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DAVID T. DUNCAN

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THE EFFECT OF A STRESSOR (APERIODIC NOISE) ON AN INDIVIDUAL'S LEVEL OF AGGRESSION

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Bachelor of Arts, University of Windsor, 1972
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Submitted to the Faculty of Graduate Studies
Through the Department of Psychology
in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy
at the University of Windsor

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1978
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ABSTRACT

The effect of a noisy work environment on aggression was explored in a two-phase experiment. In Phase I, Ss worked for 25 minutes at a simple task (assembling jigsaw puzzles) while exposed to aperiodic bursts of white noise at a level of 90 dbA. Half of the Ss could predict; that is, a warning light occurred 0.5 sec. in advance of each noise burst. Half of the Ss could control; that is, a switch was provided by which S could terminate any given noise burst. A control group worked at the same task for the same time in a quiet environment.

The Ss were tested in pairs. In Phase II, both members of each pair answered a series of questions about the task in Phase I. Then each, in succession, rated the other's answers, by pressing a button to administer one or more mild shocks. On this scale, one shock represented a good evaluation; seven a bad answer. However, the apparatus was so arranged that the first member rated always received seven shocks. The number of button presses was recorded, for each member of each dyad. It was important to know how many shocks Ss B intended and how many Ss A gave in return.

It was hypothesized that the S who always received a bad evaluation would be frustrated, and that he would therefore respond aggressively to his opposite number by pressing, in his turn, the shock button more often. It was also hypothesized that aggression so measured would vary with the noise conditions, and with control showing the least amount of aggression.

In general, the major hypotheses were confirmed, although some
difficulties were encountered with the relationship between task performance and subjectively judged stressfulness in Phase I, and the differences in aggression shown in Phase II. The results were discussed in terms of the Glass and Singer (1972) position on the effects of environmental stress, and Berkowitz's (1964) elaboration of the frustration-aggression hypothesis.
CHAPTER I
INTRODUCTION

The phenomenon of human aggression and its origins have been conceptualized from several divergent positions, the oldest of these theoretical perspectives holds that violence is instinctual and that man is by nature aggressive. Freud being the most famous proponent felt that aggression arises from a powerful death instinct possessed by all human beings. Freud (1930) states:

"Civilized society is perpetually menaced with disintegration through this primary hostility of men toward one another----culture has called up every possible reinforcement in order to erect barriers against the aggressive instinct of men and hold their manifestations in check." (p. 86)

Diametrically opposed to the instinct point of view is that aggression is socially learned behaviour and is acquired and maintained in much the same manner as many other forms of human activity. This position has been advocated by such theorists as Bandura (1971, 1973) and Buss (1961).

Also in contrast to the instinct view of aggression is the position that aggression results from the arousal of a learned or acquired drive to harm or injure others. The frustration-aggression hypothesis delineates this position and is espoused by such theorists as Dollard and Associates (1939) and more recently Berkowitz (1962, 1964, 1965).

Regardless of the theoretical position one assumes regarding the genesis of human aggression, in recent years it has become apparent that acts of violence and aggression are becoming more
frequent in our daily lives. As pointed out by Baron, Byrne, and Griffitt (1974):

"As the world moves into the final decade of the twentieth century, it becomes increasingly difficult to pick up a daily newspaper, tune in the evening news, or leaf through a magazine without being confronted by shocking evidence of man's inhumanity to his fellow human beings." (p. 265)

They further state:

"It appears that the unchecked spread of violence represents one of the most serious and pressing problems facing the world today." (p. 265)

It is equally evident that we live in a society which subjects its citizens to a wide range of environmental stressors. Glass and Singer (1972) in their monograph *Urban Stress* state:

"Life in the city is an endless round of obstacles, conflicts, inconvenience and bureaucratic routine. The urban dweller is confronted daily with noise, litter, air pollution and overcrowding. Some of these conditions are pervasive; others occur only at home, or at work, or in transit. Their incidence is profoundly disturbing and many commentators on modern life allege that such conditions produce behavioural and physiological consequences inimical to the health and well being of men. The study of these consequences may be subsumed under the category of stress, which has been generally defined as the affective, behavioural, and physiological response to adverse stimuli." (p. 5)

Granting the reality of these two phenomena in our society, it may not be too far afield to suggest that a possible relationship exists between environmental stressors and acts of aggression. With particular reference to noise as a stressor, many workers are necessarily exposed to high levels of noise in their daily environment. From this line of reasoning two questions arise, (1) what, if any
are the harmful effects of noise, and (2) what can we do to mitigate the effects?

Research has shown that a direct physical effect does exist from noise levels exceeding 85 db, particularly in terms of hearing losses. Reports of hearing losses of workers in a noisy environment have been summarized by Berrien (1946), Kryter (1950), and McCord (1938). Hearing losses due to high intensity noise, typically involve two types of losses, temporary and permanent. With regard to the former condition which is known as a temporary threshold shift (Cohen, 1961), there is some evidence to suggest that for a given amount of sound energy, there is a greater temporary loss from continuous noise than from impulsive noise. After a period of no noise, hearing will usually return to normal. However, studies have shown that with increasing duration of exposure there is less and less recovery of the temporary hearing loss and increasing amounts of permanent loss (Speith and Treppipoe, 1958). In this connection, evidence indicates that the extent of temporary threshold changes following a day's exposure to continuous noise is surprisingly close to the magnitude of permanent hearing loss noted after ten years of exposure to the same type of noise (Ward, 1957).

In addition to hearing losses due to noise, studies on the physiological effects of noise indicate that initial exposure to loud noise affects various autonomic indices. In a study by Finkle and Poppen (1948) using the noise from a turbojet engine they found that initial autonomic arousal occurred, such as increases in pulse rate, respiration rate, blood pressure, and electrocardiographic activity, with subsequent adaptation occurring. Glass and
Singer (1972) found essentially the same phenomenon occurring to high noise levels, initial autonomic activity with subsequent adaptation. All the available evidence then clearly indicates that while high noise levels or sudden noise do affect autonomic responding typically in the direction of sympathetic dominance, adaptation of these processes almost always occurs settling back to normal or nearly normal levels.

Where subjects did arithmetic problems under both quiet and noise conditions, Harmon (1933) found there was a 37% rise in metabolic rates of those subjects who were exposed to noise. Subsequent adaptation, however, was very rapid for the metabolic rates under noise conditions, and settled back to about the same level as the quiet condition.

