THE EFFECTS OF FACIAL EXPRESSIVITY AND COGNITIVE ATTENTION ON RESPONSE TO STRESS

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COMPARISONS OF FACIAL EXPRESSIVITY AND COGNITIVE ATTENTION, OF NATURAL AND INSTRUCTED STRATEGIES, AND OF CONCURRENT AND RESULTANT REACTIONS.

by

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February, 1983

Being a report of an investigation submitted as a partial requirement for the degree of Master of Psychology in the department of Psychology at the University of Tasmania.

Acknowledgements

I gratefully acknowledge the assistance afforded me in the preparation of this work by Dr. G. Wilson who aided in many respects, but especially in the operation of the Devices Recording System, and in the preparation of this document; the staff of the Research and Evaluation Unit of the Mental Health Services Commission of Tasmania, especially Dr. R. Morris and Mr. W. Slaghuis, for allowing me to use the Devices Recording System and their facilities; and those twenty four people who went out of their way for me to receive a series of painful electric shocks for no payment.

Abstract

Previous research on the effect of facial expressivity upon autonomic and self-reported arousal to stress has found an inverse relationship when data from observations of natural responses are correlated, supporting the Discharge theories of emotion, and a positive relationship when expressivity is experimentally manipulated, supporting the Proprioceptive theories of emotion. The present review suggested that if the concept of discharge is assumed to refer to a proportional decrease in arousal over time, rather than an inverse relationship among concurrent modes of response, then the dichotomy in previous findings will disappear when expressive and autonomic measures are taken at exactly the same time (concurrent effects), thereby avoiding the effects of discharge phenomena (resultant effects).

Similarly, while instructions to cognitively attend to a threat have consistently resulted in greater autonomic or self-reported arousal, studies observing the relationship between natural cognitive attention/avoidance and such arousal have produced mixed results. It has been suggested that an overriding variable such as level of perceived threat may in natural conditions simultaneously affect attention and subjective anxiety in opposite directions. The same issue of confusion of discharge effects may however also be relevant here.

This investigation therefore sought to compare the effects of natural and manipulated cognitive and

expressive behaviour on clearly distinguished concurrent and resultant indices of arousal.

It was also possible to assess the possibility that natural expressive or cognitive tendencies affect response to instructions in each respective area.

Finally, several authors have discussed the possibility that either concurrent uncontrolled expression or cognitive behaviour could explain the results of studies manipulating or observing the other. Therefore, the relative impact of simultaneous cognitive and facial activity was assessed.

Four trials of electric shock with 20 second warning were administered to 24 subjects under no specific coping instructions (Part One). In each case this was followed by eight trials under instructions to facially express and cognitively attend, express and avoid, hide and attend, or hide and avoid (Part Two). In both parts anticipatory self-reported anxiety, heart rate increase, respiration rate increase, and SC increase from baseline were measured (concurrent indices), as were change in heart rate, respiration rate, and SC from anticipatory to post-shock levels (resultant indices). In Part One anticipatory cognitive attention/avoidance was assessed by questionnaire, and facial expression for the same period by raters of video recordings. Degree of compliance with facial and cognitive instructions in Part Two was determined by these same means.

Both cognitive attention and facial expression were found to be effective in altering concurrent and resultant indices of arousal. However, neither mode of response emerged as a more direct or potent determinant of autonomic and self-reported arousal.

While expressing and attending were associated with greater concurrent arousal, both activities were followed by less resultant arousal. The concept of discharge of arousal over time was supported.

Natural and instructed strategies, whether expressive or cognitive, had parallel effects. It is suggested that this finding resulted due to the clear distinguishing of concurrent and resultant indices, thus avoiding the methodological problems of past studies.

Finally, compliance with cognitive and facial instructions was found to vary according to subjects' natural tendencies toward the respective activities. Effects of these disparities on arousal patterns were not detected, perhaps due to the subtlety of such secondary effects among only 24 subjects.

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Much theory and research on human emotional reactions over the years, including reactions to stress, has been concerned with the precise relationships between various facets of these reactions. Some of the facets emphasized have been: (a) *Overt expression*, such as approach versus avoidance, facial expression, or body posture; (b) *Subjective or cognitive state*, including perception and appraisal of situations or of own behaviour, subjective anxiety, degree of attention, personality variables, etc.; (c) *Physiological responses*, being mainly autonomic but often including (questionably) muscle tension; (d) *Stimulus situation;* and (e) *Neural mediation.*

The work upon which this study draws has generally elevated only a few of these to the status of primary *indicators* of the presence of emotion: namely subjective anxiety (per self-report) and autonomic responses.[1]

Variables which have been regarded as possible *determinants* of emotion, which will be compared in this light, are facial expression and degree of attention.

It should be noted that any of the variables listed could be labelled as indicators or determinants. This simply comprises a methodological allocation of

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[1]Many authors choose to use the term "physiological". Included in this are EMG phenomena. The skeletal, as opposed to visceral, nature of muscle tension is well known and should be carefully taken into account whenever EMG measurement is included with skin conductance, heart rate, etc. as a "physiological" variable. Therefore, to avoid the confusion that lack of insight into this point has caused throughout the literature, the terms "autonomic" or "visceral" will be used whenever relevant, and "physiological" avoided completely.

independent and dependent variables. For a total causal picture to emerge this allocation needs to be reversed as well.

Facial Expression

With regard to the effect of facial expression upon emotional indicators such as subjective experience and autonomic reaction, two fairly separate lines of research have grown to support two allegedly opposite theoretical stances. The 'discharge' theories of emotion presuppose an inverse relationship between expressivity and emotional intensity. The 'proprioceptive feedback' theories on the other hand posit a directly proportional relationship.

Discharge Theories

Some work has supported the view elaborated by Allport (1924). He claimed that "if the somatic responses are totally inhibited, the visceral energizing effects can be discharged only inwardly ... [causing] an extended, intensified and lasting state of unpleasant internal feeling" (p.98). This has been labelled the 'discharge' theory of emotion (Rapaport, 1953) and leads to the use of such procedures as abreaction.

Early work by Jones (1950, 1960) led him to claim that autonomic arousal and overt behaviour are substitutable modes of decreasing emotional tension (see Table 1). He noted the existence of three types of reactors: Externalizers, who show an infantile pattern of high expressive but little autonomic responding; Internalizers, who react little overtly but explode autonomically; And generalizers, who show high overt and internal 'discharge'.

Block (1957) disagreed with two aspects of Jones's proposal. Firstly, generalizers should not exist in this scheme. And secondly, he could not see autonomic reactions as means to drive reduction. Block's model to overcome these problems moved cognitive or subjective anxiety to the 'drive reducer' side of the equation with overt behaviour. Then the internalizing-externalizing dimension characterizes cognitive versus overt drive reduction, as monitored by autonomic arousal (see Table 1).

Proprioceptive Feedback Theories

The idea of a positive relationship between the expression of emotions and their intensity goes back even further. Darwin (1904) alleged that "the free expression by outward signs of an emotion intensifies it. On the other hand, the repression, as far as possible of all outward signs, softens our emotions" (p.22).

Jacobson (1967) based his early work with progressive relaxation on the notion that emotion comprises visceral and neuromuscular processes. Eliminate the latter, he says, and the emotion disappears (see Table 1). Since thinking incorporates ocular and laryngeal muscle movements, elimination of these removes the cognitive aspects of an emotion as well (Jacobson, 1967, p.190).

The James-Lange theory belongs to this category as well. The bodily changes that, according to James (1884), are perceived and become an emotion include visceral

Table 1

Discharge and Proprioceptive Theories of Emotion

Source	Model	Explanation [a]
Discharge theories		
Jones (1950)	$(F,B \propto 1/V,S)$	Where skeletal reaction is greatest, visceral and cerebral reactions are least, and vice versa.
Block (1957)	$(F,B \propto 1/S) \Rightarrow .. \; 1/V$	Where skeletal reaction is greatest, cerebral reactions are least. Either leads to discharge.
Proprioceptive theories		
Jacobson (1967)	$F,B \Rightarrow S,V$	Neuromuscular activity directly affects neocortical and limbic lobe - hypothalamic activity.
James (1884)	$F,B,V \Rightarrow S$	Perception of "bodily changes" directly affects the experience of emotion.
Tomkins (1962)	$F \Rightarrow S,V$	Proprioceptive feedback of specific innately programmed facial responses determines subjective experience and accompanying visceral response.
Gellhorn (1964)	{ $F \Rightarrow S^T,V^T$	Facial proprioceptive feedback directly affects type of hypothalamic functioning and thus autonomic balance and cortical activity.
	{ $B \Rightarrow S^D,V^D$	Postural proprioceptive feedback directly affects hypothalamic balance and thus autonomic balance and cortical activity.
Izard (1977)	{ $F \Rightarrow S^T,(V^T)$	Facial proprioceptive feedback activates qualitatively distinct emotions.
	{ $V,B \Rightarrow S^D$	Striate and smooth muscle activity amplifies and sustains emotions.
Laird (1974)	{ $F,B \Rightarrow C \Rightarrow S^T$	Expressive behaviour affects the self-attribution of the quality of felt emotion.
	{ $V \Rightarrow C \Rightarrow S^D$	Autonomic arousal affects the self-attribution of intensity of felt emotion.

