ANTICIPATION OF STRESS: BENEFICIAL OR NOT?

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ABSTRACT

Title of Thesis: Anticipation of Stress: Beneficial or not?

Stacey W. Street, Master of Science, 1985

Thesis directed by: Jerome E. Singer, Ph. D.
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Effects and aftereffects of anticipating a stressor were compared with those associated with experience with the stressor. Forty subjects participated; half were led to expect a 45 second cold pressor, while the others were not. Half of the subjects in each group completed the pressor, while half did not. This crossed anticipation with experience allowing study of biological and behavioral effects of anticipation alone and in combination with actual experience. While anticipating the stressor, subjects did not exhibit blood pressure and heart rate responses comparable to those associated with the stressor. Behavioral aftereffects following anticipation alone were comparable to those associated with anticipating and then experiencing the stressor and greater than those produced by unanticipated experience with the stressor. Urinary epinephrine and norepinephrine indicated that the most arousing condition was anticipation with no experience. These data show that anticipating the stressor was not beneficial. Anticipation proved detrimental after the fact.

Anticipation of Stress: Beneficial or Not?

by

Stacey W. Street

Thesis submitted to the Faculty of the Department of Medical Psychology Graduate Program of the Uniformed Services of the Health Sciences in partial fulfillment of the requirements for the degree of Master of Science 1985

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Experience suggests that being able to anticipate a stressor can have positive and negative effects. On the one hand, knowing that an event will occur allows preparation for it; expecting an examination permits one to study for it, while knowing that one will have surgery allows him or her to seek out appropriate information or otherwise prepare for the event. Anticipation may also have negative effects; studying for an examination may be more stressful than is taking it, and awaiting unknowns such as surgery may be upsetting and aversive. The conditions under which warning of a stressor has positive or negative effects are not known, and the ways in which people anticipate unpleasant events or respond to symbolic representations of stressors have not been clarified. More importantly, the fact that both positive and negative effects and aftereffects may accompany anticipation has not been explored and moreover, it is not known whether waiting for a stressor influences aftereffects in ways similar to the stressor itself. The present study was designed to measure affective and physiological changes that occur during anticipation of stress, to examine differences in response to stressors when anticipation has or has not preceded them, and to determine whether anticipation of stressors generates cognitive aftereffects different from those generated by experience with stressors.

Research has provided support for both positive and negative characterizations of anticipating stress. Several investigators have suggested that knowing of an imminent stressor prompts preparatory coping that may reduce the stressor's impact (e.g., Janis, 1958; Lazarus & Launier, 1978). Being able to anticipate the onset of an aversive or

threatening event is beneficial because it provides an opportunity to prepare and thereby enables us to cope more effectively when the stressor occurs. Research on anticipation of crowding stress has indicated that people take preparatory actions while alone so that the effects of the expected crowding will be minimized (Baum & Koman, 1976). However, whether this actually helped was not evaluated; these crowding studies did not address whether preparatory coping affected subsequent response when the stressor materialized. Janis (1971) also noted that anticipation of aversive events can facilitate coping with them. Consistent with this, several studies have shown beneficial effects (e.g., shortened recovery time) of providing information to patients awaiting surgery or aversive medical procedures (e.g., Egbert, Battit, Welch, & Bartlett, 1964; Langer, Janis, & Wolfer, 1975).

Some studies, however, have suggested that periods of anticipation can have negative effects. Gerber, Rusalem, Hannon, Battit, and Arkin (1975), for example, found that of bereaved spouses who anticipated the death of their spouses during chronic illness, women fared no better and men fared more poorly following the death than did spouses whose mates died suddenly. Thus, some research has indicated that anticipation of a stressor can also be stressful, and can have negative consequences of its own. Studies of physiological changes (e.g., blood pressure and heart rate) during anticipatory periods have suggested that responses during anticipation are similar to and sometimes stronger than those during exposure to the stressor (e.g., Birnbaum, 1964; Nomikos, Opton, Averill, & Lazarus, 1968; Solomon, Holmes, & McCaul, 1980; Spacapan & Cohen, 1983). Negative affect was associated with anticipation of crowding even when preparatory coping

measures were available and executed (Baum & Koman, 1976), and perceived control has had effects on anticipatory responses that are similar to its effects during actual stressful experiences (e.g., Holmes & Houston, 1974). A series of studies investigating the effects of anticipating stressors reported by Spacapan & Cohen (1983) showed that anticipation of an aversive event was associated with higher blood pressure and lower tolerance for frustration than was anticipation of a non-stressful event. Aftereffects were found after anticipation when the stressor was not subsequently experienced. In addition, perceived control had effects on the anticipatory response similar to those effects that accompanied the stressful experience.

A number of questions remain. Most studies have examined the effects of anticipation itself without measuring response to the actual stressor after subjects have expected it. It may be that the effects and aftereffects of anticipation alone differ from those produced by the stressful experience and it is also important to determine whether the addition of an anticipatory period is beneficial or detrimental to coping with the stressor. Are the changes that occur during the anticipatory period beneficial and are they similar to changes associated with the awaited stressor? Finally, it may be that the aftereffects of anticipating and preparing for a stressor that does not occur are different from those exhibited when an individual prepares and then experiences the stressor.