The effect of noise on performance has been given special attention, owing to the obvious industrial application. Kryter (1970) states the following: "The questions of whether such effects exist is one on which there are conflicting opinions and evidence." (p. 556) He further states that:

"On the basis of the review of many investigations I conclude that most of the industrial and laboratory studies that have shown adverse effects of noise on work output are open to criticisms because of poor experimental and uncontrolled factors, whereas those experiments carried out with proper controls of pertinent variables have generally shown no adverse effects on psychomotor activity." (p. 556)

Kryter further points out that there is no evidence that noise has any influence on reaction time, the learning of simple tasks, or performance on intellectual or coordination tests. The recent work of Glass and Singer (1972) has for the most part substantiated the findings and the conclusions of Kryter, with the qualification that
one must consider the psychological and cognitive factors associated with the noise. Azrin (1958) reports that high intensity sound can become a noxious stimulus and reduce performance quality if the noise becomes associated with incorrect behaviour. In keeping with this line of reasoning, Kryter (1970) has suggested that experimental results showing noise-induced task degradations such as vigilance tasks may be attributable to such stimulus and response contingencies, where the subject makes an interpretation of the meaning of the noise. For example, if noise is a punishment for poor performance, the task becomes disliked and is performed poorly because it is seen as contingent on the noise (stimulus contingency); or the subjects believe their response will reduce the noise (response contingency). What Kryter seems to be saying here is that the context in which the noise occurs and how the subject cognitively appraises the situation are principal determinants of the effects of noise on task performance. Based on an extensive review of the literature as well as findings from their own research on the effects of noise on performance, Glass and Singer (1972) have made three claims:

(1) In most cases noise does not adversely affect performance or autonomic reactions.
(2) Even when the noise is made noxious by presenting it under conditions that are uncontrollable and/or unpredictable, physiological and behavioural adaptation will occur where the onset of the noise cannot be controlled.
(3) The occasions when noise does produce task decrements are those in which the individual is either working at a highly complex task or is engaged in a vigilance task (e.g. radar
watch-keeping), and then mainly when the noise occurs unpredictably or uncontrollably. For Glass and Singer randomly occurring (aperiodic) bursts of noise are unpredictable, as opposed to regularly occurring (periodic) noise, which can be anticipated. Similarly, control means that the individual can (or things he can) shut off or escape from the noise at will.

Noise, then, apart from the well-known temporary threshold shifts in hearing, seems to have few immediate effects. However, are there any aftereffects in terms of psychomotor task performance and lowered frustration tolerance that may precipitate aggressive behaviour? And what factors, or combination of factors, can act either to exacerbate or to minimize these effects?

Again, Glass and Singer (1972) addressed their research to these questions, examining the behavioural aftereffects of exposure to high intensity noise, taking into account the context in which the noise occurs. They conducted a series of experiments, using predictable as opposed to unpredictable noise (periodic versus aperiodic) as the main independent variable. Their findings led them to state:

"Taken together, the results of these experiments demonstrate substantial impairment of task performance (verbal and numerical) and decrements in frustration tolerance (time spent on insoluble puzzle) immediately following termination of noise." (p. 54)

They obtained a predictable/unpredictable noise difference on post noise performance even though the tasks the subjects worked on during and after the noise exposure were relatively simple. The main findings of their series of experiments on the effects of unpredictable noise is that frustration tolerance is lowered following
unsignalled noise relative to signalled noise. Signalled noise here means the Ss were warned 3 sec. in advance of the onset of the noise, by a flashing light. They further conclude that:

"The behavioural aftereffects of predictable/unpredictable noise were interpreted in terms of the notion of information control (c.f. Puredy & Doob, 1971), that is, knowing when to expect a sound was assumed to provide a measure of cognitive control over the stimulation that reduced its aversive effects." (p. 1)

 Explicitly, Glass and Singer (1972) measured the aftereffects of noise in two ways. The first was a performance measure, in which the subjects were scored on simple verbal and numerical tasks. Secondly, they argued that a task which has in fact no solution is inherently frustrating: and that, therefore, the longer a person is willing to struggle with such a task, the more tolerant he is of frustration. Aperiodic (unpredictable) noise, they found lowered both performance and frustration tolerance. Using the same measures, they looked at the aftereffects of an individual's ability (or belief in his ability) to control the noise. They report that the perception of control, however induced, appears to reduce the negative aftereffects of exposure to high intensity noise.

The findings of Glass and Singer (1972) indicate two main points regarding the effects of high intensity noise on human performance. Firstly, noise has no substantial effect on the ongoing behaviour or performance regardless of its uncontrollability or unpredictability. There is, however, a body of research suggesting that high intensity noise does have a negative effect on performance. Using a vigilance task where Ss had to monitor a series of dials, Broadbent (1958) found performance decrements. Further to this point, Boggs & Simon (1968) also found that noise levels of 92db produced significant errors on
auditory monitoring tasks that were paired with a complex reaction time task. What appears to be the critical issue here is the complexity of the task. This study appears to have demonstrated that where high intensity noise is superimposed on a complex task more performance errors will occur than if the task was a simple one. The second point that Glass and Singer make is that high intensity noise which was either uncontrollable and/or unpredictable had significant aftereffects on human performance as well as substantially lowering a subject’s frustration tolerance.

The proposition that the aftereffects of noise in general depend to a considerable part on the degree of perceived control is not unique to Glass and Singer. They state that:

"Lazarus (1966) has taken a similar position on the role of controllability in response to stressor stimuli. He speaks about the "relative balance of power" between the aversive stimulus and the resources of the individual and his environment to cope with the stimulus. When the balance favors the stimulus, stress responses are increased." (p. 87)"

Lazarus is referring here to the individual’s perception of control, and equating perceived lack of control with feelings of helplessness to cope with the stressful stimuli.

Seligman, Maier and Solomon's (1971) concept of learned helplessness also appears relevant. They found during a series of experiments that dogs placed in a situation such that no response they could make would modify these outcomes (unable to avoid shock) developed what they called a psychological sense of helplessness, meaning that dogs could not learn a response dependent contingency (where response would modify outcomes). Brady's (1958) study of the "executive monkey" also shows a connection between control of a
stressor and its aftereffects, but of the opposite kind: in Brady's study, it was the monkey which had control who suffered. Apart from the possibility (Seligman, 1970) that Brady's results were an artifact of his design, it seems reasonable to assume that the differences are due to differences in time scale. Brady's studies were investigating long term (25 days) physiological aftereffects of a stressor resulting in sustained autonomic arousal in the direction of sympathetic dominance, something analogous to Selye's (1950) general adaptation syndrome. With the continuous presence of the stressor (shock), Brady's monkeys advanced to the second stage of the G.A.S. (resistance). With continued presence of the stressor the monkeys passed into the last stage of the G.A.S., where a total breakdown of the organism occurs, with bleeding ulcers, and finally the death of the organism. Postmortems on Brady's monkeys did indeed reveal death was due to massive gastrointestinal lesions. Glass and Singer (1972) on the other hand, were examining short term (25 minutes) behavioural aftereffects. Had Glass and Singer exposed their Ss to such long term exposure to such noxious stimulus they may well have developed similar physiological results.