Note: F = Facial expression } Skeletal reaction
B = Body posture } (Expressive behaviour)
V = Visceral reaction V^T = type of V^D = degree of
S = Subjective reaction S^T = type of S^D = degree of
C = Cognitive mediation

[a] Using predominantly each author's own terminology.

and somatic ones. Therefore, although this theory regards one of the usual "indicators" of emotion as a "determinant" (i.e. visceral reaction), it still claims a positive relationship between all of the facets (see Table 1).

When Cannon (1927) proceeded to attack the visceral aspect of the James-Lange theory by pointing out the diffuseness, slowness, etc. of autonomic responses, he unfortunately ignored the somatic side of the argument. This was picked up by Tomkins (1962) who noted that the visceral objections did not apply to facial expression. He cited indirect evidence concerning the properties of facial muscles (great variety of contraction patterns, dense receptor-effector units, little startle habituation, etc.) to suggest that facial expression may be *the* determinant of autonomic and subjective aspects of emotional responses (see Table 1).

Drawing on neurophysiological evidence, especially concerning the function of the hypothalamus, Gellhorn (1964) presented a slight variation and elaboration on this idea. He claimed that the *quality* of an emotional experience relies upon facial expression, whilst its *quantity* is a function of the overall somatic body posture (see Table 1).

Izard (1971, 1977) outlined a slight variation again, upholding the facial expression-quality link but regarding visceral reactions as a "determinant" of the intensity of subjective emotional experience along with somatic body activity, instead of just an "indicator" of intensity (see Table 1).

A final variant on this group of theories which deserves inclusion has been presented by Laird (1974). He saw body posture as a determinant of emotional quality along with facial expression. Autonomic arousal, then, is the sole primary determinant of subjective emotional intensity. However, both determinations are mediated by a process of "cognitive self-attribution" rather than resulting from direct, innate neural links (see Table 1).

As well as disagreeing on the allocation of "determinants" and "indicators", proprioceptive theorists have several ideas on the precise mechanisms or mediators of influence involved. Laird (1974) cites cognitive attributional processes. Gellhorn (1964) favours direct, neuronal feedback. And Kleck, Vaughan, Cartwright-Smith, Vaughan, Colby, and Lanzetta (1976) suggest a process of classical conditioning in which expressive UCRs occur before autonomic UCRs, and therefore eventually become Conditioned Stimuli for the autonomic responses.

Support for Discharge Theories

The first reproducible indications of an inverse relationship between the expression of emotions and their subsequent intensity came with the introduction of skin conductance measurement. Waller (1919) observed that "the more perfectly an examinee can control the visible signs of emotion, the more violently is the galvanometer deflected .... by reason of the suppressed emotion" (pp.27-28).

Prideaux (1922) noted a similar observation. Then Landis (1932) found that of 100 boys on a pursuit rotor task those that showed fear, anger, pain, or cried had fewer galvanic skin responses (GSRs) than the group average. Abel (1930) related GSR reactivity with attitudinal measures in the same direction.

Jones (1950, 1960) observed this phenomenon developmentally in a series of studies. With infants he found overt expression to be proportional to GSR activity with mild responses, but inversely proportional with greater disturbances. That is, crying accompanied decreased GSR frequency. Nursery-school children also showed a weak positive relationship overall, but could be reliably categorized as 'externalizers', 'internalizers', and 'generalizers'. Eleven to eighteen year olds revealed a clearer picture of inverse relationship, though, when GSR scores were related to personality trait judgements involving expressivity. High reactives were judged as quiet, reserved, and calm, while low reactives were regarded as talkative, active, and attention-seeking. Jones (1935) hypothesized that infants were generally extraversive with low expression thresholds, but later disapproval and punishment of such behaviour caused many to turn to internal channels to discharge emotional tensions (i.e. become internalizers).

Jones's work was not followed up for some time, although various studies obtained results consistent with his ideas of alternative discharge avenues. For example, Haggard and Freeman (1941) found that frustrated boys who reacted with more overt activity recovered from the upset more quickly. Also, Freeman and Pathman (1942) found that subjects who moved most in response to a pistol shot showed shorter skin conductance reactions.

It was not until Block (1957) that Jones's ideas were built upon. He undertook a substantial study comparing high and low GSR reactors on psychologists' ratings and personality inventory scores. Results generally supported the idea of autonomic reactivity being greatest in unexpressive subjects.

Learmonth, Ackerly, and Kaplan (1959) subjected 20 females to various physical, verbal, and auditory stresses, noted SC fluctuations, and compared these with a number of MMPI and Rorscharch scores. Again, of the 88 resulting correlation coefficients, the 19 that attained significance showed high autonomic reactors to be less expressive types.

The recent resurgence in interest in the field sprang largely from the work of Lanzetta and Kleck (1970) aimed mainly at comparing ability to express emotions accurately and ability to recognize others' emotions from nonverbal signs. Apart from being surprised to find that good encoders (accurate expressers) were poor decoders (judges of others), they also found them to be low skin conductance (SC) reactors to the threat of a shock.

Buck, Savin, Miller, and Caul (1972) also used a video sender/observer design with the expression variable being accuracy, but with slide stimuli. As they expected, the accuracy of the observers' pleasantness ratings of the slides that only the senders saw related inversely with the senders' SC and heart rate responsiveness.

A followup by Buck, Miller, and Caul (1974) again found autonomic responsiveness to be inversely related to nonverbal communication accuracy, but also in this case to number of slide descriptions rated as personal versus impersonal. They claimed that this showed that internalizers acknowledge their reactions less both facially and verbally.

Buck (1977) provided evidence to support the extension of these findings in weaker form to young children, which Jones (1935) had originally asserted.

Whereas Jones had preselected subjects for groups according to GSR reactivity, Notarius (1977) preselected natural facial expressers versus inhibitors by observer ratings. Subsequent exposure to a stressor revealed greater heart rate and respiration rate reactions among the facial inhibitors.

Finally, Notarius and Levenson (1979) repeated this result, again with preselected natural expresser and inhibitor groups.

Support for Proprioceptive Theories

It may have been noted in the previous section that all of the studies cited dealt with naturally occurring expressivity, either trait or situational. All results were subsequently correlational in nature. A number of recent studies, however, have looked at the effects of manipulating expressive behaviour as an independent variable in an experimental design.

Notarius (1977), already cited, went on in his study to ask half of each of his groups (natural expressers and inhibitors) to "post neutral" or "express naturally". Heart rate and respiration rate responses in this case varied *in direct proportion* to expressive behaviour.

Earlier, Lanzetta, Cartwright-Smith, and Kleck (1976) had completed a very comprehensive three-part study obtaining the same results. They found instructions to "hide" or "reveal" anxiety in anticipation of, and in reaction to, an electric shock proportionately modified SC and self-report of shock aversiveness in both sexes and at all shock levels.

A followup by Colby, Lanzetta, and Kleck (1977) again found posed expressivity directly proportional to SC responses, this time with shocks that increased in intensity until terminated by the subject.

Izard (1971) had suggested that individuals will voluntarily inhibit expressive behaviour when they know they are being observed. To test this hypothesis, and to assess the effect of this inhibition upon subjective and autonomic reactions to shock, Cartwright-Smith (1975) ran subjects who knew they were being observed. Compared to controls they showed less expressive behaviour, less self-report of shock painfulness, and less SC responding. The second part of this study included posing instructions, and again confirmed the proportional effect of facial expression on self-report and SC measures.

A followup by Kleck et. al. (1976) again found knowledge of being observed decreases expressivity, SC and self-report of shock pain, this time irrespective of the sex of the observer.

These studies show that manipulation of facial expression, whether upon instruction or in response to social cues, can modify autonomic and self-reported reactions to stress.

Laird (1974) goes a step further in claiming that facial expression can *produce* emotions as well as modify them. He manipulated facial patterns under the guise of studying muscle activity, and concurrently obtained self-reports of mood. All subjects who hinted at insight into the expression manipulation were eliminated. Higher aggression scores occurred during "frown" trials and higher elation, surgency, and social affection scores during "smile" trials. Also, viewing a film produced higher humour ratings during the "smile" condition.

However, several subsequent researches have qualified this finding. Firstly, Laird and Crosby (1974) in a two-session replication found no effect of "smile" versus "frown" in the first session. A significant effect did result in the second, and when subjects were divided into positive-expression-effect and no-expression-effect groups these were found to be consistent across sessions. The weaker effect was interpreted as being a result of possibly having fewer consistent positive-expression-effect subjects than Laird (1974). So already the claim of facial expression being able to *create* emotional experiences has become limited to some (allegedly consistent) individuals.

