovascular variables in Recovery, positively with HR ( $r = 0.47$ ,

Table 1  
Mean (SEM) of appraisal scores in both conditions

	S-condition ( $n = 23$ )	W-condition ( $n = 22$ )
Internal attribution	3.5 (2.1)	3.4 (0.2)
External attribution	2.3 (0.2)	2.4 (0.2)
Frustration	1.9 (0.2)	1.8 (0.2)
Motivation	3.7 (0.2)	3.5 (0.2)
Effort	2.7 (0.2)	2.4 (0.2)
Stress	3.4 (0.2)	3.0 (0.2)
Difficulty	2.3 (0.2)	2.1 (0.2)
Performance	3.3 (0.2)	3.1 (0.2)
Evaluation	3.0 (0.2)	2.9 (0.3)

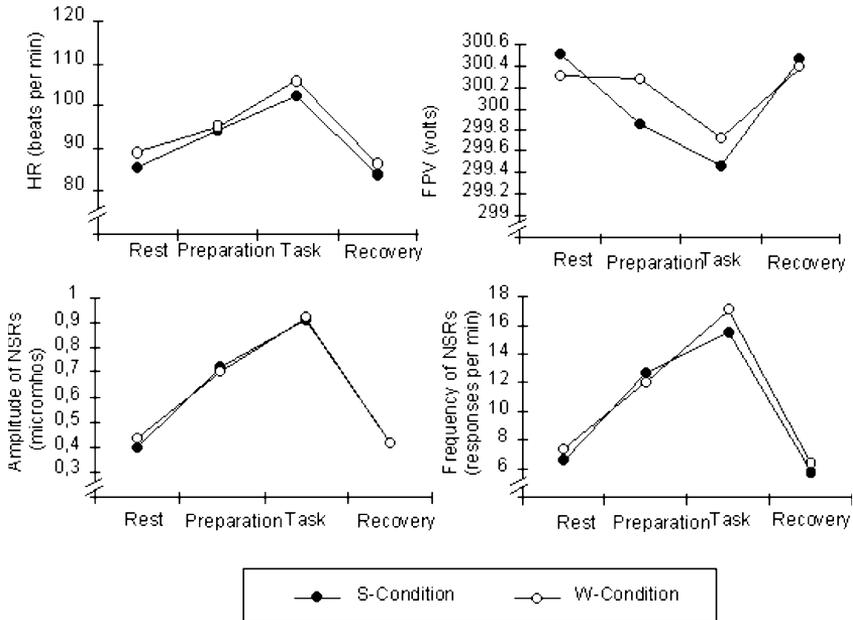


Fig. 1. HR, FPV, and amplitude and frequency of the NSRs in the S- and W-conditions during Rest, Preparation, Task and Recovery.

$P < 0.05$ ) and negatively with FPV ( $r = -0.43$ ,  $P < 0.05$ ). No significant correlation was found in W-condition.

### 3.2. Effects of anticipation of speech on electrophysiological measures

When one-tailed independent  $t$ -tests between conditions were carried out with each autonomic reactivity measure in the Preparation period. Only FPV reactivity was significantly different between conditions ( $t(33) = 1.92$ ,  $P < 0.05$ ), with S-condition showing greater decreases than W-condition. No significant differences between conditions were found in Task reactivity.

### 3.3. Trait anxiety as moderating factor of physiological anticipation and situational anxiety to speech

The total sample was distributed into groups depending on STAI-T and ISRA scores. This distribution resulted in 15/16 subjects per group with the following mean scores:  $28.63 \pm 1.55$  and  $10.27 \pm 0.77$  for high- and low-anxiety groups according to STAI-T scores;  $224.30 \pm 1.36$  and  $73.73 \pm 4.54$  for high- and low-total anxiety of ISRA;  $94.40 \pm 3.96$  and  $37.31 \pm 2.67$  for high- and low-cognitive anxiety, respectively;  $65.85 \pm 5.77$  and  $17.27 \pm 1.18$  for high- and low-physiological anxiety;  $73.40 \pm 3.76$  and  $14.60 \pm 1.35$  for high- and low-motor anxiety.