A prime concern of this study is to look for possible connections between environmental noise and acts of aggression. Noise, particularly when uncontrollable and unpredictable, appears to lower a person's ability to tolerate frustration. How then are noise-induced frustration and aggression related? The classic hypothesis is that proposed by Dollard et al (1939). Basically, they are saying frustration (interference in instigated goal behaviour) is a necessary and sufficient cause for aggression. In other words, each act of aggression is based on some kind of frustration and each frustration will lead to aggression, in some
form or another, towards some victim or other, which has a cathartic effect on the aggressor. Aggression they defined as behaviour whose goal is to injure some person or object. To what extent is this attractively plausible hypothesis still tenable, and in what form, after nearly four decades? Worcel (1974) stated that the prime consideration of this hypothesis must include a careful look at the various types of thwarting. He demonstrated that an arbitrary or unjustified thwarting was more likely to lead to aggression than non-arbitrary frustration. Nickel (1974) studied the effect of intentionality on aggression. Using shock, Nickel found that the Ss who received light shocks, but were led to believe that high shocks had been intended, retaliated with high shocks. Cited in Nickel (1974), Simbaris showed that under conditions of relative anonymity Ss expressed significantly more aggression than Ss who were identifiable.

Buss (1953, 1961) feels that the sweeping generalizations made by Dollard, et al (1939) may be somewhat overstated. In a series of experiments he found that frustration exerted only extremely minor effects upon aggression. Buss found that increasing the degree of frustration did not lead to higher levels of aggression as would be predicted by a logical extension of the frustration-aggression hypothesis. In interpreting these results Buss (1961) points to the fact that intense frustration may often lead not to heightened aggression, but to marked anxiety and depression. This is in contrast to the position espoused by Dollard, et al (1939) that frustration always leads to aggression.

After a consideration of the past literature, Berkowitr (1965)
felt that the original frustration-aggression hypothesis should be altered in three ways. First, the emotional reaction elicited by frustration produces only a readiness to act aggressively and not necessarily an aggressive act. Second, aggressive responses will not occur, even given this readiness, unless there are suitable cues or stimuli associated with the present or previous anger instigators. The strength of the aggressive response made to the appropriate cue is a function of (1) the aggressive cue value of the stimulus, i.e., the strength of the association between the eliciting stimulus and the past or present determinants of aggression, and (2) the degree of aggression readiness, i.e., anger intensity or strength of the aggression habit. Third, not all aggressive acts are produced by frustration as previously proposed by Dollard, et al. Berkowitz (1965) feels that cues such as objects or persons that have been associated with previous anger or aggression are capable of evoking aggressive responses. These cues may have been previously learned or latent in nature. This position then appears to focus on Berkowitz' second alteration as cited above. This is to say that if a person frustrates or makes another person angry he can expect to be aggressed against in the future if the appropriate conditions exist. This result has been very well documented in a number of Berkowitz' studies.

In his article, Berkowitz (1964) cites a number of studies showing that the expression of aggression is determined not only by some internal drive but also by some external stimulation. Berkowitz (1965) had subjects suggest ways to make football
stadium seats more comfortable and how to attract new customers to a service station. Then he asked judges to rate the quality or creativity of the answers by giving either one shock for good suggestions or as many as ten shocks for poor suggestions. Actually, the experimenter controller who received one shock for good answers and who received six shocks for poor answers. Then the roles of judge and suggester of ideas were reversed. It was found that subjects who had received a high number of shocks retaliated by also giving many shocks. Conversely, subjects who received few shocks delivered few also. Berkowitz conducted a number of studies investigating additional variables affecting the intensity of the direction of aggression. In accounting for these results, the frustration-aggression hypothesis must be involved indirectly. The suggestion (as to how to attract customers) is treated as an instigated goal response, one of whose goals is to receive approval from the judge. When, however, the latter signals disapproval (by delivering shocks), the response is held to be frustrated leading to aggression against the frustrator.

A typical study introduced an additional variable before the role reversal took place. A subject entered a room and was introduced to another subject (accomplice) whose name was Kirk Anderson for half the subjects and Bob Anderson for the other half. Next, the subject and accomplice were told that the experiment involved problem-solving ability under stress. The subject was asked to solve a problem and the accomplice judged the quality of the answer by giving the subject either one shock for a good answer or up to ten shocks for a very poor answer. Then the subject and the accomplice
saw either a film of justified violence which presumably lowers the inhibition to aggression, and in which a man named Kirk was the protagonist, or a neutral film of a track race. After this, the accomplice took the problem-solving task and the subject was supposed to judge this response by shocking him from one to ten times depending upon the quality of the answer. The results supported the aggression evoking-cue hypothesis. That is, the subjects who were introduced to an accomplice named Kirk Anderson, who subsequently shocked them seven times, and then saw a film where the aggressive protagonist's name was Kirk, shocked the accomplice more times than under any other condition. As Berkowitz and Green (1966) state:

"The accomplice's name had apparently caused him to be associated with the violent scene so that he could then elicit strong overt hostility from the people, who, being angered, were primed to act aggressively." (p. 527)

Taken together, Berkowitz's studies seem to provide support for his second revision to the frustration-aggression hypothesis. Aggressive responses will not occur unless there are suitable cues associated with the present or previous anger instigators.

On the basis of the evidence so far available, it is now possible to put forward some hypotheses about the relation between noise and aggression. First, it seems likely that individuals called on to work at complex tasks in a noisy environment will not do as well as those doing the same tasks in quiet environments; and effects of the noise will be also to lower frustration tolerance, which will show up later as increased aggression in response to frustration, given the appropriate instigation. Second, the magnitude of this effect will depend on the degree to which an individual can predict and control the noise in his environment.
An appropriate way to test these hypotheses would be to combine the Glass and Singer and the Berkowitz techniques: with Ss first working in noise-free or in noisy environments with various combinations of control and prediction; and then being frustrated and given a chance to make aggressive responses. A two-phase experiment was thus developed. In the first phase, Ss were to carry out several tasks (assemblage of jigsaw puzzles) in the manner of Glass and Singer. In the second phase, they were to answer questions about their prior performance: questions which would be rated (following Berkowitz) by shocks graded in number according to the merit of the answer. Berkowitz and Green (1966) used a confederate; in the present study, the use of a confederate was avoided by running the Ss in pairs, with the apparatus so designed that one S in each pair would be an unwitting confederate.
CHAPTER II

METHOD

Subjects

Subjects were fifty males and fifty females enrolled in the Introductory Psychology course at the University of Windsor. The subjects were randomly assigned into twenty-five male and twenty-five female pairs or dyads. These dyads were then randomly assigned to a control (no-noise) group or to one of the following four experimental groups:

- Group I: uncontrollable/unpredictable (uc/up)
- Group II: controllable/predictable (c/p)
- Group III: controllable/unpredictable (c/up)
- Group IV: uncontrollable/predictable (uc/p)

Apparatus

In Phase I, a continuous-loop tape drive furnished a pseudo-random series of pulses. Each pulse, after shaping by a Lehigh Valley pulse former (#1307), triggered two LVE timers (#1302), connected in series. When "predictability" was desired, the first timer (set at 1 sec duration) turned on two 60-watt lamps, one in front of each S. The output of the second timer (0.5 sec), after reshaping, switched a white noise generator, whose output drove two-inch speakers, one to the right of each S. The noise output, before reaching each speaker, passed through a normally-closed spring loaded push button, the "control" switch; pressure on this terminated the burst of sound. Each switch was mounted directly in front of its speaker, to the right but in easy reach of S.
The speakers, switches and lamps were mounted on 1.52 meter tables in separate but adjoining rooms; with speaker and switch to the left edge of the table, warning lamp at centre back, and task material (boxed jigsaw puzzles) at the left. The clear, central part was S's work area. All other equipment for Phase I was mounted outside the experimental rooms, in an adjoining control area. Two Lafayette electronic metronomes were mounted here; their only function was to provide a series of masking clicks. The output of the speakers was calibrated before each session, using an A. H. Scott sound-level meter (C weighting) placed in the centre of S's work area.