Kotsch (1976) worked with a greater range of facial manipulations: resemblances of anger, distress, and surprise, and incompatibles of each. "Anger", its incompatible, and "distress" all resulted in anger experiences. No other "expression" was effective. He suggested that the anger resulted either from an increase in general proprioceptive activity from any muscle tension, or was an artefact of the experimental procedure.

Finally, Colby, Lanzetta, and Kleck (1977) found that, although three levels of posing proportionately affected SC on shock trials, it produced no effect during nonshock trials. They concluded that facial expression can modulate arousal to shock but not initiate arousal in its absence.

Natural vs Manipulated Expressivity

It may be noted at this point that the evidence supporting the Discharge theories of emotion comprises correlational studies of observations of subjects' natural expressive tendencies and their autonomic and self-reported responses. The Proprioceptive evidence, on the other hand, consists of studies in which expressivity is experimentally manipulated.

Recognizing this distinction, several authors have attempted to provide explanatory hypotheses. Since the inverse expression - autonomic reaction relationship that has been found is correlational, attempts to align this with the positive relationship of experimental findings have offered intervening variables that can account for both an individual's lack of expressivity and abundance of autonomic response in some cases.

For example, Buck (1977) reversed the proposition by Jones (1960) that inhibition of overt expression in children via social disapproval leads to internal autonomic discharge. He argued from the stance of Eysenck (1967) and Gray (1972) that perhaps children who are autonomically arousable (introverts) are more conditionable and therefore learn better to inhibit overt expression. If this is the case 'internalizers' would be expected to be predominantly introverts. While Buck et. al. (1972, 1974) found this to be the case, Notarius (1977) and Notarius and Levenson (1979) could find no Extraversion score differences between their natural expressers and inhibitors.

Lanzetta and Kleck (1970) suggested that a history of punishment of affect expression may result in a decrease in such expressivity, but also a response conflict in succeeding emotional situations between expression and inhibition. This response conflict may increase autonomic arousal.

Buck et. al. (1974) preferred a modification of this hypothesis, implicating the remnants of the original stressful social learning experiences in subsequent autonomic arousal, rather than concurrent response conflict.

Both of these latter views draw support from the finding that, generally, adult females are externalizers and males are internalizers (Buck, 1976; Buck et. al., 1972, 1974) presumably due to the greater pressure of socialization on emotional expression upon males in our culture. Further, this sex difference is small among preschool children (Buck, 1975) with whom socialization has not completed its work, while expressivity declines with age among boys in this group, but not girls (Buck, 1977).

'Discharge' not Opposed to 'Proprioception'

To recapitulate, we have Jones (1960) presenting a 'discharge' theory of emotion according to which a stimulus will produce an emotional charge which needs to be dissipated by expressive or internal means. Since most individuals use one *or* the other an inverse relationship between expressive and autonomic reactions has been observed in many studies.

Block's (1957) explanation for the inverse relationship, however, when examined carefully reveals itself to be *very* different from Jones's (see Table 1). His assertion that autonomic reactions do not 'discharge' emotion, but that cognitive or expressive processes do, means that two inverse relationships could be noted: the preference for cognitive *or* expressive discharge; and the subsequent effect of either, with time, on the visceral indicators of emotional discharge.

The 'proprioceptive feedback' theories on the other hand claim that expressive reactions will be accompanied by *greater* autonomic arousal. Note that this assertion is *not* strictly in direct opposition to the idea of 'discharge' with time. It refers to the expected relationship between overt and autonomic behaviour during the experience of emotional stimulation, as does Jones' theory. But without his context of eventual discharge.

Therefore the opposition of the terms 'discharge' and 'proprioception' is somewhat misleading in the current context of inverse versus direct proportionality of expressive and autonomic reactions subsequent to emotional stimulation.

<u>Concurrent versus Resultant Measures</u>

Attempts to reconcile the research findings of an inverse relationship in naturally occurring reactions and a positive relationship in instructed reactions have postulated some feature of learning history that has inversely linked expressive and autonomic behaviour to a sufficient degree in some situations to override the ordinarily-occurring proportional link between the two, whether it be conditionability, the remnants of numerous punishment experiences, or a developed response conflict.

This has all been on the assumption that the naturally occurring inverse relationship has been substantiated. However, the analysis presented above reveals a point of confusion not yet recognised in the literature. The term 'discharge' does *not* refer to the inverse relationship between expressive and autonomic reactions to emotional stimuli in Jones's scheme. It refers to the decrease in the *sum* of these reactions with time that Jones would expect.

Therefore, to test the existence of the inverse relationship it is important to take expressive and autonomic measures at exactly the same time. It is possible that naturally occurring concurrent expressive and autonomic reactions are proportional, but that later measurement of autonomic reactions (after some discharge) appear inverse to earlier expressive measures. With regard to Block's two alleged inverse relationships, testing requires simultaneous assessment of somatic and cognitive reactions and later assessment of the autonomic result.

That this important variable has been overlooked is especially surprising considering the long history of recognition of the importance of time sequence in anxiety reactions. In 1950 Malmo, Shagass, and Davis found that EMG reactions to auditory stress among psychoneurotics with prominent anxiety problems were similar initially to a control group, but persisted and peaked much later. Wing (1964) found a similar comparison with SC as the dependent variable. Martin and Sroufe (1970) reviewed parallel findings with blood pressure and GSR conditioning studies.

Meyer and Reich (1978) alleged that cognitive factors determined these differences in course of reaction. Perhaps, then, cognitive and/or expressive and/or visceral discharge occurs differentially among different groups and explains the course of autonomic arousal levels. Thompson (1981) in a review of behavioural and cognitive control and stress reactions saw fit to deal separately with the effects of cognitive controls such as denial, distraction, and reappraisal on anticipation, impact, and post-event periods.

A Reinterpretation of Results of Natural vs Manipulated Studies

An alternative interpretation of the contradictory experimental and correlational results obtained can be drawn from the above insights. It is suggested that the immediate link between expression and autonomic reaction is positive, but that studies of natural reactions have measured autonomic arousal at a point in time after onset of stress when some discharge due to expressive reactions could have occurred. When the prospect of a stressor is known to a subject this onset occurs at the beginning of anticipation. It is important, then, to take autonomic measures as soon after this point as practicable (*concurrent* arousal) as later arousal (after prolonged anticipation, or after onset or termination of the stressor) can be expected to be an *inverse* function of earlier expressive discharge (*resultant* arousal). That is, inhibitors would discharge less effectively.

The first test of this interpretation requires inspection of the natural reaction studies to assess the possibility that resultant, and not concurrent, autonomic arousal has been related to expressivity.

The work of Haggard and Freeman (1941) and of Freeman and Pathman (1942) give the first clear answer. As outlined earlier, in both studies subjects who reacted very expressively gave the shortest autonomic responses. This has been interpreted as meaning the least responses but does not mean this at all. Expressivity and autonomic responsiveness could well have been proportional during anticipation and at the point of reaction. Greater discharge with greater initial expressive and autonomic response would then explain the briefer response.

In Block's (1957) study rated expressivity-type traits differed between a group of high GSR reactors and low reactors. Reactivity was assessed from continuous SC monitoring during a lie-detection situation.

Clearly here resultant autonomic reactions (those affected by expressive discharge over time) as well as concurrent ones were measured, and, given the nature of the assessment situation, these longer term effects could well have been predominant.

Learmonth, Ackerly, and Kaplan's (1959) expressivity measures were again personality trait scores. Palmar skin potential reactivity was continually assessed during periods of verbal stress (e.g. intimate questions) and physical stress (e.g. gunshot, electric shock, cold pressor). Again, like Block, autonomic reaction scores did not differentiate anticipatory (concurrent) or post-stimulus (resultant) reactions, nor were they taken with simultaneous expression measures.

The series of studies by Buck and his colleagues (Buck, 1977; Buck et. al., 1972, 1974) employed slides as stimuli. Autonomic reactions were assessed after introduction of the slides, and later during subjects' descriptions of reactions to slides. Expression ratings were found to relate to SC responses in the ten seconds after slide presentation, and to heart rate responses only when subjects were later describing their reactions. Once again post-stressor reactions seem more involved than anticipatory or immediate reactions.

Notarius and Levenson (1979) found rated facial expressions and concurrent heart rate and respiration rate reactions to an impending electric shock were inversely proportional. However, a major methodological feature of this study makes it very different from all others in the area, and also makes its results difficult to interpret. The impending shock was avoidable, simply by ringing a buzzer. Such behavioural control over a stressor has been shown in several studies to reduce anticipatory autonomic arousal and self-reported anxiety, increase tolerance of noxious stimulation, and reduce interference on concurrent tasks, while not reliably affecting experienced painfulness of the actual stimulus. (For a review, see Thompson, 1981.) Also Averill, O'Brien, and deWitt (1977) found that availability of an avoidance response increases vigilance in the situation, which in turn may have effects on arousal (and expressivity?).