Table 2

Mean (standard error mean) of HR (in beats per min) in Rest, Preparation, Task and Recovery periods in S- and W-Condition in function of high- and low-cognitive anxiety

	High-cognitively anxious		Low-cognitively anxious	
	S-Condition	W-Condition	S-Condition	W-Condition
Rest	87.26 (4.65)	89.99 (3.87)	88.51 (2.84)	90.57 (3.53)
Preparation	98.32 (5.13)	93.13 (2.76)	95.50 (3.46)	98.42 (6.17)
Task	108.53 (5.92)	109.22 (2.72)	99.59 (10.19)	101.79 (7.13)
Recovery	86.16 (4.62)	87.46 (3.47)	84.81 (2.21)	90.09 (4.40)

When ISRA total anxiety or STAI-T scores were the criteria in distributing the sample, no significant effects on electrophysiological variables were found. However, in the case of STAI-T, a significant main effect of the ‘Group’ ( $F(1, 27) = 9.93$ ,  $P < 0.005$ ) appeared with high-anxiety women exhibiting higher state-anxiety before and after the task than the low-anxiety group.

When women were distributed according to cognitive anxiety and  $2 \times 2$  ANOVAs with ‘Condition’ and ‘Group’ as between-subjects factors were performed, a significant effect of ‘Condition  $\times$  Group’ interaction ( $F(1, 30) = 4.19$ ,  $P < 0.05$ ) on HR reactivity was found. Post hoc analyses revealed that in high-anxiety women, increases in HR were greater in S- than in W-condition ( $F(1, 14) = 9.68$ ,  $P < 0.01$ ), while no significant differences were found among low-anxiety individuals (Table 2; Fig. 2). Cognitive anxiety also moderated situational anxiety, since significant effects of ‘Condition  $\times$  Group  $\times$  Time (pre-/post-stress)’ interaction and ‘Group’ were found on state-anxiety ( $F(1, 27) = 9.13$ ,  $P < 0.005$  and  $F(1, 27) =$

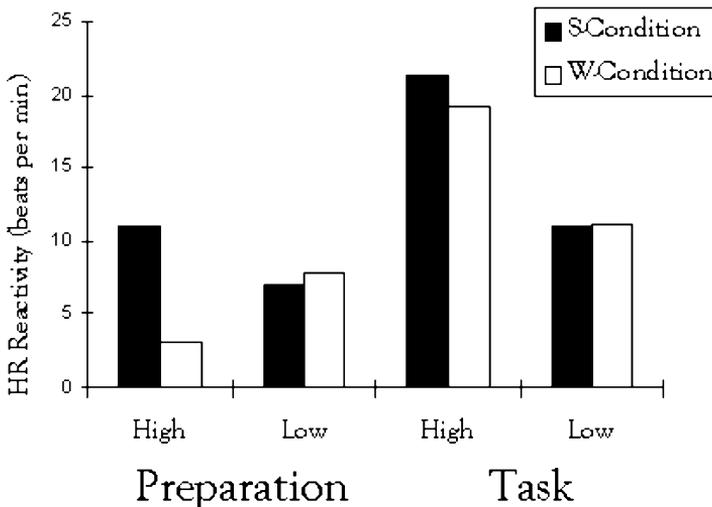


Fig. 2. HR reactivity in Preparation and Task in high- and low-cognitively anxious women in S- and W-conditions.

16.25,  $P < 0.0001$ , respectively), apart from the ‘Condition  $\times$  Time’ previously described ( $P < 0.05$ ). State-anxiety scores increased in S-condition and decreased in W-condition in the high-cognitively anxious women, while no significant differences were found in the low-cognitively anxious group.

When subjects were distributed according to physiological or motor anxiety, no main effect of ‘Group’ or its interactions were found in any of the electrophysiological or psychological variables.

#### 4. Discussion

Our results suggest that, overall, the only psychophysiological response that showed specificity in an evaluated speech in comparison with an evaluated essay was FPV. However, reactivity of HR in the preparation of the task and state-anxiety were modulated by cognitive trait anxiety.