A study was designed to address these questions by measuring physiological (i.e., blood pressure, heart rate, and urinary catecholamines) and psychological responses before, during and after experience with a stressor after having anticipated or not anticipated

the event. By crossing anticipation with experience in a 2 x 2 design, anticipated and unanticipated stressful experiences could be compared with each other as well as with unrelieved anticipation (expecting a stressor that never materializes) and a control, no anticipation/no stress, condition. Changes occurring during the anticipatory period for groups told that a stressor was coming were expected to resemble those occurring during the stressful experience; subjects awaiting a stressor were expected to exhibit increased blood pressure (relative to baseline levels) and negative affect while those not expecting a stressful experience would not. Actual response to the stressor was expected to vary as a function of expectation; anticipated experience was expected to lead to less intense responding during the stressful experience than unanticipated experience. In addition, aftereffects were expected to vary as a function of both anticipation and experience with the anticipated experience producing greater aftereffects than both the unanticipated experience and the unrelieved anticipation. However, unrelieved anticipation may generate large aftereffects due to unresolved preparation and readiness.

METHOD

Subjects

A newspaper advertisement was used to recruit forty subjects (20 male and 20 female) for participation in the study. The ages of the subjects ranged from 18 to 69 with a mean age of 34.5 years with no differences between any of the groups.

Measures

Physiological, behavioral and self-report measures were used to assess several different aspects of the stress response. Urinary epinephrine and norepinephrine levels, blood pressure and heart rate all tapped physiological responses, while a proofreading task and the Feather (1961) tolerance for frustration tasks provided behavioral aftereffects data. Self-report ratings of the cold pressor experiences were obtained both before and after the cold pressor.

Design

A two (anticipation, no anticipation) x two (experience, no experience) factorial design was used. The experimental groups were the anticipation/no experience group (subjects were led to expect a stressful event that never occurred), the anticipation/experience group (subjects were led to expect a stressor and then experienced it), and the no anticipation/experience group (subjects were given no warning but experienced the stressful event). The fourth group was a no anticipation/no experience group. Ten subjects (five male and five female) were randomly assigned to each of the four groups.

The procedure was identical for all groups during the first half of the study. Subjects were led to believe that the study was a pilot

study being conducted to validate a number of unrelated tasks. They were told that since there were far too many tasks for them to complete in one session they would do only a random portion, in a random order, that would differ for each subject. The tasks they were to work on were to be selected by a computer, and they were told that the experimenter was not informed of which were to be administered until the "last minute." After collecting informed consent, a urine sample and three baseline blood pressure and heart rate readings were taken for all subjects. Heart rate and blood pressure were also measured throughout the session (see Figure 1). All subjects in all groups then completed a preliminary 10°C cold pressor (45 sec) in order to familiarize them with the cold pressor experience. The cold pressor consisted of immersing the non-preferred hand up to the level of the mid-forearm. Subjects were told how long the experience lasted but were not informed of the exact water temperature. Immediately following this first cold pressor, self-report ratings of the painfulness and stressfulness of the experience as well as estimated water temperature were obtained. A proofreading task, used previously as a measure of stress aftereffects (e.g., Glass & Singer, 1972), was administered.

Insert Figure 1 about here

All subjects then completed neutral filler tasks (e.g., completing questionnaires, watching a slide montage) requiring 40 minutes of their time to allow any behavioral and physiological aftereffects of the initial cold pressor to dissipate. Pre-testing suggested that this was sufficient to assure that lingering aftereffects

had disappeared. At this point, procedures diverged for each of the four groups (see Figure 1). Following the 40 minutes of filler activity, the anticipation period began and lasted for ten minutes. Subjects in both anticipation groups were told that the computer had indicated that they would again do the cold pressor and were asked to rate the expected stressfulness, painfulness and temperature of the upcoming cold water. The no anticipation groups were told nothing about a second cold pressor at that time, and were presented with another neutral filler task with no mention of a second cold pressor. Ten minutes into the anticipation period the two experience groups were exposed to the second cold pressor, one with prior warning (anticipation/experience) and one without prior warning (no anticipation/experience). Self-report ratings of the painfulness, stressfulness and temperature of the cold water were obtained after this procedure. At this same time the anticipation/no experience subjects were told they would <u>not</u> do the second cold pressor after all and waited quietly while the experimenter "prepared the next task." The no anticipation/no experience subjects continued doing neutral filler tasks during this time. Following the experience period (see Figure 1) all groups were administered the Feather (1961) tolerance for frustration task as a behavioral measure of aftereffects. The subjects were then debriefed, the second urine sample was collected and the subjects were dismissed.

RESULTS

Blood pressure and heart rate were analyzed as actual values as well as change from baseline. The analyses were comparable; therefore, change from baseline analyses are reported here. Premanipulation measures included recordings from the first baseline through the second aftereffects measure following the first cold pressor (baseline 1 and time periods 1-3). Premanipulation measures were analyzed using a repeated measures analysis of variance of change from the first baseline. The manipulation was performed following a second set of baseline measures. For this reason the blood pressure and heart rate during and following the manipulation of anticipation and experience were analyzed, again with a repeated measures analysis of variance, as change from this second baseline (baseline 2 and time periods 4-8). Nonrepeated variables, including the proofreading task, tolerance for frustration task, and cold pressor 2 ratings were each analyzed with a two-way analysis of variance. Repeated measures analysis of variance were used to examine differences between cold pressor ratings following the first cold pressor and ratings before and after the second cold pressor. Finally, the catecholamine data (before manipulation and after manipulation voids) were analyzed with a repeated measures analysis of variance. Tukey's HSD post hoc analyses were conducted to determine significance of differences among cells.