Therefore, of the studies previously cited, only that by Lanzetta and Kleck (1970) remains clearly in support of a concurrent inverse relationship between facial expression and autonomic arousal to the prospect of an unavoidable noxious stimulus. Their SC measures were taken during anticipation of electric shocks, with facial expressivity assessed for the same time period, although indirectly via attempted identification of shock and nonshock trials.

We are left, therefore, with at least two possible schemes. Given that instruction to facially express increases autonomic arousal for whatever time period those instructions are followed, the discovery of an inverse relationship can occur if either (a) measures are not taken concurrently, and a 'discharge' effect is thus detected, or (b) subjects' conditioning histories overrule this directly proportional relationship in some situations.

To assess these alternatives this experiment will incorporate two distinctive features. Firstly, in all conditions autonomic measures will be taken both in anticipation of shock and immediately post-shock. Secondly, in the case of the effect of instructions, such instructions will apply only to the anticipatory period. This will allow post-shock measures to address phenomena interpretable as 'discharge' effects. (See Research Hypotheses 5 and 7.)

The expressivity instructions of Lanzetta, Cartwright-Smith, and Kleck (1976) applied to both the anticipation and shock periods. The low anticipatory SC reaction and 'whole-trial' SC reaction correlation that they found (+.28) suggests that the SC reactions *to the shock itself* may not have aligned with anticipatory SC response even with shock expressivity instructions!

Interaction of Natural Tendency and Instructions

Only one of the studies cited thus far (Notarius, 1977) has attempted to observe the effects of natural expressivity and expression instructions on emotional indices with the same subjects. Unfortunately the combined effects of the natural and imposed expression variables were not noted.

Cunningham (1977) and Zuckerman, Larrance, Hall, De Frank, and Rosenthal (1977) found that subjects whose facial expression is clearly interpretable when not aware of monitoring (natural expressers) are also good senders when attempting formal nonverbal communication. This difference in degree of compliance with expression instructions between natural expressers and inhibitors may be expected to result in differences in the effects of those instructions on emotional indices.

This study will therefore attempt to confirm the effect of natural expressivity upon compliance with expression instructions, and will also look for any effects of this compliance disparity on emotional indices. (See Research Hypothesis 9.)

Cognitive Attention/Avoidance

In discussing the effects of expressive behaviour upon an individual's emotional reactions it seems reasonable to suggest that this behaviour has links in turn with cognitive activity at the time. One is unlikely to be grimacing while effectively ignoring a stimulus.

Let us therefore now turn to a review of the effects of cognitive activity upon reactions to stress, specifically of varying cognitive attention, in a search for parallels with the findings on facial expressivity.

Schachter

The first substantial cognitive theory of emotional reaction developed from the work of Schachter and his colleagues (Nisbett & Schachter, 1966; Schachter & Singer, 1962; Schachter & Wheeler, 1962). They manipulated the context (via stooges), autonomic arousal (via drugs and placebos), and cognitive appraisal of subjects (via information and misinformation), and found that the effect of context and autonomic arousal on emotional experience and overt expression depended upon the cognitive appraisal of both (see Table 2).

The similarities between this model and the self-attribution approach as represented by Laird (1974) can be seen in Table 2. The main difference, as Laird (1974) points out, is that expressive behaviour is seen by Schachter as merely a *result* of cognitive appraisal of visceral reactions and perceived context; Whereas Laird claims cognitive appreciation of one's expressive reactions to be a *determinant* of subjective emotional experience.

Cognitive Reappraisal

The most substantial followup to Schachter et. al.'s work has been undertaken by Lazarus and his colleagues (Lazarus, 1966, 1974; Lazarus & Alfert, 1964; Lazarus, Opton, Nomikos, & Rankin, 1965; Lazarus, Speisman, Mordkoff, & Davison, 1962; Speisman, Lazarus, Mordkoff, & Davison, 1964).

Their methodology involved the observation of autonomic and self-reported reactions to stressful films subsequent to various manipulations of verbal description of the visual content of the films. They found that commentary or introduction that denied or intellectualized the content of the films resulted in lower arousal responses than no-commentary or trauma-emphasis.

Although the model of emotional reaction built upon this work (see Averill, O'Brien, & Lazarus, 1969) is not as broad as Schachter's - for example it deals only with negative emotions (Shapiro & Schwartz, 1970) - it is totally consistent with Schachter (Lazarus et. al., 1965).

However, several problems have been noted in these findings. Firstly, it has been pointed out in several commentaries that the reappraisals were imposed by the Experimenter and therefore changed the actual nature

Table 2

Cognitive Theories of Emotion

Source	Model	Explanation
Schachter	Context $\Rightarrow C \Rightarrow S^T,F,B$	Type of emotional state and expressive behaviour depends upon cognitive appraisal of context.
	$V \Rightarrow C \Rightarrow S^D,F,B$	Degree of emotional state and expressive behaviour depends upon cognitive appraisal of autonomic arousal.
Laird	$F,B \Rightarrow C \Rightarrow S^T$	Expressive behaviour affects the self-attribution of the quality of felt emotion.
	$V \Rightarrow C \Rightarrow S^D$	Autonomic arousal affects the self-attribution of intensity of felt emotion.

Note: F = Facial expression) Skeletal reaction
B = Body posture) (Expressive behaviour)
V = Visceral reaction
S = Subjective reaction S^T = type of S^D = degree of
C = Cognitive mediation

of the stressor (Bloom, Houston, Holmes, & Burish, 1977; Holmes & Houston, 1974; Koriat, Melkman, Averill, & Lazarus, 1972). Effects of the commentaries probably reflected levels of Experimenter credibility and the effects of modeling, rather than of self-generated reappraisals of threat.

To overcome this problem, Koriat et. al. (1972) simply asked subjects to try to involve or detach themselves from an industrial accident film. Autonomic and self-report measures showed attempts at involvement to result in more arousal than attempts to detach, although the latter tended to also be more stressful than a no-instructions condition.

Holmes and Houston (1974) instructed subjects to 'redefine' a threatened shock stimulus, or to try to 'isolate' themselves from it, without ignoring its existence. Both strategies resulted in heart rate, SC, and self-reported anxiety reactions intermediate between a no-instruction condition and a no-threat condition.

These two studies therefore overcome the problem of *imposition* of an attitude toward threatening stimuli in supporting the effectiveness of cognitive reappraisal in coping with stress.

A second problem with the Lazarus et. al. studies actually finds support, however, from the Koriat et. al. (1972) findings. It has been suggested that the vicarious type of stress imposed by a film may interact with various coping strategies differently from more direct stressors such as the threat of electric shock (Bloom, Houston, Holmes, & Burish, 1977; Holmes & Houston, 1974). Koriat et. al (1972) had found that the most common involvement and detachment strategies employed by their subjects were imagining the film was happening to oneself, and reminding oneself that it was all just a film and not real. This criticism therefore stands as a limitation on the generality of the Lazarus et. al. findings.

Another feature of their findings, however, has most relevance to the issues of this paper. In none of their work was the degree of attention to the stressor a variable. Even when detachment was encouraged attention was still expected to be maintained, while interpretations of the content were allowed to vary. Lazarus (1974) himself distinguishes "coping", which includes direct action on the stressor and intrapsychic defense mechanisms such as reappraisal, from "direct control" over one's visceral and motor reactions via drugs or diversion of attention.

The Schachter and Lazarus findings, therefore, suggest that since cognitive mediation can influence aspects of emotional reactions, varying attention to stimuli should also affect such reactions. To find the direction of these effects we need to look at other researches dealing more directly with the degree of attending itself.

Repressers versus Sensitizers

Byrne (1961) developed a scale from the MMPI that attempted to differentiate people according to their manner of response to threatening stimuli. Several early studies with this R-S scale found 'repressers' verbalize their anxiety less than 'sensitizers' (Byrne, 1961; Byrne, Barry, & Nelson, 1963; Ullman, 1962). Some subsequent work has been interpreted to suggest that repressers at the same time may show more autonomic disturbance.

However these interpretations have been dubious. For example, while Lazarus and Alfert (1964) found several MMPI scales (K, Dn, R) to directly relate to autonomic and inversely relate to self-report indices of reaction to a film, they found R-S to relate significantly only to the self-report measures. Hare (1966), undeterred, cites this as an indication that repressers show more autonomic disturbance. He went on to find that R-S correlated significantly with only two out of five autonomic reaction measures, one of which was a baseline measure. Scarpetti (1973), in a similar study, discovered that while sensitizers reported significantly more anxiety, repressers reacted more autonomically on only two of seven variables, again one being a baseline measure.