In Phase II, electrodes were attached to each S's left hand. An additional switch was also provided to each S: in this case, a spring-loaded double-pole single-throw normally-open push button. For each S the two switch circuits led, one to a pen-and-ink event recorder, the other to a Harvard shock stimulator. Connections at the stimulator differed for the two S's. For one S (later to be termed A) connection was made to the single-pulse circuit of the Harvard stimulator: the output was connected to the electrodes of the other S. Hence, each time A pressed his switch, his partner B received a single shock, and this fact was recorded. For subject B, however, the connection was through a timer to the pulse-train mode of the stimulator; the output was delivered to A's electrodes. The time interval and pulse frequency were set so that a single pressure yielded seven shocks. The recorder, however, registered only the number of times S pressed the button.

The task material consisted of two identical sets of 25 boxed jigsaw puzzles (see Appendix IV).
Procedure

The Ss were run in pairs, concurrently; they were seated in separate rooms, and did not see or talk to each other during the experiment.

Phase I

The four experimental groups received bursts of white noise at 90dBa intensity; each burst lasted 0.5 seconds. The bursts occurred at random intervals throughout the twenty-five minute period of Phase I. The four experimental groups differed only with respect to the degree of control and/or predictability they had over the noxious stimulus. Thus, Group II (c/p) was warned in advance of the occurrence of each burst of noise by a flash of light occurring 0.5 seconds before its onset. Glass and Singer used 3 seconds which they felt may have been too long. This group was also able to exercise the option of control, they could if they wished, push a button which would turn off that particular burst of noise. This control would have to be exercised for each burst of noise. Group I (uc/up) was afforded no advance warning of the stimulus onset, neither did they have the option of exercising control. Group III (c/up) was not given advance warning of the noise onset, however, they could control it (turn off). Group IV (uc/p) was given advance warning of the noise but could not turn it off. For Group V, the control group, no noise bursts occurred.

All four experimental groups were instructed as follows:

"The purpose of today's experiment is to study the effect of different noise levels on your performance on psychomotor tasks which will be compared to other groups. While you are working on it you will hear loud bursts of noise over the speaker from time to time."

In addition
to this, special instructions were given to each dyad of each group, i.e., the dyads in Group II (c/p) were told the following: "During the random bursts of noise a light will flash prior to the noise signalling its onset. In addition, you may turn off each burst of noise by pushing this button." Group I (uc/up) was given only the opening statement read to all groups for instructions. Group III (c/up) was told: "You may turn off each burst of noise by pushing the button." Group IV (uc/p) was told: "During this random burst of noise a light will flash prior to the noise signalling its onset." Group V subjects were told: "The purpose of today's experiment will be to test your ability on this psychomotor task."

During Phase I, each subject was asked to assemble as many of the sets of jigsaw puzzles as he or she could. To avoid evoking what Rosenzweig (1943) called "need-persistence and ego defense reactions", no criteria of failure were imposed, nor were there any interruptions of task performance. Subjects were told: "We only want to see how many puzzles you can assemble during this noise period." There was no criteria of failure imposed and no interruption of their ongoing task performance, therefore Ss did not experience the residual tension of need-persistence from a task not completed. Upon termination of the noise Ss were allowed to complete the last puzzle they were working on. Ss did not experience frustration as defined by Rosenzweig (1943) and Berkowitz (1964); the former author suggesting that not allowing the Ss to complete the task created frustration, the latter stating that frustration is the result of a thwarted, instigated goal response. A record was kept of the number of puzzles completed by each S.

**Phase II**

Following the last burst of noise, and the completion of the
last puzzle, both Ss in the dyad were asked to rate (Appendix III) the relative stressfulness of the noise condition under which they had just worked. They were then given six questions (Appendix V) to answer about the puzzles they had assembled. They were told: "Here are a series of six questions about the puzzles you just completed. I want you to answer them as accurately as possible, because you and the other S will rate each other by delivering one or more mild shocks for each answer. (S was then given a demonstration shock). By pressing this button, you can give one or two shocks for a good answer to each question, seven or more if you think the answer was bad."
At this time, one member of the pair (member A) was told that he would be rated first; and then would rate the other person. The other member was, of course, told that he would rate first, and then be rated.

At this point, the Ss were not aware of the experimental manipulations which ensured that member A would always receive seven shocks for each answer, regardless of its merit, whereas member B would receive only those intended by A.

At the conclusion of the experiment Ss were informed fully of the purpose of the experiment, the experimental manipulations in Phase II, and were given ample opportunity to comment on any aspect of the procedure. Each S was asked not to give away to any potential S the nature of the deception in Phase II.

The purpose of this procedure was a logical extension of the findings of Glass and Singer (1972) concerning the deleterious after-effects of environmental stressors within the context of uncontrollable/unpredictable noise by incorporating these findings with Berkowitz'
(1965; 1966; 1967; 1969) regarding the effects of frustration on levels of aggression.

The design outlined here, and the theoretical position taken, lead to the following hypotheses:

(1) All four experimental groups (noise) will show significantly greater levels of aggression (number of shocks given) than will the control (no-noise group).

(2) In each dyad, member A will show more aggression (number of shocks given) than will member B.

(3) Group I (uc/up) will show greater aggression (number of shocks given) than will all other groups; as well as rate their experience as more stressful than all other groups.

(4) The amounts of aggression will vary with the amount of controllability/predictability.

(5) There will be a significant difference between the experimental group and control group relative to the number of puzzles completed with the experimental groups completing fewer.
CHAPTER III
RESULTS

Phase I

Task performance during Phase I (average number of puzzles completed) is shown in Table 1. A three-way analysis of variance, stress condition x group membership (A and B) x Sex was carried out on these data.* Although the Ss were tested in pairs, they did not interact in this part of the experiment: for simplicity, individuals later classed as A and B were treated as independent for the analysis of all Phase I scores. The stress conditions differed significantly (F = 6.37, p < .01). There was a sex difference (F = 12.25, p < .01) with males on the average completing more puzzles than females; the interaction between stress condition and sex was also significant (F = 7.65, p < .01). No other significant effects were found.

Because of the significant interaction, simple effects of the stress conditions were calculated separately for male and female Ss. No significant differences were found for the female groups; male groups did differ significantly (F = 11.27, p < .01). The male groups were then compared, using the Tukey (A) or hsd procedure. As can be seen in Table 2, the effect is due to a smaller than average number of puzzles being completed by the uc/p group, and a larger than average number completed by the c/up group.