Premanipulation Period

Initial data analyses were directed towards determining whether there were any differences in baseline and in response to the first administration of the cold pressor, i. e., whether there were any differences among groups prior to the manipulation of anticipation. In

addition, analyses were used to "check" the stressful nature of the cold pressor.

There were no significant differences among groups for baseline blood pressure and heart rate. Repeated measures analysis of this baseline and time periods 1-3 (the first cold pressor and two aftereffects measures) revealed significant main effects of time for systolic and diastolic blood pressure and for heart rate, $F(3, 108) = 34.432$, $p < .001$, $F(3, 108) = 51.895$, $p < .001$, $F(3, 108) = 6.130$, $p < .001$, respectively (see Figures 2 and 3). The cold pressor produced significant increases in blood pressure and heart rate among all groups; post hoc analysis revealed no significant differences among groups on systolic blood pressure or heart rate during the first cold pressor experience. Although there were no significant effects for anticipation or experience variables, the anticipation/no experience group demonstrated a significantly smaller ($p = .05$) diastolic blood pressure increase during the stressor than did the no anticipation/no experience group. There were no significant differences among the four groups for systolic or diastolic blood pressure or heart rate during the two aftereffects readings.

In addition to the blood pressure and heart rate data, analyses of self report ratings and the proofreading aftereffects task suggested that the cold pressor experience was stressful and indicated that subjects in different groups responded comparably. Subjects reported an average pain rating of 4.2 and an average stress rating of 4.8 (scales ranged from 1-extremely to 9-not at all), with no significant differences among groups in these ratings. Analysis of variance of temperature ratings revealed a main effect for anticipation

$F(1,36) = 5.299$, $p = .025$, showing that the subjects who would be exposed to anticipation prestress rated the cold water as warmer than did the subjects who would not be anticipating stress ($p = .05$). Analysis of performance on the proofreading task following the cold pressor revealed no significant differences among the four groups.

Insert Figures 2 and 3 about here

Post-manipulation Measures

After the manipulation of anticipation and/or experience, blood pressure and heart rate were measured several times, a number of self-report questions were administered, and a task designed to assess tolerance for frustration was presented. Each measure was made at a different time in order to assess 1) effects of anticipating the stressor, 2) effects of the second presentation of the stressor, and 3) aftereffects following termination of the stressor and/or the anticipation of it. Repeated measures analyses of variance were performed across the second baseline readings, anticipation and experience phases, and the post-exposure period (procedure periods B2, 4, 5, 6, 7, 8). These analyses will be reported first, followed by more specific analyses and comparisons of measures collected that address the three types of effects noted above.

Analysis of variance for systolic blood pressure yielded a significant main effect for time, $F(5, 180) = 8.004$, $p < .001$, and also a significant time x experience interaction, $F(5, 180) = 3.893$, $p < .002$ (see Figure 2). The two groups that actually experienced the second cold pressor exhibited an increase in systolic pressure during exposure,

while subjects in the two no experience groups did not show this dramatic increase at the equivalent point in the study. Mean comparisons indicated that the increase from the last pre-stressor reading to the stressor reading was significant for both the experience groups ($p < .05$). Post-stressor decreases among experience subjects were also significant ($p < .05$). No other significant effects were noted, though there was an elevation of the anticipation groups' readings during the three measures taken after anticipation began and before the stressor was experienced. These increases were small (M = 3 mmHg) and were not significantly different from nonanticipation groups.

Diastolic blood pressure showed a similar pattern, with significant main effects of time, $F(5, 280) = 12.602$, $p < .001$ and experience, $F(5, 180) = 7.37$, $p < .01$, and a significant interaction of the two variables, $F(5, 180) = 9.020$, $p < .001$ (see Figure 3). Again, experience groups exhibited an increase in pressure during exposure to the cold pressor while no experience subjects did not show an increase at the equivalent point. Anticipatory increases were negligible among groups awaiting the stressor. Mean comparisons indicated that the stressor caused significant increases from baseline among experience groups and these levels were greater than those for no experience subjects. Decreases following termination of the stressor were also significant for subjects experiencing the stressor ($p < .05$). No other significant effects were found.

Analysis of heart rate showed a different pattern of response. The main effect of time was marginally significant, $F(5, 180) = 2.159$, $p < .06$, but the interaction between time and experience was not significant. Heart rate did not increase for the two groups experiencing the

stressor while exposed to it; only the group that did not anticipate it showed a significant increase (M = 14 BPM), as suggested by time x anticipation and anticipation x experience interactions $F(5, 180) = 4.185$, $p < .001$, $F(1, 136) = 4.177$, $p < .05$. This was borne out by mean comparisons showing that the only significant changes to and from the stressor period were exhibited by subjects in the no anticipation/experience group ($p < .05$).

Anticipation effects. As noted above, there were no effects of anticipating the stressor on blood pressure or heart rate during the anticipatory period. Ratings of expectations were collected from subjects in the two groups anticipating the second cold pressor. These two groups did not differ from each other in rating the expected painfulness, stressfulness, and temperature of the cold pressor. These ratings were also statistically comparable to subjects' premanipulation judgments.