An explanation for these confusing findings may be found in Weinstein, Averill, Opton, and Lazarus (1968). They analyzed the amalgamated data from six studies, including Lazarus and Alfert (1964), and found that the apparent autonomic/self-report discrepancy between repressers and sensitizers lay entirely in the self-report area, and that overall autonomic reactions are similar across groups. They suggested that the high correlations often reported between inventory measures of repression-sensitization (K, Dn, R, and R-S) and self-reported anxiety may result because these dimensions are largely the same.

Support for this interpretation has since emerged. If R-S is defined situationally using self-report/autonomic reaction discrepancy scores from the experimental situation, then "deniers'" performance on Digits Backward is affected less by stress than "accentuators'" (Houston, 1971; Houston & Hodges, 1970). Also, when MMPI Dn scores are adjusted for Taylor MAS scores, then, opposite to the results of Lazarus and Alfert (1964), high deniers perform better on Digits Backward than low deniers (Houston, 1971, 1972). Further, their heart rate reactions are smaller and their Affect Adjective Checklist scores are similar (Houston, 1972).

In summary, inventory measures of attention to stressful stimuli were for some time misleading in suggesting that attending is accompanied by decreased autonomic reactions, for they were confounded by a close relationship to subjective anxiety. Adjustment for this reveals trait and situational denial to be beneficial to autonomic reactions and concurrent task performance, but only under stress (Houston, 1971, 1972).

<u>Situational Measures of Attention</u>

Some parallel work has employed situational measures of degree of attention to threatening stimuli instead of inventory measures of trait denial. The results of such correlational studies have been mixed.

Wolff, Friedman, Hofer, and Mason (1964) found that parents of children dying of leukemia who did not acknowledge this situation totally showed lower serum hydrocortisone levels (i.e. less stress reaction). The surgical patients studied by Cohen and Lazarus (1973) who coped by avoidant means recovered more quickly, developed fewer complications, and requested less pain medication than their vigilant or confrontive counterparts. Monat, Averill, and Lazarus (1972) observed that, while anticipating an electric shock, the course of their subjects' attention levels was paralleled by the course of their autonomic arousal levels as it varied according to shock probability at different times.

The aforementioned work suggests that attention to threat is accompanied by greater arousal. However, Hare (1966) found significant negative correlations between anticipatory SC measures and a post-experimental questionnaire measure of cognitive attention while waiting for a recurring electric shock. That is, avoidance accompanied greater autonomic arousal. The "avoiders" in studies by Andrew (1970) and De Long (1971) showed poorer recovery from surgery than either "copers" or "nonspecific defenders". Also, Averill and Rosenn (1972) found that subjects who elected not to attend to a warning signal (nonvigilant) showed greater autonomic arousal in anticipation of a shock than vigilant subjects. Unfortunately direct self-report of attention deployment did not correlate significantly with selection of vigilant and nonvigilant strategies. A followup by Averill, O'Brien, and de Witt (1977) found that selection and effectiveness of a vigilant strategy (listen for warning) depended upon the availability of a means for shock prevention. Vigilance increased with this availability, but attention deployment decreased! The Averill et. al. findings are hard to compare with other findings, therefore. Finally, Barrell and Price (1977) found subjects classifiable as cognitive 'contronters' reacted more on an EMG measure and cognitive 'avoiders' more on a heart rate measure to a threat of electric shock. Again avoidance and autonomic reaction varied proportionately.

The reason for the inconsistency in results relating naturally occurring cognitive attention/avoidance and autonomic reactivity may be the same as was the case with inventory measures of cognitive approach (MMPI Dn, R-S, etc.). As Monat, Averill, and Lazarus (1972) have pointed out, perhaps situations that are inherently more stressful lead to both less attending and greater autonomic arousal. Then the nature of the attention/ autonomic relationship is hidden by the overwhelming intervening variable of level of perceived threat. As was the case with the inventory measures, attention scores may largely be a function of subjective anxiety.

It is therefore more likely that the true effect of cognitive attention upon autonomic reactions will be revealed by experimental, rather than correlational, studies.

Experimental Studies of Attention

In noting studies on the effects upon autonomic arousal and subjective anxiety of manipulation of cognitive attention, it is important and sometimes difficult to separate reappraisal conditions (as per Lazarus et. al.) from attentional diversion.

A substantial body of work has been reviewed by Scott and Barber (1977) indicating that cognitive strategies of suggestion of analgesia can decrease the magnitude of self-reported pain or increase subjects' tolerance thresholds, whether hypnotic induction is used or not. Among these studies instructions can subtly, but importantly, vary. For example, Spanos, Horton, and Chaves (1975) found that imagining the heat of a desert increases tolerance threshold to cold pressor pain, which is reappraised as relievingly cool, more than an irrelevant attentional diversion, although both are effective strategies. However, Chaves and Barber (1974) found with pressure pain that imagining irrelevant pleasant experiences is as effective in decreasing self-reported pain as is imagining analgesia.

These precise comparisons involve many instructional variables (relevant vs irrelevant, pleasant vs neutral, reappraise stimulus or pain, etc.), but overall the effectiveness of both cognitive reappraisal and attentional diversion in controlling the experience of pain is supported.

Such overall conclusions have led to the development of combined treatment packages, which not surprisingly show better results than single strategy treatments when compared on group results (Scott & Barber, 1977).[1] The subsequent theoretical formulations of Beck (1976), Meichenbaum (1977), and others have further resulted in the application of self-control cognitive treatment packages such as Stress Inoculation Training (Meichenbaum, Turk, & Burstein, 1975) which have been shown to be useful with a wide range of problems (see Holroyd & Andrasik, 1978, for a review).

In 1974, Houston and Holmes obtained a surprising result. Subjects who had been instructed to avoid

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[1] Components of such packages can include: (a) attention diversion, (b) dissociation from pain, (c) reinterpretation of pain, (d) imagining numbness, (e) reappraisal of context, or (f) somatization. (Klepac, Hauge, Dowling, & McDonald, 1981; Scott & Barber, 1977).

thinking about the prospect of an electric shock showed greater autonomic disturbance, though not self-reported, than non-avoidant-thinking subjects. Rating post-experimental questionnaires, they found less cognitive reappraisal of threat in the avoidant-thinking group. They suggested that avoidant thinking may be useful only in unambiguous situations in which reappraisal is not possible.

It may be remembered that a limitation of the Lazarus work with cognitive reappraisal of film stimuli was the vicarious and ambiguous nature of the threat. Reappraisal would have been facilitated, in contrast to avoidant thinking, in this case.

Bloom (1975) found with threatened electric shock that, among his subjects, instructions for avoidant thinking (read a story) reduced stress as per autonomic and self-report measures, but situational redefinition (write reasons not to be nervous) did not. If the ambiguity hypothesis is correct, Bloom's work suggests that threat of shock has the potential to be unambiguous and best dealt with by avoidant thinking. Houston and Holmes' (1974) subjects had received no actual shocks throughout their study and thus retained stimulus ambiguity.

To assess this possibility Bloom, Houston, Holmes, and Burish (1977) gave subjects sample shocks before commencing baseline trials. They also demanded evaluation and improvement of the story read as a diversion, thus making this a more active cognitive avoidance behaviour. Bloom et. al. (1977) found that, while attentional diversion instructions decreased autonomic reactivity, situational redefinition did not.

In summary, while correlational studies have been inconsistent, most probably due to the effects of confounding variables, experimental work has shown that avoidant thinking decreases immediate autonomic arousal levels, especially where the threat is unambiguous, and therefore not readily amenable to reappraisal.

Concurrent versus Resultant Measures

The same issue of timing as arose with the effect of overt expression upon autonomic reactions may be relevant in studying the effect of cognitive attention-avoidance.

Janis (1958) introduced the idea of the "work of worrying". He suggested that attending to a threat allows mental rehearsal and the development of realistic reassurances that prevent surprise, disappointment in protective authorities, and feelings of helplessness. In support, he found avoidant surgical patients showed less preoperative anxiety but also less favourable postoperative attitudes.

It has since been discovered that, while the parents of children dying of leukemia profit from avoidance prior to the child's death (Wolff et. al., 1964), they seem to suffer more afterward (Visotsky, Hamburg, Goss, & Lebovits, 1961; Chodoff, Friedman, & Hamburg, 1964). Also, students who use avoidant strategies to cope with examination anxiety have less test anxiety but poorer exam performance (Houston, 1977). Langer, Janis, and Wolfer (1975) found provision of preparatory information to surgical patients initially increased anxiety levels, but that this effect dissipated with time. Cohen and Lazarus (1973) suggested that avoidance may yet be the preferable strategy if a positive outcome to the stressful situation is possible.

No study yet seems to have manipulated cognitive attention-avoidance to investigate the subsequent effect upon clearly distinguished anticipatory and post-shock arousal. The present work shall attempt to do this. (See Research Hypotheses 6 and 8.)