*Tables for analyses of variance will be found in Appendix I.
TABLE 1 -
Mean Number of Puzzles Completed by Members A and B
- Male and Female

<table>
<thead>
<tr>
<th>Explanation Condition</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Member A</td>
<td></td>
<td>Member A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Member B</td>
<td></td>
<td>Member B</td>
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<tr>
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<td>14.4</td>
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<tr>
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<td></td>
</tr>
<tr>
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<td>13.6</td>
<td>12.4</td>
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<td>17.6</td>
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<td>10.6</td>
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</tr>
<tr>
<td>No-Noise</td>
<td>16.6</td>
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<td>13.0</td>
</tr>
</tbody>
</table>

N.B. The s.d. for these groups ranged around an average of 3.
<table>
<thead>
<tr>
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<th>Female</th>
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</thead>
<tbody>
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</tr>
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<td>Uncontrollable/predictable</td>
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</tr>
<tr>
<td>No-Noise</td>
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<td>13.6</td>
</tr>
</tbody>
</table>

N.B. Differences of 3.5 or more are significant (p < .01).
At the conclusion of Phase I, all Ss in the four noise groups were asked to judge the subjective stressfulness of the noise. Mean values for this score are shown in Table 3. An analysis of variance was carried out on these data. The stress conditions were found to differ significantly \( (F = 32.51, p < .01) \); no overall sex differences were found; but, unexpectedly and inexplicably, individuals later to be assigned to the A category in Phase II, judged the stress to be greater than did those later to be assigned to category B \( (F = 12.89, p < .01) \). This difference also interacted with sex \( (F = 8.04, p < .01) \). As seen in Table 4, these two latter effects appear to arise from an anomaly in the female group; tests of simple effects of the A-B differences showed only a chance variation for male Ss but a large and significant effect for female Ss \( (F = 8.90, p < .01) \).

The four conditions were then treated as a 2 x 2 factorial, with controllability and predictability as the relevant variables. The effects of both variables were significant at the 1% level; there was no interaction between these variables.

**Phase II**

Mean aggression scores, as measured by the number of shocks given (by A) or intended (by B) are shown in Table 5, classified by Stress Condition (including the control or noise group), Sex and Membership (A or B) in the interacting pair, or "dyad".

Since the responses of any member of a given pair depend on what the other member has done (what A has written, in B's case; what B has written, and the shocks received, in A's case), this contingency can only be taken into account by considering the dyad (as did Coutts and Schneider, 1975), and not the individual S, as the
### TABLE 3
Mean Ratings of Judged Stressfulness by Members A and B
- Male and Female

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Member A</td>
<td>B</td>
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<tr>
<td>Uncontrollable/unpredictable</td>
<td>3.6</td>
<td>4.4</td>
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<td>1.2</td>
</tr>
<tr>
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<td>3.6</td>
</tr>
<tr>
<td>Uncontrollable/predictable</td>
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<td>3.0</td>
</tr>
</tbody>
</table>
TABLE 4
Combining Means of Perceived Stress by Members A and B
- Male and Female

<table>
<thead>
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</thead>
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<td>3.2</td>
<td>3.4</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Explanation</td>
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</tr>
<tr>
<td>--------------------------------</td>
<td>-------</td>
<td>----------</td>
</tr>
<tr>
<td>Uncontrollable/unpredictable</td>
<td>33.0</td>
<td>17.6</td>
</tr>
<tr>
<td>Controllable/predictable</td>
<td>24.8</td>
<td>12.8</td>
</tr>
<tr>
<td>Controllable/unpredictable</td>
<td>17.4</td>
<td>14.2</td>
</tr>
<tr>
<td>Uncontrollable/predictable</td>
<td>29.2</td>
<td>12.1</td>
</tr>
<tr>
<td>No-Noise</td>
<td>12.0</td>
<td>6.6</td>
</tr>
</tbody>
</table>
lement of analysis. Accordingly, the aggression scores were first analyzed as a 3 × 2 × 2 analysis of variance, with repeated measures over the last factor, membership in the dyad. Stress Condition, Sex and their interaction were therefore treated as "between dyad" effects; Membership and all interactions therewith, were "within dyad" effects, and separate error terms were obtained. There were no differences attributable to Sex, either overall or in interaction with any of the other variables; all F-ratios being close to unity. This factor was therefore ignored in all subsequent analysis. The effect of the different stress conditions was clearly evident (F = 7.60, p < .01), as was that of Membership (F = 102.80, p < .01) and the membership by stress interaction (F = 3.33, p < .05). (see Appendix I)

The next step was to divide the variation due to stress into parts attributable to (a) the difference between the control (no-noise) group and the four experimental (noise) groups; and (b) to examine the experimental factors of controllability and predictability. The analysis here was the conventional one of a factorial design with a single control group (Winer, 1971, p. 263). The control vs. experimental comparison was significant (F = 3.88, p < .01) with the experimental groups showing on the average more aggression than the control (see Table 5). Within the factorial part, controllability was the only significant factor (F = 8.65, p < .01), with groups having control showing less aggression. Predictability made no apparent difference; nor did the interaction with controllability (see Table 5).

In considering the within dyad effects, since both Membership and Membership × Stress were significant, two additional partitions were examined. Simple effects of membership were first calculated.
for each stress condition: all were significant (p < .01), with membership A in each case showing the greater aggression. Simple effects of Stress were next calculated for each member of the dyad, and separately partitioned into noise vs. no-noise comparison, and a factorial part, as before. For a member A (the member of the pair who was "frustrated") the results were as before: those working under noise showing significantly more aggression than did the no-noise group (F = 25.2, p < .01); and, within the factorial part, Controllability was the only determining factor (F = 17.5, p < .01).

For member B (the individual who was not "frustrated"), only the noise vs. no-noise comparison showed a larger than chance difference (F = 4.3, p < .01); none of the F-ratios for the factorial part exceed unity.
CHAPTER IV

DISCUSSION

The primary purpose of the present research effort was to determine what would be the negative aftereffects that individuals would experience in terms of lowered frustration tolerance and subsequent aggression, if they were first subjected to an environmental stressor such as aperiodic noise, under conditions that were uncontrollable and/or unpredictable. The basis for this line of inquiry follows directly from the findings of Glass and Singer (1972) and Berkowitz (1964).

Among the major findings of the Glass and Singer (1972) studies were when individuals were subjected to environmental stress there was a significant lowering of frustration tolerance. The purpose of the present two-phase study was to relate these findings to the Berkowitz (1964) frustration-aggression hypothesis. Essentially, this hypothesis states that in a state of lowered frustration tolerance, an individual will act aggressively if first aggressed against, if given the opportunity to act aggressively and if provided with cues from a past aggressor. Thus, this study attempted to bridge the gap between the Glass and Singer (1972) and Berkowitz (1964) findings. A summary of the results presents a relatively clear picture confirming for the most part the study's hypotheses, there were, however, some minor exceptions that will be dealt with at length.