Experience effects. The second cold pressor clearly elicited physiological changes, as predicted and shown in the preceding section. In addition, those subjects who experienced the second stressor were asked to provide ratings of the experience. No differences were found between the two groups for these dimensions; subjects rated the experience as comparably stressful, painful, and cold regardless of whether they had anticipated the cold pressor.

Aftereffects. Behavioral aftereffects of the anticipation and/or experience of the second cold pressor were measured by performance on the two unsolvable puzzles that index tolerance for frustration and persistence. The fewer the number of puzzle trials attempted and the less the amount of time spent per attempt, the lower the level of

tolerance for frustration and the higher the level of behavioral aftereffects. Table 1 shows that the anticipation groups demonstrated significantly greater aftereffects than did the no anticipation groups across experience conditions $F(1, 36) = 5.457$, $p < .023$. Regardless of whether they eventually were exposed to the stressor, anticipation subjects attempted fewer trials on the two puzzles than did subjects who were not told to expect the second cold pressor. There was not a significant main effect for experience, and post hoc analysis revealed that anticipation alone (anticipation with no experience) generated significantly greater aftereffects than did experience alone ($p = .05$).

Insert Table 1 about here

As noted in Table 2, subjects in the anticipation groups also spent significantly less time per attempt on the puzzles than did the no anticipation groups $F(1, 36) = 9178$, $p = .003$. No significant differences were evidenced in any individual group comparisons.

Insert Table 2 about here

Catecholamine levels. Assay of urine samples provided an overall estimate of sympathetic activity during the entire session. When a double-void procedure is used (i.e., when subjects are asked to provide samples at the start and finish of a study), there is a tendency for levels of epinephrine and norepinephrine in the second sample to decrease over the course of a laboratory study relative to levels in the first sample (e.g., Levi, 1972). Among the reasons for this is the fact

that subjects spend the majority of their time in studies like this one involved in sedentary, nonreactive tasks. Regardless, the differences in experience and anticipation during the present study were sufficient to produce differences in catecholamine levels in the second urine sample.

Epinephrine levels showed an overall decrease from first to second sample, $\underline{F}(1, 36) = 4.714$, $\underline{p} < .05$ but also revealed a marginally significant interaction between the time of the sample and the anticipation manipulation $\underline{F}(1, 36) = 3.844$, $\underline{p} < .06$ (see Table 3). Subjects who were led to expect the second cold pressor, regardless of whether they experienced it, did not show decreases in epinephrine levels over time, while those not anticipating the stressor did show decreases. Post hoc comparisons indicated that only the no anticipation/no experience group decreased significantly over time ($\underline{p} < .05$).

Norepinephrine levels also decreased over time; a marginally significant effect for time indicated that levels decreased from the first to second sample, $\underline{F}(1, 36) = 3.259$, $\underline{p} < .076$. A marginally significant effect of experience was also found, suggesting that decreases were greater among subjects not experiencing the second cold pressor, regardless of whether they anticipated it, $\underline{F}(1, 36) = 3.578$, $\underline{p} < .065$. The no anticipation/no experience group again was the only one that exhibited significant decreases over time ($\underline{p} < .05$).

Initial (first sample) catecholamine values were similar across groups, and analysis of variance on the second urine samples alone produced marginally significant interactions between anticipation and experience for norepinephrine, $\underline{F}(1, 36) = 3.458$, $\underline{p} < .07$. Subjects who

anticipated but did not experience the stressor had higher levels of norepinephrine than did other subjects. A similar pattern held for epinephrine, but the interaction was not significant.

Insert Table 3 about here

DISCUSSION

The findings from this study suggest a number of things. Responses during anticipation were different from those during experience. Blood pressure and heart rate were influenced primarily by direct experience with the stressor; although these indices increased dramatically during both cold pressors, increases during the anticipation period were small. Small increases in systolic blood pressure while subjects were anticipating the stressor were not significant. Anticipation did not evoke stress-like physiological responses, while exposure to the stressor did. Anticipation did affect heart rate change, reducing responsiveness to the stressor. Subjects who anticipated and then experienced the second cold pressor did not exhibit increased heart rate during the stressor, but subjects who did not expect and then experienced the cold pressor showed substantial increases in heart rate during exposure.

Second, there were aftereffects on the tolerance for frustration measure, with anticipation alone increasing aftereffects more than did the stressor itself. Anticipation of the stressor alone had the same effect on performance as did anticipation followed by actual experience and had a greater effect than did unanticipated exposure to the stressor. Interestingly, the cold pressor alone, though viewed as stressful, did not produce behavioral aftereffects. Subjects who experienced the second cold pressor but who did not anticipate its occurrence performed comparably to subjects who neither expected nor experienced it. There were no significant differences in blood pressure or heart rate immediately after experience with or anticipation of the stressor.

Finally, the catecholamine data indicated that anticipation of the second cold pressor as well as the experience of it were associated with what appears to be greater sympathetic arousal. They also suggested that the most arousing condition was the one in which subjects anticipated but did not experience the stressor. However, the blood pressure and heart rate responses during anticipation do not indicate overall sympathetic arousal. The discrepancies between these two physiological indices are interesting and deserve further study.