Interaction of Natural Tendency and Instructions

A more specific question, rarely addressed thus far, concerns the relative effectiveness of avoidant thinking instructions between people who habitually use this strategy and those who do not.

Speisman et. al. (1964) and Lazarus and Alfert (1964) found that subjects scoring high on MMPI DN seemed to benefit most from a 'denial' soundtrack on a film. The import of this finding is limited by the aforementioned problems of subjective anxiety affecting Dn scores, and the situational 'denial' being imposed.

On top of this, though, Andrew (1970) found that the recovery of surgical patients who were cognitive "avoiders" was slower when they were given preparatory information than when the same information was provided post-operatively, while vigilant "copers" recovered well regardless of when this information was conferred. De Long (1971) provided patients with either surgery-specific or general-hospital information before surgery. The benefit of specific over general information in terms of recovery complications and time to discharge was greatest among cognitive "copers".

Finally, Auerbach, Kendall, Cuttler, and Levitt (1976) found that the adjustment to dental surgery of internal locus of control subjects was aided by specific preparatory information; that of external locus of control subjects by general information.

In this study, therefore, the reactivity of natural cognitive avoiders and confronters ("copers") will be compared under instructional conditions of attending and non attending. Whether compliance with instructions can explain any differences will be assessed also. (See Research Hypothesis 10.)

Facial Expression vs Cognitive Attention

When Laird (1974) claimed to find that the manipulation of subjects' facial expressions without their awareness of the similarity to smiling and frowning caused parallel changes in mood, he cited this as support for the idea that people interpret their behaviour in context and attribute to themselves emotions accordingly. He saw his subjects as saying to themselves: "I am frowning (or smiling), and I don't have any non-emotional reasons for frowning, so I must be angry" (Laird, 1974, p.484).

Two errors are apparent here. Since all subjects giving a hint of experimental awareness were eliminated, none could have said, even to themselves, "I am frowning". Secondly, subjects *did* have nonemotional reasons for 'frowning': the Experimenter had told them to tense a certain set of muscles.

Laird's results actually supported the notion of a direct neuronal link between facial expression and emotional experience, contrary to his conclusions.

However, the failure to replicate Laird's results on the production (versus modification) of emotional experience by facial manipulations means that, although he unwittingly cast doubt on the relevance of cognitive mediation, its importance remains a possibility.

Noting the many parallels between the work on the effect of facial expression and of cognitive attending upon autonomic reaction and emotional experience, the question arises as to whether one of these is a direct determinant and the other only indirectly effective, through the first. In only the Laird stream of studies was one of these (attending or expressing) a concurrently controlled variable, and results here were inconclusive.

Several indications have emerged that in other studies covariance occurred without proper recognition. Barber and Hahn (1962) found that instructions to imagine pleasant experiences decreased not only self-reports of pain and respiratory irregularities, but also frontalis EMG. This latter variable bears an obvious relationship to facial expression. Buck et. al. (1974) found that externalizers (expressers) gave more personal descriptions of their stress experiences (were more attentive?). Subjects categorized as cognitive 'confronters' by Barrell and Price (1977) showed significantly greater EMG responsiveness to stress than their 'avoiders'.

The possibility that the effects of expressivity may be mediated by cognitive activity was acknowledged by Notarius and Levenson (1979). In support they referred to the large amount of evidence suggesting that personality differences exist between people who are expressive and those who are not (Block, 1957; Buck, 1975; Buck et. al., 1972, 1974; Crider & Lunn, 1971; Jones, 1950; Learmonth, Ackerly, & Kaplan, 1959; Notarius, 1977; Notarius & Levenson, 1979).

When Cartwright-Smith (1975) introduced the presence of a camera to his subjects, he found that the effects of posing upon autonomic and self-reported arousal were more pronounced, even though the degree of expressivity shown did not significantly change. He postulated the mediation of "unspecified cognitive processes".

Lanzetta, Cartwright-Smith, and Kleck (1976) presented several arguments against the possibility that the effects of expression manipulations they found were due to cognitive mediation. They claimed that their design allowed too little time between trials for reappraisal of the shock threat to occur, especially as 'pose no shock' and 'pose intense shock' trials were intermixed. However, this argument cannot apply to subjects' attention/avoidance. Direction of attention, unlike cognitive appraisal, can be changed as quickly as facial expression.

They also argue that no reference was made to cognitive reappraisal in their instructions. This point begs the question. No mention is made of facial expression in cognitive attention/avoidance studies either, but Lanzetta et. al. (1976) still go on to claim that the effects of cognitive manipulations are most likely mediated by subsequent expressive behaviour changes.

Therefore, it is yet to be determined whether the effects of facial expression upon autonomic reaction and emotional experience are a result of mediating cognitive factors (specifically attention/avoidance), or whether the effects of cognitive attention to a threat are a result of the mediation of expressive behaviour. It is also possible that both may be independently effective determinants (see Figure 1). (See Research Hypotheses 1, 2, 3, and 4.)

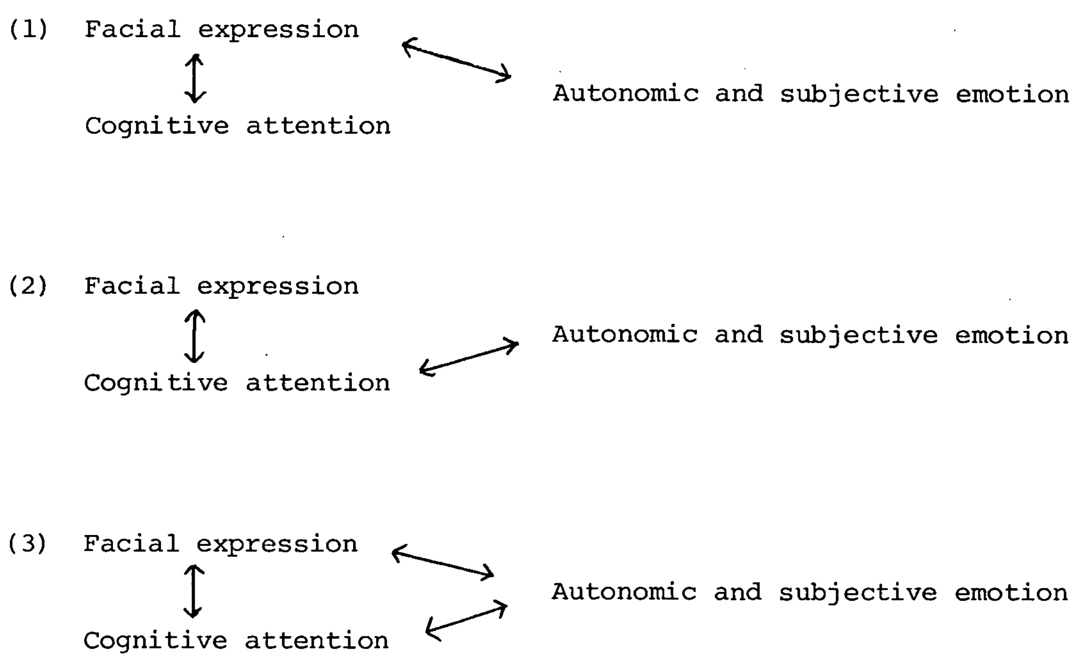

Figure 1. Three Alternative Schemes of Emotional Causation.

Research Hypotheses

This review has produced four major unanswered questions:

(a) Are the effects of natural or manipulated *facial expression* upon concurrent emotional reactions a result of the mediation of levels of *cognitive attention*, or vice versa, or are both independently effective? (Research Hypotheses 1, 2, 3, and 4).

(b) Do the *concurrent* and *resultant* effects of natural or manipulated facial expression or cognitive attention differ? (Research Hypotheses 5, 6, 7, and 8).

(c) Do *natural* patterns of facial expression or cognitive attention differ in their effect upon concurrent or resultant indices of emotional reaction from *manipulated* patterns? (Research Hypotheses 1 vs 3, 2 vs 4, 5 vs 7, and 6 vs 8).

(d) Do individuals' natural tendencies to express/inhibit or attend/avoid affect compliance with and/or the effects of expressive or cognitive instructions? (Research Hypotheses 9 and 10).

If natural patterns of facial expression and cognitive attention are to have the potential for explaining each other's effects, then it must be shown that they occur in parallel:

> *Research Hypothesis 1:* Natural facial expressivity will vary in direct proportion to natural cognitive attending.

On the assumption that cognitive attention is the more immediate and direct determinant of emotional reaction, and that facial expression is effective only in as much as it reflects or affects cognitive attention:

> *Research Hypothesis 2:* Measures of natural cognitive attending will relate more closely to concurrent indices of emotional reaction than measures of natural facial expressivity.

From R.H.1 we may expect a similar tendency toward parallelism in cognitive and expressive behaviour under instructional conditions:

> *Research Hypothesis 3:* Compliance with instructions to facially express while cognitively avoiding, or to cognitively attend while facially inhibiting (inconsistent instructions) will be reported as more difficult than compliance with instructions to facially express while cognitively attending, or facially inhibit while cognitively avoiding (consistent instructions).