First of all, it is worth noting that the speaking task was efficient in eliciting enhanced cardiovascular and electrodermal responses in agreement with previous studies (Knight and Borden, 1979; Al’Absi et al., 1997). This activation was found in the Preparation periods of both conditions. This previously reported finding in speech (Puigcerver et al., 1989; Saab et al., 1992; Baggett et al., 1996; Tardy and Allen, 1998; Gregg et al., 1999) therefore now extends to the anticipation period in other situations in which subjects are evaluated. Evaluation itself supposes a threatening stimulus to the self-concept, especially when the task is important to the subject. In the present study, no differences were observed between conditions in motivation, which was secured by means of getting academic credits. Furthermore, all physiological parameters reached similar or even lower values at the end of the recording than during the Rest period, indicating a complete recovery.

Regarding the first aim of this study, our results indicate that significant autonomic differences occurred in both conditions but only the FPV change showed specificity to speech anticipation. Strong similarities between both conditions in aspects such as mental effort, psychological threat, social evaluation and frustration (this latter perception being especially important because instructions were changed in W-condition) could be responsible for this scarcity of differences. Other studies have analyzed the preparation phenomena employing situations or tasks which were less similar in the individual’s requirements (Abel and Larkin, 1991; Sausen et al., 1991; Adler et al., 1994; Gerin et al., 1994), or simply comparing different tasks (Gregg et al., 1999). Anticipation of speech per se produced higher anxiety, since it significantly increased in the speech group and decreased in the other group. A speech could be more threatening for the self-concept since it implies face-to-face confrontation, offering the individual more personal information (gestures, motor capabilities, facial expressions, etc.).

The second aim of the present study was to examine the role of trait anxiety as a moderating factor of anticipatory response. Only cognitive anxiety modulated the HR preparatory response with high-anxious women showing greater reactivity when preparing a speech than when preparing a writing task. There were no

differences on electrodermal reactivity measures. This role of cognitive anxiety in HR contrasts with results of experiments in which the role of social anxiety on cardiovascular and electrodermal measures were considered in a sample of men and women (Knight and Borden, 1979; Puigcerver et al., 1989). In these studies, no differences were found between high- and low-anxiety groups. One reason for these discrepancies could be the type of anxiety evaluated. In fact, moderate correlations have been found among different measures of trait anxiety, authors emphasizing the need of determining which components of the anxiety construct might be most influential on HR variability (Dishman et al., 2000). Another reason for contradictory results could be that the samples of these studies, although they were composed of men and women, no specific analyses of gender were carried out (Girdler et al., 1997; Carrillo et al., 2001). In agreement with Carels et al. (2000), high-anxiety subjects tend to be more responsive to cues that indicate a threat in the environment. Accordingly, significant differences in anxiety between conditions were also found in the high-cognitively anxious group but not in the low-anxiety women. These results differ from those of Wilken et al. (1999, 2000), who found that trait anxiety acts as a buffer against situational stress under cognitive-processing conditions. Although trait anxiety was evaluated after the task in the current experiment, this does not suggest that heightened anxiety scores represent a carry-over effect since mean scores of anxiety were in the lowest range of the non-pathological population. Furthermore, it is not likely that experimental manipulations significantly affected trait anxiety scores since no significant differences between conditions were found.

The present study adds some new aspects to this field of research: the control of evaluation contrasting tasks of similar requirements; the extension of results of electrodermal parameters in public speaking tasks, usually limited to cardiovascular variables, and the examination of different components of anxiety, theoretically involved, but not usually studied in speech tasks. There are also limitations of the present study. The lack of a neutral, non-evaluated condition does not allow the effects of an explicit evaluation to be discriminated from possible effects of self-presentation. Future research will be required to clarify this question.

In sum, the anticipation of public speaking elicits a specific FPV response that is not present in another evaluated task with similar requirements but no public speaking preparation. Significant HR and SCR responses were present in both tasks. More importantly, an anticipatory HR reactivity was found in high-cognitively anxious women, suggesting that cognitive anxiety may be an important factor to take into account when cognitive processes are involved in the task.