Overall, these findings do not suggest that anticipating the stressor reduced stress during subsequent experience with it. Blood pressure response to the cold pressor was not affected by whether it was expected or not. Heart rate increases during exposure to the stressor were reduced by anticipation, but blood pressure increases were not affected. Further, anticipation did not affect ratings of pain or stress during the cold pressor and did not reduce behavioral effects after the stressor was experienced. Instead, anticipation was associated with some characteristics of a stressor; though it did not produce significant elevations in blood pressure or heart rate, anticipation was associated with higher catecholamine levels. Further, anticipation of the stressor, regardless of whether it was actually experienced, produced more aftereffects than did exposure to the stressor when it was not expected. Both experience and anticipation of the second cold pressor were associated with stress-related effects but, as both the physiological and psychological data revealed, the nature of these effects were different.

One suggestive finding was that anticipation was more stressful when the stressor was not eventually experienced than when it was.

Though differences were found at nonsignificant levels for a number of variables, differences between these groups were significant for norepinephrine levels and aftereffects, with subjects who anticipated but then did not experience the stressor showing higher levels of norepinephrine and poorer "post-task" performance. It is possible that preparation for a stressor requires an outlet and if the stressor never materializes, this preparatory affect must somehow be vented. While the mental work described by Janis (1958) as a benefit of anticipation may be useful when the stressor is experienced, it may not be beneficial when the stressor does not occur. Thus, the comparability of the two anticipation groups on some measures may reflect different processes. Unvented preparation may have led to problems in one group, while in the other the nature of the cold pressor may have made preparation for it more difficult or less effective than for other stressors. The issue of venting of "unused" anticipatory coping and the possibility of stressor-specific effects remain topics for future research.

One additional issue may be related to these findings. Some researchers, including Burchfield (1979) have not addressed the positive or negative aspects of anticipation but instead view anticipatory responding as conditioned. A number of factors suggest that this was not the case in the present study. First, changes in blood pressure immediately prior to the onset of the stressor were not comparable to those associated with the stressor as Burchfield's description of conditioned anticipatory response would suggest. Anticipatory changes in blood pressure were substantially smaller than the unconditioned responses to the stressor; if conditioned, they should have been more comparable to those during response to the stressor. Further, if the

anticipatory responses were conditioned versions of the actual stress experience, aftereffects should have been similar. They were not. In sum, it does not appear that the anticipatory responses demonstrated in this study were conditioned by initial exposure to the stressor.

The present study extended previous research by comparing the effects of anticipating a stressor to direct experience with the stressor. It also allowed comparison of experience when it was or was not expected and of anticipation when experience did or did not follow. Contrary to the idea that anticipation reduces subsequent stress effects, expecting the stressor appeared to cause some of these effects. Clearly, under some circumstances preparation is useful or even vital. However, in other instances it appears that the benefits of anticipation may be accompanied by or replaced with detrimental effects. In addition, the nature of the stress effects evoked by anticipation were different from those associated with experience. These findings suggest that a more comprehensive view of these issues emphasizing the balance or interplay of positive and negative aspects of anticipation of stressors is needed.

References

Baum, A., & Koman, S. (1976). Differential response to anticipated crowding: Psychological effects of social and spatial density. Journal of Personality and Social Psychology, 34, 526-536.

Birnbaum, R. M. (1964). Autonomic reaction to threat and confrontation conditions of psychological stress. Unpublished doctoral dissertation, University of California, Berkeley.

Burchfield, S. (1979). The stress response: A new perspective. Psychosomatic Medicine, 41(8), 661-672.

Egbert, L. D., Battit, G. E., Welch, C. E., & Bartlett, M. K. (1964). Reduction of postoperative pain by encouragement and instruction of patients. New England Journal of Medicine, 270, 825-827.

Feather, N. T. (1961). The relationship of persistence at a task to expectation of success and achievement related motives. Journal of Abnormal and Social Psychology, 63, 552-561.

Gerber, I., Rusalem, R., Hannon, N., Battin, D., & Arkin, A. (1975). Anticipatory grief and aged widows and widowers. Journal of Gerontology, 30(2), 225-229.

Glass, D. G., & Singer, J. E. (1972). Behavioral aftereffects of unpredictable and uncontrollable aversive events. American Scientist, 60, 457-465.

Holmes, D. S., & Houston, B. K. (1974). Effectiveness of situation redefinition and affective isolation in coping with stress. Journal of Personality and Social Psychology, 29(2), 212-218.

Janis, I. L. (1971). Stress and frustration. New York: Harcourt & Brace Jovanovich, Inc.

Janis, I. L. (1958). Psychological stress: Psychoanalytic and behavioral studies of surgical patients. New York: Wiley.

Langer, E. J., Janis, I. L., & Wolfer, J. A. (1975). Reduction of psychological stress in surgical patients. Journal of Experimental Social Psychology, 11, 155-165.

Lazarus, R. S., & Launier, R. (1978). Stress-related transactions between person and environment. In L. A. Pervin & M. Lewis (Eds.), Perspectives in interactional psychology. (pp. 287-827). New York: Plenum.

Levi, L. (1972). Stress and distress in response to psychosocial stimuli: Laboratory and real life studies on sympathoadrenomedullary and related reactions. Acta Medica Scandinavia Supplement, 528.