Again assuming cognitive activity to be the more direct determinant of emotional indices:

> *Research Hypothesis 4:* Instructions to attend or avoid will proportionately affect concurrent emotional reactions to a greater degree than will facial expression instructions at the time.

The present review has suggested that the finding of an inverse relationship between natural expressivity and autonomic and self-reported reactions may be a result of measurement that is not concurrent. Therefore, if concurrent anticipatory and resultant post-shock measures are taken separately, we may expect:

> *Research Hypothesis 5:* If natural facial expressivity relates proportionately to concurrent autonomic and self-reported measures, it will relate inversely to resultant measures.

The weight of evidence concerning natural cognitive attending/avoiding points to a directly proportional effect on concurrent emotional indices. No study has further observed distinctly resultant arousal. Janis's "work of worrying" notion suggests that this latter variable may be inversely affected:

> *Research Hypothesis 6:* If natural cognitive attention relates proportionately to concurrent autonomic and self-reported arousal, it will relate inversely with resultant arousal.

Nor has any study limited expressivity instructions to the pre-shock period. If this is done the indications reviewed for a 'discharge' or rebound phenomenon suggest that, as occurs with natural expressivity patterns:

Research Hypothesis 7: If concurrent emotional indices are affected proportionately by instructions to facially express or inhibit, resultant measures will be affected inversely.

Janis's "work of worrying" phenomenon should be detectable when cognitive attention is controlled by instructions as much as when the natural tendencies of individuals are observed:

Research Hypothesis 8: If concurrent emotional indices are affected proportionately by instructions to cognitively attend or avoid, resultant measures will be affected inversely.

The results of tests of Research Hypotheses 1 to 8 should enable a comparison of naturally-occurring and experimentally-manipulated cognitive attending effects on concurrent and resultant indices. No substantial claims have been made in the literature that the effects of natural and imposed strategies differ. The finding of such a difference, contrary to Research Hypotheses 6 and 8, would be surprising.

However, as reviewed earlier, the contrast in results between correlational studies of natural expressivity and experimental studies of the manipulation of expressivity has led to explanatory hypotheses involving the 'weak nervous system' notion or the effects of a history of punishment of expressivity. The explanation which may emerge from this study, specifically Research Hypotheses 5 and 7, is a methodological one emphasizing the importance of seeing 'discharge' phenomena as occurring over time, not concurrently in different response spheres. That is, perhaps the effects of natural and manipulated expressivity are not different, but there has been a (justifiably?) greater interest in the *resultant* effects of natural expressivity patterns, and in the *concurrent* effects of instructed expressivity.

It has been suggested that natural expressers can follow expression instructions more fully than can natural inhibitors. This could possibly affect emotional reaction under expression instructions by affecting compliance levels, or by upsetting the normal pattern of response of individuals:

> *Research Hypothesis 9:* The pattern of emotional response subsequent to instructions to facially express or inhibit and/or the degree of compliance with these instructions will differ between natural expressers and inhibitors.

Some work has also suggested that natural cognitive tendency to attend or avoid may alter the effect of the imposition of these strategies:

> *Research Hypothesis 10:* The pattern of emotional response subsequent to instructions to

cognitively attend or avoid and/or the degree of compliance with these instructions will differ between natural attenders and avoiders.

Table 3 presents a summary of Research Hypotheses 1 to 10.

Table 3

Summary of Research Hypotheses 1 to 10

Classes of Independent Variables:

A. Allocation according to natural facial expression/inhibition.
B. Manipulated facial expression/inhibition.
C. Allocation according to natural cognitive attending/avoiding.
D. Manipulated cognitive attending/avoiding.

Classes of Dependent Variables:

E. Concurrent autonomic and self-reported arousal.
F. Resultant autonomic and self-reported arousal.

Symbols: $\propto$ = varies in direct proportion to

mct = more closely than

R.H. 1	:	$A \propto C$
R.H. 2	:	$C \propto E$ mct $A \propto E$
R.H. 3	:	$B \propto D$
R.H. 4	:	$D \propto E$ mct $B \propto E$
R.H. 5	:	If $A \propto E$ then $A \propto 1/F$
R.H. 6	:	If $C \propto E$ then $C \propto 1/F$
R.H. 7	:	If $B \propto E$ then $B \propto 1/F$
R.H. 8	:	If $D \propto E$ then $D \propto 1/F$
R.H. 9	:	Covariable A affects R.H. 7
R.H.10	:	Covariable C affects R.H. 8

Method

Subjects

Subjects comprised 24 volunteers, mainly motivated by interest, and despite forewarning of the involvement of mild electric shocks. Twenty subjects were acquired from or through the John Edis Hospital, Tasmania, and four were acquaintances of the Experimenter. None were patients of the Hospital. The group comprised 15 females and 9 males. Ages ranged from 19 to 58 years.

Apparatus

Skin resistance, ECG, and respiration were recorded upon a Devices M19 Recording System (8 channel version). Silver electrodes of area .785cm^2 were used. For skin resistance were used two 'active' electrodes upon the second-joint palmar surfaces of the index and third fingers of the left hand, and one 'earth' upon the left ear lobe. For ECG, two 'active' electrodes upon the right lateral ankle and left medial wrist surfaces, and one 'earth' on the left mastoid process. Respiration recordings were obtained via a mercury-in-rubber strain gauge placed around the chest at sternum level.

Electric shock was administered from a privately-constructed generator via two electrodes placed 1.5 inches apart slightly above the left lateral ankle. Shock intensity could be varied by current change according to a 0-10 scale, of which levels 7-10 did not actually exist in the machine.

Warning of impending shock came from a single 2.2 watt globe placed on the table immediately before the subject, with a control switch in the adjoining Experimenter's room.

Video recordings of each subject from the chest up were obtained using a black-and-white Sony video camera placed 2.5 metres in front of the subject and a Sony video recorder, controlled entirely from the Experimenter's room.

Procedure

The procedure for all subjects was identical, except in counterbalancing the order of trials under instructions in Part Two.

Subjects were briefly shown the entire laboratory situation and ushered to a chair where the skin resistance and ECG electrodes and respiration strain gauge were attached. A brief explanation of equipment was given at this time, including a casual reference to the video camera "to be used to check the following of some instructions later on". The camera was not touched throughout this period.

The shock electrodes were then attached and the shock control box brought in. The subject self-administered shocks of increasing intensity until a level was reached which was to be ruled the limit of intensity the Experimenter could use. (*All* subsequently administered shocks were at one level below this self-determined maximum.) The effect and nature of the shocks were discussed and a Consent to Shocks Form offered. All subjects agreed to sign this form (see Appendix A).

The shock control box was removed to the Experimenter's room and the subject asked to relax and settle while the polygraph (and video recorder) was switched on to begin recording (4-5 minutes).

Then it was explained that four shocks of varying intensity would be administered at intervals of about one minute. The warning light would come on at a time some 20-25 seconds before each shock. The subject was asked to mark two linear scales immediately following each shock (see Appendix B). One was a fear thermometer of 0-10 about the anticipation period of 20 seconds while the light was on (Walk, 1956), and the other an estimate of the intensity of that particular shock. (All were actually at the same intensity.)

This procedure was then followed. Upon completion of four trials a questionnaire was presented asking subjects to indicate on a scale of 1 to 5 how much anticipation time they had spent thinking about the prospective shock, thinking of other things, or trying to reappraise the shock. An indication was also requested as to whether such behaviour was completely natural or was a consequence of a conscious policy developed to cope with the experimental situation (see Appendix C).

It was then explained that eight similarly structured trials were to follow. However, for these trials anticipation periods (with light on) would be 30 seconds, to allow time to follow instructions concerning facial poses and direction of thoughts. Eight instruction forms in an order counterbalanced across subjects were presented and explained (see Appendix D). Each told subjects on a particular trial to facially 'express' or 'hide' and to mentally 'attend' or 'avoid'. It was explained that expressing meant posing a facial expression that would appear to a rater of the video to be obviously worried. Hiding was defined as showing a blank, unemotional face to the video. Attending was described as thinking about the prospect of shock, its intensity, where it was to occur, etc., and avoiding meant thinking of anything irrelevant to the situation.

The instruction forms again had facility for self-rating of anticipatory fear and shock level estimation after each shock, but also this time feedback concerning degree of compliance with the cognitive instructions (see Appendix D). (Compliance with facial express or hide instructions was to be rated from the video recordings.)

Again the polygraph and video recording were commenced, the latter this time being acknowledged, and after two minutes the warning light signalled the start of the first trial of Part Two.

The four combinations of facial and cognitive instructions were counterbalanced across the 24 subjects such that every possible trial order was used (see Appendix E). Each subject experienced their own order of trials twice to complete eight trials.