In Phase I of this study, the Ss in the four experimental groups were subjected to aperiodic noise which (following Glass and Singer, 1972) it was assumed would lower their frustration tolerance due to
the psychic cost in having to cope with the noise. During their noise
exposure, Ss were required to assemble a series of jigsaw puzzles (see
Appendix IV) about which in Phase II Ss were asked a series of six
questions (see Appendix V). Ss rated each other on the accuracy of
each other's answers, that is, in each dyad member B would first rate
member A, then A would rate B. The rating was accomplished by admin-
istering a series of mild shocks delivered to the firefinger of the
non-predominant hand, one or two shocks represented a good and accu-
rate answer and seven shocks a bad and inaccurate answer. The
apparatus was so arranged that all members A received a bad rating
for all their answers.

In Phase II, one member of each dyad (member A) was "frustrated";
that is, assuming that he would prefer to have his answers commended,
the receipt of seven shocks (the mark of a bad answer) would constitute
a frustration. He (member A) was then given the opportunity to act
aggressively against his opposite member.

This form of the theory would predict that member A should give
more shocks than member B. Also, if the different conditions encoun-
tered in Phase I produced different changes in frustration tolerance,
these should show up as differences in A's aggressivity scores. These
are the major findings of the study. This would seem to demonstrate
that indeed a connection between environmental stress and aggression
does exist. It was found that members A showed significantly higher
levels of aggression than did members B, and the amount of aggression
varied with the degree of control. This was true for all stress groups
confirming the Berkowitz (1964) contention that if an individual's
instigated goal response is thwarted, a person will in turn, given
the opportunity and cues from a past aggressor, act aggressively.
A study by Epstein and Taylor (1973) demonstrated that the major influence on the S's level of anger and behavioural aggressions was the aggressive intent of his opponent. Frustration did not significantly affect either anger or aggressive behaviour if the S did not perceive his opponent's intent as aggressive. It is clear then that Ss must be aware of this opponent's intent to frustrate him. In this study, Ss are told that two shocks represent a good answer and seven or more represent a bad answer, therefore, if Ss receive seven shocks, there should be no misunderstanding of the other person's intent. The rationale for the use of shocks as an indication of aggression follows directly from the work of both Buss (1963) and Berkovitz (1965). Both state that the use of shock was a clear indication of aggressive intent. Buss felt that delivering progressively increased intensity was such an indication, whereas Berkovitz stated that the number of shocks given was an indication of aggression. A significant difference in the level of aggression was found between the control/no-noise group and the experimental groups confirming the earlier findings of Glass and Singer that environmental stress will result in deleterious after-effects, such as in the present case of increased levels of aggression. There appears to be a clear indication that if a person is subjected to environmental stress followed by frustration, high levels of aggression will ensue given the opportunity to aggress. The amount of the aggression will vary according to the stressful condition present the least being with a factor of control. The A-B difference was significant in all groups thereby suggesting a reliable stress/frustration aggression effect. The loss of control for Ss may have caused a greater sense of helplessness similar to Seligman's (1969) concept of learned helplessness which occurs in a situation where no
response S can make will modify its outcome, as in the present case escaping or avoiding loud noise. Seligman felt this helplessness state could cause psychological dysfunctioning, such as anxiety, depression and lowered frustration tolerance. Glass and Singer (1972) further state:

"The helplessness hypothesis provides a nice explanation for the relationship between unpredictable and uncontrollable noise and deleterious aftereffects. If the impact of a repeatedly presented aversive event is greatest when feelings of helplessness are maximal, it follows that adverse aftereffects will also be maximal." (p. 59)

Based on the evidence presented by the aforementioned investigations, it would appear that the greater the perceived control of the aversive stimulus, the less impact the stressor will have, leaving the individual with more ability to cope with the environmental situation, such as frustration and complex sensory motor tasks. These findings may be due in part to the manipulation of predictability. Glass and Singer (1972) used a three second warning, in the present study the noise blast was signalled by a flash of light 0.5 seconds in duration prior to the onset of the noise. Perhaps this did not offer the S enough time to prepare psychologically for the burst of noise, thereby negating any potential dampening effect the factor of predictability might have had.

In the present study, control (which was not exercised) was in the form of a button, which, when pressed, would shut off the noise. Only one S (whose data were excluded from the analysis) used the control button at all, a fact which seems paradoxical at first glance. A number of investigators have studied the phenomenon of perceived control. Pervin (1963) examined the effect of Ss who administered electric shocks on particular trials by pressing one of two levers. The results showed that Ss preferred the situation in which they had direct control of shock administration.
They also reported somewhat less anxiety when they delivered the shocks themselves than when the experimenter had control. More recently, LePanto, Moroney, and Zennhausern (1965) showed that a preference for control over stimulus onset is reflected in an actual reduction of pain sensitivity. The mean pain threshold for radiant heat was lower when the experimenter had control of the pain source than when the S was in control.

More recently, Coan and Boffa (1970) have shown that providing Ss with a button that terminates aversive sound leads to reductions in GSR amplitude and ratings of discomfort. They also found that giving Ss a choice about escape, even on no-escape trials, produced a decrement on both dependent measures. (Only two Ss actually exercised the option, and they were eliminated from analysis.) They state in other words: "The mere perception of escape operated to reduce the aversive quality of the stimulus and the resultant physiological arousal." (p. 1)

Further support for this conclusion comes from a study by Stotland and Blumenthal (1964). Ss were told they would have to work on an I.Q. test consisting of several subtests. One group was told they could take the subtests in any order they wished, whereas the second group was told that they must take the tests in a prescribed sequence for "administrative reasons". Ss with no choice over the order of the subtests increased in palmar sweating during this instruction period, whereas those who were given a choice did not appreciably choose to order the tests, apparently having control over one's environment sufficient to reduce the impact of a threatening stimuli even though there is no immediate confirmation of the belief.
Further to this point, Glass and Singer (1972) state: "Our own research produced data indicating somewhat lower magnitudes of GSR and vasoconstriction in conditions where subjects perceived control over noise." (p. 35)

The preceding research demonstrates that if an individual controls the onset and/or offset of stressful stimuli, or if he simply expects to have such control, behavioural and autonomic indices of stress are reduced. In three experiments (Mower & Viek, 1948; Corah & Boffa, 1970; and Champion, 1950) an instrumental response (e.g., lever or button pressing) permitted escape from the stressor; in other studies (Haggard, 1946; Pervin, 1963; and LePantco, et al., 1965) the stressor was inevitable, but the S could determine some aspect of its occurrence, such as who would be directly responsible for onset; and in still other studies (Corah & Boffa, 1970; Stotland & Blumenthal, 1964) there was only the perception of potential control over the stimulus.

There are two anomalies to be recognized. First, an important facet of the study was to ascertain whether Ss perceived the noise in Phase I as stressful, for if they did not, it would prove difficult to argue for a stress exposure frustration-aggression effect. As has been pointed out, the two members of each dyad, although treated alike in Phase I, rated the subjective stressfulness of the situation quite differently. This difference, however unlikely, seems only attributable to chance. But did it affect the difference found in Phase II? As can be seen by the results of the analysis, the Ss did indeed perceive the noise as stressful according to a rating scale they were given to fill out immediately upon termination of the noise exposure. The difference found appeared to be due to the consistently
low rating that was given to controllable/predictable group. This result would not be unexpected with the Ss having both controllability and predictability as a dampening effect against noise bursts.