Nomikos, M. S., Opton, E. M., Jr., Averill, J. R., & Lazarus, R. S. (1968). Surprise versus suspense in the production of stress reaction. Journal of Personality and Social Psychology, 8, 204-218.

Solomon, S., Holmes, D. S., & McCaul, K. D. (1980). Behavioral control over aversive events: Does control that requires effort reduce anxiety and physiological arousal? Journal of Personality and Social Psychology, 39, 729-736.

Spacapan, S., & Cohen, S. (1983). Effects and aftereffects of stressor expectations. Journal of Personality and Social Psychology, 45(6), 1243-1254.

Table 1

Mean and standard deviation of number of puzzle trials attempted on tolerance for frustration task.

	Anticipation	No Anticipation	
Experience	6.35	9.95	8.15
	(4.33)	(4.55)	(4.44)
	5.05	7.45	6.25
No Experience	(3.37)	(3.98)	(3.63)
	5.7	8.7	
	(3.8)	(4.27)	

Table 2

Mean and standard deviation of time spent (in seconds) per puzzle on tolerance for frustration task

	Anticipation	No Anticipation	
Experience	23.91	43.59	33.75
	(18.41)	(20.45)	(19.43)
No Experience	26.82	41.36	34.09
	(16.40)	(13.08)	(14.74)
	25.37	42.48	
	(17.41)	(16.77)	

Table 3

Mean and standard deviation of epinephrine and norepinephrine levels - first and second voids

Group	Before session Epinephrine	After session Epinephrine	Before session Norepinephrine	After session Norepinephrine
Ant/Exp	8.96 (10.3)	6.92 (6.2)	24.95 (25.5)	22.78 (23.3)
Ant/Nexp	9.54 (5.8)	10.97 (8.5)	45.98 (32.6)	44.99 (22.8)
Nant/Exp	8.95 (8.8)	4.67 (3.51)	35.68 (32.9)	28.81 (37.4)
Nant/Nexp	15.05 (11.39)	7.25 (3.77)	57.51 (50.3)	21.18 (10.4)

Figure 1. Procedure Timeline.