## References

- Abel, J.L., Larkin, K.T., 1991. Assessment of cardiovascular reactivity across laboratory and natural settings. *Journal of Psychosomatic Research* 35, 365–373.
- Ackerman, K.D., Martino, M., Heyman, R., Moyna, N.M., Rabin, B.S., 1996. Immunologic response to acute psychological stress in MS patients and controls. *Journal of Immunology* 68, 85–94.

- Adler, P.S., Ditto, B., France, C., France, J., 1994. Cardiovascular reactions to blood donation in offspring of hypertensives and normotensives. *Journal of Psychosomatic Research* 38, 429–439.
- Al'Absi, M., Bongard, S., Buchanan, T., Pincomb, W.A., Licinio, J., Lovallo, W.R., 1997. Cardiovascular and neuroendocrine adjustment to public speaking and mental arithmetic stressors. *Psychophysiology* 34, 266–275.
- Baggett, H.L., Saab, P.G., Carver, C.S., 1996. Appraisal, coping, task performance, and cardiovascular responses during the evaluated speaking task. *Personality and Social Psychology Bulletin* 22, 483–494.
- Canon, W.B., 1929. *Bodily Changes in Pain, Hunger, Fear and Rage*. D. Appleton, New York.
- Carels, R.A., Blumenthal, J.A., Sherwood, A., 2000. Emotional responsivity during daily life: relationship to psychosocial functioning and ambulatory blood pressure. *International Journal of Psychophysiology* 36, 25–33.
- Carrillo, E., Moya-Albiol, L., González-Bono, E., Salvador, A., Ricarte, J., Gómez-Amor, J., 2001. Gender differences in cardiovascular and electrodermal responses to public speaking task: the role of anxiety and mood states. *International Journal of Psychophysiology* 42, 253–264.
- Davidson, R.J., Marshall, J.R., Tomarken, A.J., Henriques, J.B., 2000. While a phobic waits: regional brain electrical and autonomic activity in social phobics during anticipation of public speaking. *Brazilian Biological Psychiatry* 47, 85–95.
- Dishman, R.K., Nakamura, Y., Garcia, M.E., Thompson, R.W., Dunn, A.L., Blair, S.N., 2000. Heart rate variability, trait anxiety, and perceived stress among physically fit men and women. *International Journal of Psychophysiology* 37, 121–133.
- Fichera, L.V., Andreassi, J.L., 2000. Cardiovascular reactivity during public speaking as a function of personality variables. *International Journal of Psychophysiology* 37, 267–273.
- Fowles, D.C., Christie, M.J., Edelberg, R., Grings, W.W., Lykken, D.T., Venables, P.H., 1981. Publication recommendations for electrodermal measurements. *Psychophysiology* 18, 232–239.
- Gerin, W., Pieper, C., Pickering, T.G., 1994. Anticipatory and residual effects of an active coping task on pre- and post-stress baselines. *Journal of Psychosomatic Research* 38, 139–149.
- Girdler, S., Jamner, L.D., Shapiro, D., 1997. Hostility, testosterone, and vascular reactivity to stress: effects of sex. *International Journal of Behavioral Medicine* 4, 242–263.
- González-Bono, E., Salvador, A., Serrano, M.A., Ricarte, J., 1999. Testosterone, cortisol, and mood in a sports team competition. *Hormones and Behavior* 35, 55–62.
- Gregg, M.E., James, J.E., Matyas, T.A., Thorsteinsson, E.B., 1999. Hemodynamic profile of stress-induced anticipation and recovery. *International Journal of Psychophysiology* 34, 147–162.
- Jennings, J.R., Kamarck, T., Stewart, Ch., Eddy, M., Johnson, P., 1992. Alternate cardiovascular baseline assessment techniques: vanilla or resting baseline. *Psychophysiology* 29, 742–750.
- Kirschbaum, C., Gonzalez-Bono, E., Rohleder, N., Gessner, C., Pirke, K.M., Salvador, A., Hellhammer, D.H., 1997. Effects of fasting and glucose load on free cortisol responses to stress and nicotine. *Journal of Clinical Endocrinology and Metabolism* 82, 1101–1105.
- Kirschbaum, C., Pirke, K.M., Hellhammer, D.H., 1993. The 'Trier Social Stress Test', TSST—a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology* 18, 76–81.
- Knight, M.L., Borden, R.J., 1979. Autonomic and affective reactions of high and low socially-anxious individuals awaiting public performance. *Psychophysiology* 16, 209–213.
- Lang, P.J., 1968. Fear reduction and fear behavior: problems in treating a construct. In: Shilen, J.M. (Ed.), *Research in Psychotherapy*, vol. III, American Psychological Association, Washington.
- Lang, P.J., Greenwald, M.K., Bradley, M.M., Hamm, A.O., 1993. Looking at pictures: affective, facial, visceral, and behavior reactions. *Psychophysiology* 30, 261–273.
- Lawler, K.A., Schmied, L.A., Armstead, C.A., Lacy, J.E., 1990. Type A behavior, desire for control and cardiovascular reactivity in young adult women. *Journal of Social Behavior and Personality* 5, 135–158.
- Miguel-Tobal, J.J., Cano-Vindel, A.R., 1988. *Inventario de situaciones y respuestas de ansiedad ISRA*, TEA Ediciones, Madrid.
- Mischel, W., Shoda, Y., 1995. A cognitive-affective system theory of personality: reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review* 102, 246–268.