Secondly, rationale for a task performance measurement during Phase I (stress exposure) was two-fold: first, Ss must have participated in a task that could be questioned on during Phase II, the frustration-aggression segment, that had some relevance to Phase I. Secondly, it was of prime importance to determine whether the stress exposure had a differential effect on the psychomotor task performance of the various groups in order to ascertain whether Ss may have been frustrated during Phase I, which may be carried on into Phase II, thus making it difficult to argue for a single frustration-aggression effect in Phase II.

Glass and Singer claimed that variations in environmental stress (as mediated by ability to predict or control) had no immediate effect on performance. The performance measurement used by Glass and Singer was a cognitive task (simple math problems) whereas the present study used a more complex psychomotor task. All groups in Phase I should, therefore, have shown only chance differences in number of puzzles completed.

Thus the study intended to avoid what Rosenzweig (1943) called need-persistence, which is a residual tension effect from a task not completed. Berkowitz (1964) might argue that the noise interfered with the ongoing response causing frustration. The results revealed somewhat mixed findings with a significant stress condition effect. It was hypothesized that there would be a difference between the four experimental groups and the no-noise control group, which did occur. Inspection of the tables shows that in
the case of males under the conditions uncontrollable/predictable, they had significantly lower scores, thus causing the difference. In addition, a test of covariance between puzzles completed and number of shocks given revealed a non-significant correlation coefficient of negative 0.09. Therefore, it would not be too far afield to state that Ss entering Phase II (frustration-aggression) were not in a general state of frustration, or at least equally so, thereby not causing any serious confounding problems. Lack of control for males appears irrelevant here, as they have lower scores than did the females. The effect of the various stress conditions had a decided differential effect between males and females. Females generally respond to the stress condition in a relatively homogeneous manner, the lowest scores for males being in Group IV, uncontrollable/predictable. (See Tables 1 and 2).

It would seem that a covariance adjustment would be in order. However, the measures are very different in kind. Number of puzzles completed is a clear performance measure; subjective ratings are, at best, only dubiously handled by analysis of variance techniques; and number of shocks administered is, perhaps, a measure of arousal, or of discharge of aroused tensions. Due to this incompatibility of measures, and to the strong theoretical reasons that arousal and performance are not linearly related, no covariance adjustments were attempted. ¹

¹A more detailed discussion of these and other points will be found in Appendix II.
Ss that were exposed to the condition uncontrollable/unpredictable representing the most stress, showed the highest level of aggression, this was true for both males and females. The case seems reasonably clear for member A, the "frustrated" member of the dyad. Member B, supposedly, was not frustrated and, within the noise groups, there were no differential effects, as should have been the case. But there was a significant difference, for member B, between those who worked in silence and those who worked in noise. This difference (since none was frustrated in Phase II, although their frustration tolerance should have been differentially affected in Phase I) was not predictable.

Can one suggest that all Ss, regardless of their treatment in Phase II, did not perform up to their own expectations in Phase I, and hence were internally frustrated?

The fact that the present study appears to confirm the Berkowitz (1964) frustration-aggression hypothesis does not preclude the possibility of an alternate explanation of the study's findings regarding the elicitation of an aggressive response as a consequence of frustration.

The present study's results and conclusions are predicted on two assumptions: first that frustration tolerance was lowered in Phase I as a consequence of noise, and secondly, that a state of frustration was generated in Phase II which led to the observed aggression. These findings notwithstanding, however, several pertinent questions must be asked. Did member A Ss show significantly higher levels of aggression toward member B Ss because of the noise and lowered frustration tolerance, or just as a pure act of retaliation for having been aggressed against first? Did Ss really have an instigated goal response of
receiving a good rating that was frustrated? What accounted for the noise/noise difference in member B's? They were not frustrated, nor did they have any need to retaliate against member A's. Their acts of aggression here may be examples of what Buss and Fendelstein (1974) referred to as displaced aggression resulting from the noise exposure. Or does noise, in addition to any effect on frustration tolerance, make people more irritable or critical, which may be reflected in the number of shocks Ss B intended for Ss A. Thus the appeal to a frustration-aggression relationship may be premature. This line of reasoning then speaks to the possibility of an inherent weakness in the study's basic design, namely the use of indirect frustration and the assumption that having received a negative rating would be frustrating at all. Perhaps the elimination of the frustration segment would yield similar results. The present study, unfortunately, does not allow for such comparisons. Further studies using more direct frustrations are needed to make those determinations. Such a design might have direct interaction between Ss A and B with one S actually interfering with the ongoing instigated goal response of the other S. Such an interference might be taking away pieces of the puzzle that a S has to complete in an allotted time that is linked to a reward-punishment contingency, then a measure of subsequent aggression could be made. Comparisons could be made between indirect versus direct frustration groups as well as no frustration groups. The results might prove to be rewarding.

Whatever may be the best explanation, the general findings appear to demonstrate a connection between environmental stress and subsequent aggression; thus bridging the gap between the findings of Glass and Singer (1972) and Berkowitz (1964) version of the frustration-aggression hypothesis.
The foregoing set of results suggests that the aversive impact of an unpredictable stressor is partly attributable to the individual's inability to control the stressor. Providing him with knowledge of when to expect the stressor affords a measure of control over the situation. It is felt that the results of the present study have provided a sound rationale for any further investigations regarding the precursors of aggression, an ubiquitous phenomenon in our society. The conditions leading to and the control of aggression should be of prime concern to all social scientists.

Granting the general validity of these findings, that deleterious effects of stress (in terms of subsequent aggressive behaviour) may be mitigated by giving the individual control over his environment, can these findings be applied in any reasonable way to an industrial setting?
APPENDIX I

ANALYSIS OF VARIANCE TABLES
### APPENDIX I

3-Way Analysis of Variance - Puzzles Completed

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
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<th>MS</th>
<th>F</th>
</tr>
</thead>
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<td><strong>Main Effects</strong></td>
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<td>4</td>
<td>35.81</td>
<td>6.37***</td>
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<td>(B) Group Member</td>
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<td>.78</td>
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<tr>
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<tr>
<td><strong>Interaction Effects</strong></td>
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<tr>
<td>(A) x (B)</td>
<td>29.44</td>
<td>4</td>
<td>7.36</td>
<td>1.31</td>
</tr>
<tr>
<td>(A) x (C)</td>
<td>171.96</td>
<td>4</td>
<td>43.99</td>
<td>7.65***</td>
</tr>
<tr>
<td>(B) x (C)</td>
<td>1.21</td>
<td>1</td>
<td>1.21</td>
<td>.22</td>
</tr>
<tr>
<td>(A) x (B) x (C)</td>
<td>29.44</td>
<td>4</td>
<td>7.36</td>
<td>1.31</td>
</tr>
<tr>
<td><strong>Residual</strong></td>
<td>149.60</td>
<td>80</td>
<td>5.62</td>
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</tr>
</tbody>
</table>