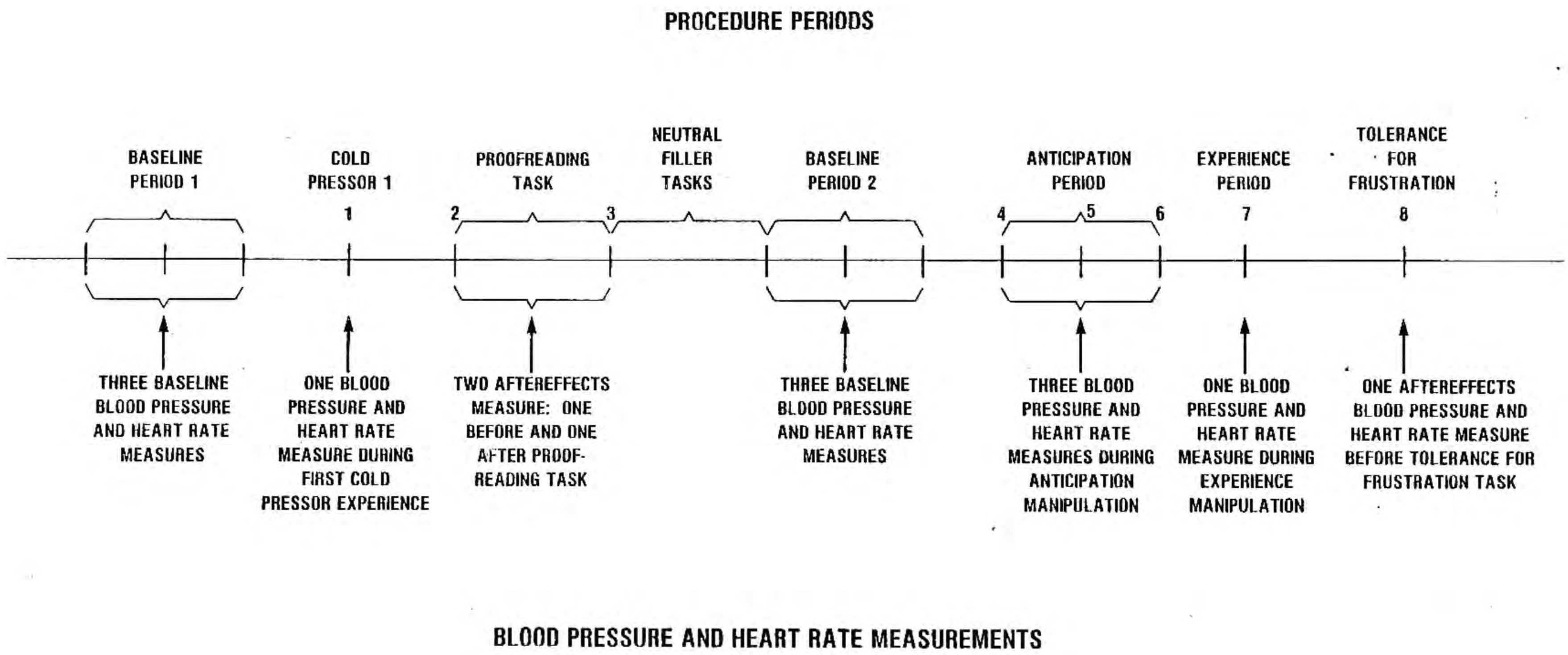

PROCEDURE PERIODS
BASELINE PERIOD 1
COLD PRESSOR 1
PROOFREADING TASK
NEUTRAL FILLER TASKS
BASELINE PERIOD 2
ANTICIPATION PERIOD
EXPERIENCE PERIOD
TOLERANCE FOR FRUSTRATION
1
2
3
4
5
6
7
8
THREE BASELINE BLOOD PRESSURE AND HEART RATE MEASURES
ONE BLOOD PRESSURE AND HEART RATE MEASURE DURING FIRST COLD PRESSOR EXPERIENCE
TWO AFTEREFFECTS MEASURE: ONE BEFORE AND ONE AFTER PROOF-READING TASK
THREE BASELINE BLOOD PRESSURE AND HEART RATE MEASURES
THREE BLOOD PRESSURE AND HEART RATE MEASURES DURING ANTICIPATION MANIPULATION
ONE BLOOD PRESSURE AND HEART RATE MEASURE DURING EXPERIENCE MANIPULATION
ONE AFTEREFFECTS BLOOD PRESSURE AND HEART RATE MEASURE BEFORE TOLERANCE FOR FRUSTRATION TASK
BLOOD PRESSURE AND HEART RATE MEASUREMENTS

Figure 2. Systolic blood pressure. Change from baseline for each group at each measurement period.

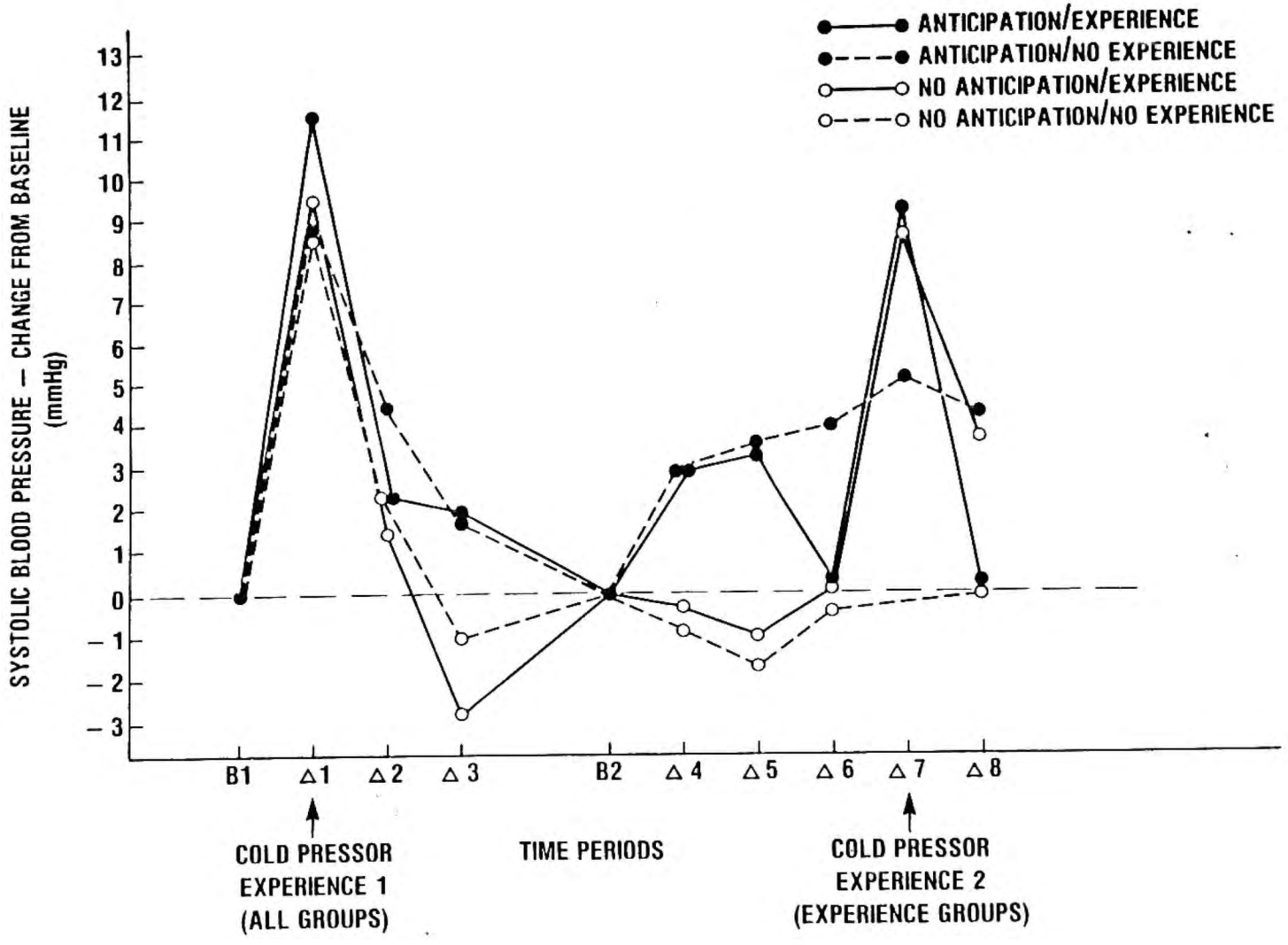
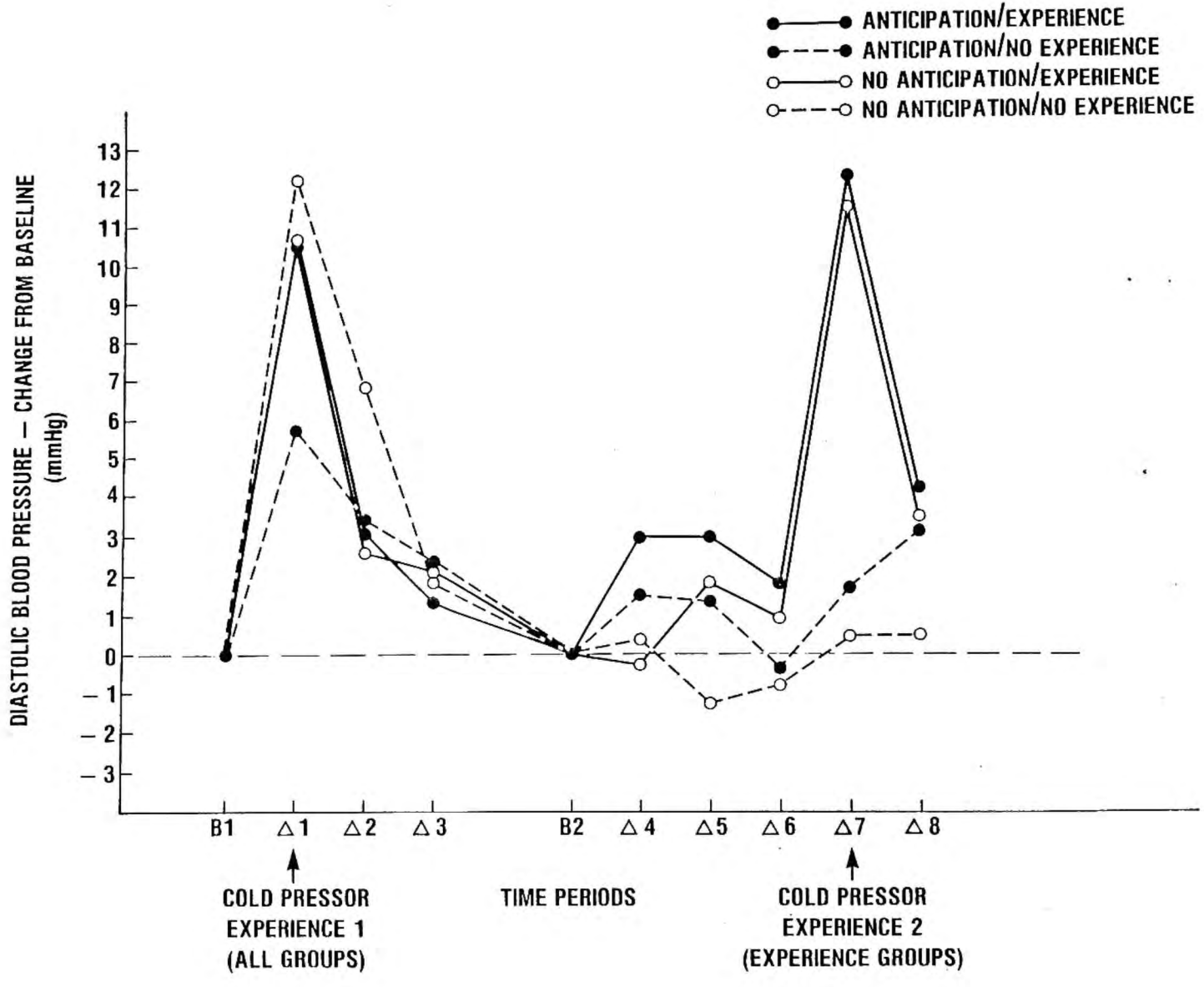