- Palma, S.M., Guimaraes, F.S., Zuardi, A.W., 1994. Anxiety induced by simulated public speaking and stroop color word test in healthy subjects: effects of different trait-anxiety levels. *Brazilian Journal of Medicine and Biological Research* 27, 2895–2902.
- Puigcerver, A., Martinez-Selva, J.M., Garcia-Sanchez, F.A., Gomez-Amor, J., 1989. Individual differences in psychophysiological and subjective correlates of speech anxiety. *Journal of Psychophysiology* 3, 75–81.
- Saab, P.G., Llabre, M.M., Hurwitz, B., Frame, C.A., Reineke, L.J., Fins, A.I., McCalla, J., Cieply, L.K., Schneiderman, N., 1992. Premenopausal and peripheral vascular responses to behavioral challenges and their stability in Black and White Americans. *Psychophysiology* 29, 384–397.
- Sausen, K.P., Lovallo, W.R., Wilson, M.F., 1991. Heart rate reactivity, behavior pattern and parental hypertension as predictors of cardiovascular activity during cognitive challenge. *Psychophysiology* 28, 639–647.
- Smith, T.W., Nealy, J.B., Kircher, J.C., Limon, J.P., 1997. Social determinants of cardiovascular reactivity: effects of incentive to exert influence and evaluative threat. *Psychophysiology* 34, 65–73.
- Spielberger, C.D., Gorsuch, R.L., Lushene, R.E., 1970. *Manual for the State-trait anxiety inventory*. Consulting Psychologists Press, Palo Alto, CA. Spanish version 1978, TEA Ediciones, Madrid.
- Suay, F., Salvador, A., González-Bono, E., Sanchis, C., Martínez, M., Martínez-Sanchis, S., Simón, V.M., Montoro, J.B., 1999. Effects of competition and its outcome on serum testosterone, cortisol and prolactin. *Psychoneuroendocrinology* 24, 551–566.
- Tardy, C.H., Allen, M.T., 1998. Moderators of cardiovascular reactivity to speech: discourse production and group variations in blood pressure and pulse rate. *International Journal of Psychophysiology* 29, 247–254.
- Wilken, J., Smith, B.D., Tola, K., Mann, M., 1999. Anxiety and arousal: tests of a new six-system model. *International Journal of Psychophysiology* 33, 197–207.
- Wilken, J., Smith, B.D., Tola, K., Mann, M., 2000. Trait anxiety and prior exposure to non-stressful stimuli: effects on psychophysiological arousal and anxiety. *International Journal of Psychophysiology* 37, 233–242.