***p .001
APPENDIX I

3-Way Analysis of Variance - Perceived Stress

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A) Stress Condition</td>
<td>34.11</td>
<td>3</td>
<td>11.38</td>
<td>32.51***</td>
</tr>
<tr>
<td>(B) Group Member</td>
<td>4.51</td>
<td>1</td>
<td>4.51</td>
<td>12.69***</td>
</tr>
<tr>
<td>(C) Sex</td>
<td>0.11</td>
<td>1</td>
<td>0.11</td>
<td>0.32</td>
</tr>
<tr>
<td><strong>Interaction Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A) x (B)</td>
<td>3.94</td>
<td>3</td>
<td>1.31</td>
<td>3.75*</td>
</tr>
<tr>
<td>(A) x (C)</td>
<td>3.14</td>
<td>3</td>
<td>1.05</td>
<td>2.99*</td>
</tr>
<tr>
<td>(B) x (C)</td>
<td>2.81</td>
<td>1</td>
<td>2.81</td>
<td>8.04**</td>
</tr>
<tr>
<td>(A) x (B) x (C)</td>
<td>1.64</td>
<td>3</td>
<td>0.55</td>
<td>1.56</td>
</tr>
<tr>
<td><strong>Residual</strong></td>
<td>22.4</td>
<td>6°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***p < .001
**p < .01
*p < .05
### APPENDIX I

Analysis of Variance for Shock

<table>
<thead>
<tr>
<th></th>
<th>Ss</th>
<th>df</th>
<th>MS</th>
<th>F</th>
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</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>8122.19</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Between Dyads</strong></td>
<td>3534.69</td>
<td>19</td>
<td>3347.86</td>
<td>7.60 (p .01)</td>
</tr>
<tr>
<td>Stress</td>
<td>1291.44</td>
<td>1</td>
<td>348.13</td>
<td>1</td>
</tr>
<tr>
<td>Sex</td>
<td>34.81</td>
<td>1</td>
<td>34.81</td>
<td>1</td>
</tr>
<tr>
<td>Stress x Sex</td>
<td>277.84</td>
<td>4</td>
<td>69.46</td>
<td>1.52</td>
</tr>
<tr>
<td>Error (Between)</td>
<td>1830.50</td>
<td>40</td>
<td>45.76</td>
<td></td>
</tr>
<tr>
<td><strong>Within Dyads</strong></td>
<td>4587.50</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Member (A-B)</td>
<td>2948.49</td>
<td>1</td>
<td>2948.49</td>
<td>102.80 (p .01)</td>
</tr>
<tr>
<td>M x Stress</td>
<td>383.36</td>
<td>4</td>
<td>95.84</td>
<td>3.35 (p .05)</td>
</tr>
<tr>
<td>M x Sex</td>
<td>2.25</td>
<td>1</td>
<td>2.25</td>
<td>1</td>
</tr>
<tr>
<td>M x Stress x Sex</td>
<td>106.00</td>
<td>4</td>
<td>26.50</td>
<td>1</td>
</tr>
<tr>
<td>Error (Within)</td>
<td>1147.50</td>
<td>40</td>
<td>28.69</td>
<td></td>
</tr>
</tbody>
</table>

**Noise Groups**

<table>
<thead>
<tr>
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<th>Ss</th>
<th>df</th>
<th>MS</th>
<th>F</th>
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</thead>
<tbody>
<tr>
<td>Prediction</td>
<td>26.45</td>
<td>1</td>
<td>26.45</td>
<td>1</td>
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<tr>
<td>Control</td>
<td>396.05</td>
<td>1</td>
<td>396.05</td>
<td>8.65</td>
</tr>
<tr>
<td>P x C</td>
<td>110.45</td>
<td>1</td>
<td>110.45</td>
<td>2.45 N/S</td>
</tr>
<tr>
<td>Error (Between)</td>
<td>40</td>
<td>45.76</td>
<td>1</td>
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</tr>
</tbody>
</table>
APPENDIX II

ANALYSIS OF COVARIANCE DISCUSSION
ANALYSIS OF COVARIANCE

Most discussions of the analysis of covariance (Winer, 1971; Keppel, 1973; Kirk, 1968) caution the experimenter against various inappropriate uses of this adjustment technique: cautions which, unfortunately, are too often ignored in the literature.

Without labouring the point, it may be said that these include, in addition to the usual assumptions of the analysis of variance:

(a) linearity of regression between variate and covariate;
(b) homogeneity of regression; and
(c) freedom of the covariate from treatment effects.

If these conditions are not satisfied, any adjustment made mechanically may be not only inappropriate, but dangerously misleading.

In the present case, the two possible covariates (problems completed and judged stressfulness) are clearly affected by the treatment; and hence, should not be used. However, let us ignore these restrictions, and examine what might be the result of doing a covariance adjustment on the main output variable, number of shocks. To avoid the difficulty of using multiple covariates in a complex design, the two covariates were looked at separately.

For problems completed, the differences occurred only in male Ss. For this subgroup, before attempting a full adjustment, the within-class correlation between problems and shocks was computed. It was found to be only -0.15. Thus any change in the effects of the stress conditions would, even if justified, be only of the order of 2%.
For the other "covariate", judged stressfulness, not only is it affected by the stress conditions, but inspection of the data for the four basic groups suggested a considerable group to group difference in the relationship between covariate and variate. Separate product-moment r's were computed for all homogeneous groups: these r's varied from -.04 to +.030. No covariance adjustment is appropriate.
APPENDIX III

QUESTIONNAIRES ON PERCEIVED STRESS
HOW STRESSFUL DID YOU FIND THE NOISE?

Extremely Stressful

Very Stressful

Moderately Stressful

Less Stressful

Not Stressful at all
APPENDIX IV

EXAMPLES OF PUZZLES
PREVIOUSLY COPYRIGHTED MATERIAL.
APPENDIX IV, LEAVES 51-52,
NOT MICROFILMED.

EXAMPLES OF PUZZLES:
1. PLAYSKOOL PUZZLE-BOY BUILDING HOUSE,
2. PLAYSKOOL PUZZLE-JACK IN THE BEANSTALK.

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APPENDIX V

QUESTIONNAIRE ON PUZZLES
QUESTIONNAIRE ON PUZZLES

(1) In the traffic scene name the different kinds of sports cars.

(2) In the boat scene, name the different kinds of boats.

(3) In the farm scene, describe what the farmer was doing.

(4) In the beach scene, how many children were in the water?
   How many children were in the sand?

(5) In the airport scene, name the different kinds of aircraft.

(6) Name the different kinds of animals in the various puzzles.
REFERENCES


Stotland, E. & Blumenthal, A. The reduction of anxiety as a result of the expectation of making a choice. *Canadian Journal of Psychology*, 1964, 18, 139-145.


VITA AUCTORIS

David T. Duncan was born on February 6, 1938 in New York City, New York.

In September, 1966 he began a four-year programme of studies which culminated in the awarding in September, 1972 of the Bachelor of Arts degree from the University of Windsor. In September, 1972, he began graduate work in Psychology at the University of Detroit. He received a Master's degree in Psychology (Experimental) in May, 1973. Since September, 1974, he has been engaged in work towards the doctorate degree in Philosophy at the University of Windsor.

David T. Duncan is married to the former Karen L. Hoffman.