ANTICIPATION/EXPERIENCE
ANTICIPATION/NO EXPERIENCE
NO ANTICIPATION/EXPERIENCE
NO ANTICIPATION/NO EXPERIENCE
SYSTOLIC BLOOD PRESSURE – CHANGE FROM BASELINE (mmHg)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
– 1
– 2
– 3
B1
Δ1
Δ2
Δ3
B2
Δ4
Δ5
Δ6
Δ7
Δ8
TIME PERIODS
COLD PRESSOR EXPERIENCE 1 (ALL GROUPS)
COLD PRESSOR EXPERIENCE 2 (EXPERIENCE GROUPS)

Figure 3. Diastolic blood pressure. Change from baseline for each group at each measurement period.


ANTICIPATION/EXPERIENCE
ANTICIPATION/NO EXPERIENCE
NO ANTICIPATION/EXPERIENCE
NO ANTICIPATION/NO EXPERIENCE
DIASTOLIC BLOOD PRESSURE – CHANGE FROM BASELINE (mmHg)
13
12
11
10
9
8
7
6
5
4
3
2
1
0
– 1
– 2
– 3
B1
Δ1
Δ2
Δ3
B2
Δ4
Δ5
Δ6
Δ7
Δ8
COLD PRESSOR EXPERIENCE 1 (ALL GROUPS)
TIME PERIODS
COLD PRESSOR EXPERIENCE 2 (EXPERIENCE GROUPS)