Finally, as the electrodes were removed subjects were debriefed concerning the two deceptions in the study: (a) the actual equivalence of the level of all shocks administered; and (b) the use of the video recorder in the first 'natural observation' phase of the study.

With regard to this latter deception, firstly all subjects were offered the option of having this part of the recording erased. None took up this option. And secondly, all subjects were queried as to the degree of suspicion they held concerning the camera during these four trials. Nineteen subjects reported no suspicion whatsoever. Five reported "slight" suspicion, and one "some" suspicion. This uncomplicated deception was generally very successful and avoids the elaborate deceptions used by others.

Methodological Notes

Studies employing electric shock generally follow two types of level determination: the administration of a standard level to all subjects; and determination of levels by subjects themselves. There were three main reasons for the choice of the latter strategy in this study. Firstly, the findings of Bloom, Houston, Holmes, and Burish (1977) suggested that pre-trial experience of shocks makes them a less ambiguous stimulus and therefore more amenable to avoidant thinking than reappraisal. Secondly, some adaptation effects may be dissipated by this pre-trial experience (Epstein, 1976). And thirdly, the ethical issues surrounding electric shock administration are decreased by subject-determination of maximums.

The fact that electric shock is a relatively rare real-life stressor is made less relevant by numerous findings of the effective equivalence of different stressors (Brown, Fader, & Barber, 1973; Davidson & McDougall, 1969; Learmonth, Ackerly, & Kaplan, 1959; Scott & Barber, 1977).

The facial and cognitive instructions were relatively brief. It may be suggested that significant effects can only be expected when elaborate training in such strategies is given. However, Scott and Barber (1977) found that the effects of 3 minute and 45 second cognitive instruction packages were equivalent and successful on all dependent variables on both cold and pressure pain. This is not surprising if we consider that the strategies employed are very common in people's lives, even if rarely labelled.

Measurement of natural cognitive attending/avoiding in the first part dealt with *time spent* attending to relevant and irrelevant issues (see Appendix C). Two possible flaws in previous attempts to measure natural attending were consciously avoided. Firstly, confusion of reappraisal and nonattending, as has often occurred in such questionnaires (Averill, O'Brien, & De Witt, 1977; Averill & Rosenn, 1972), was avoided by clear separation of questions. Secondly, the possibility that subjective anxiety is the predominant variable actually measured was countered by asking about *time spent* in activities, a relatively objective variable, as detailed by Monat, Averill, and Lazarus (1972).

Rating and Scoring Procedures

Responses to the direction of attention questionnaire provided after the four noninstructional trials (see Appendix C) were scored by subtracting the scale number indicating amount of time spent thinking of irrelevant issues (1-5) from the corresponding number reporting amount of time spent thinking about the impending shock (1-5). The resulting score for each subject had a potential range of +4 to -4, and was labelled *Avcon* (Avoid/Confront). Scores of +1 to +4 indicated 'confronters', -1 to -4 were 'avoiders', and 0 scores comprised a middle group.

Video records of the anticipation and shock periods of these natural trials were rated by three independent raters for distress during anticipation of shock as revealed by facial expression (0-100) and degree of facial reaction to the shock itself (0-10). (See Appendix F for instructions to raters.) The agreement between raters for anticipatory distress was $r_{1,2} = .72$, $r_{2,3} = .78$, $r_{1,3} = .75$. For shock expressivity, $r_{1,2} = .94$, $r_{2,3} = .95$, $r_{1,3} = .89$. Ratings were subsequently averaged across raters for each subject and the resulting variables were labelled *Antex* (Anticipatory expressivity) and *Shex* (Shock expressivity). Each subject thus produced four Antex and four Shex scores, one per naturalistic trial, but only one Avcon score from the same trial block.

Self-reported anticipatory anxiety was assessed after each trial by means of the Fear Thermometer, ranging from "completely calm" to "absolutely terrified" (0-10). This variable was labelled *Anx* (Anticipatory anxiety).

Subjects determined their own maximum allowable shock intensity. These asserted maximums ranged from levels 2 to 6. All subsequent shocks to the individual were at one level below this, so actual levels administered ranged between subjects from 1 to 5. Facility for self-report of perceived intensity of each shock was individualized according to each subject's actual level such that the range provided on the self-report scale covered two units below and one unit above the actual level administered (see Appendix B). Each trial score on the variable *Shock* (Perceived shock intensity) was then calculated by subtracting the actual shock level administered from the reported perceived level. A positive Shock score then indicates an exaggerated perception of the shock's intensity. A negative Shock score results if the shock level was felt as less intense than it really was. All trial Shock scores are therefore controlled for actual level administered, with each subject having a rating on this latter variable also.

Each of the autonomic measures were assessed for the last 15 seconds before warning light to get a baseline level, the last 20 seconds before shock to get an anticipation level, and the 15 seconds immediately following shock to get a post-shock level. These periods were identified on the recordings by use of an event recorder channel. Separate baselines for each trial were obtained to minimize the effects of adaptation, changes in electrode conductance, etc.

ECG data were scored for average heart rate during the baseline, anticipation, and post-shock periods by counting beats and converting to a beats per minute standard. Only records showing a clear R wave were regarded as scorable. Heart rate during baseline subtracted from that during anticipation gave heart rate change subsequent to threat which was labelled *HRC1* (Heart Rate Change One). Rate change from anticipation to post-shock, corresponding to the effect of the shock itself, was labelled *HRC2* (Heart Rate Change Two).

Exactly the same process was applied to respiration recordings. Sensitivities were adjusted so that a 5-10mm pen deflection occurred on normal respiration. Resultant variables were *Resp C1* (Respiration Change One) for rate change from baseline to anticipation, and *Resp C2* (Respiration Change Two) for rate change from anticipation to post-shock.

Skin resistance data was processed somewhat differently. Sensitivity was set at 5mm of pen deflection representing 10KΩ of skin resistance change. Maximum and minimum resistance levels occurring within each of the time periods defined above were determined and the average of these two extremes obtained for each period. These averaged resistance scores were then converted to conductance levels by the formula: $10^6 \times 1/\text{Resistance}$. Resultant data were in μmhos. Then the change from baseline to anticipatory conductance for each trial was derived. This variable was labelled *SCR1* (Skin Conductance Response One). Subtraction of anticipatory conductance from post-shock levels gave *SCR2* (Skin Conductance Response Two).

Skin conductance measures are typically given in terms of conductance per unit of electrode area. This makes comparison between studies more valid. Since the same electrodes were used throughout this study this was not done. However, readers wishing to make the conversion may note the use of two active and one earth electrode, all of area .785 cm^2.

Physiological change scores have often been found to be affected by initial levels. Operation of the law of initial values (Wilder, 1950) necessitates the use of covariance adjustments. To assess the need for this procedure correlation coefficients were obtained between all change scores and their initial levels. These are listed in Table 4. None were or approached significance, and so covariance adjustments were considered unnecessary.

Table 4

Autonomic Initial and Change Score Correlations

Initial level	Change score	r [a]
Heart rate		
baseline	to anticipation	+ .03
anticipatory	to post-shock	+ .13
Respiration rate		
baseline	to anticipation	- .10
anticipatory	to post-shock	- .18
Skin conductance		
baseline	to anticipation	- .02
anticipatory	to post-shock	+ .30

[a] Required for significance: ± .41.

Initial analyses revealed responses to trial one (of the four) to be very much greater than to ensuing trials. This had been expected since, although self-administered shocks had been experienced, this was the first non-self-administered shock trial for all subjects. For this reason all subsequent analyses were undertaken only on data derived from trials 2, 3, and 4 of the natural condition. The omission of trial 1 had been intended from the outset as it was expected that initially *all* subjects would be attentive due to perceived experimental demand and situation novelty, and therefore the variable Avcon could not apply reasonably to this trial.

In the second part of the study the passive monitoring of variables Avcon and Antex was replaced by the active imposition of instructions to cognitively attend or avoid (*Att/Av*) and facially express or hide (*E/H*).

To assess degree of compliance with Att/Av instructions each post-trial self-report form included a scale for self-rating of such compliance on a scale of one to five in terms of time spent attending to the situation (for 'Att' instructions) or time spent avoiding the situation (for 'Av' instructions) (see Appendix D). Thus a high score on any particular trial indicated success in attending or avoiding, depending upon the instruction for that trial. This variable was labelled *Coco* (Cognitive Compliance).

Compliance with E/H instructions was assessed by the same three raters used to derive Antex and Shex scores in the first part of the study. Raters were asked to perform two tasks while watching subjects follow anticipatory expressive instructions. Firstly to rate on a scale of 0-100 the degree of Expressiveness being shown. And secondly to label each trial 'E' or 'H' as to whether they believed facially express or hide instructions were being followed (see Appendix G for instructions to raters). Ratings of Expressiveness were again found to be reliable across raters, $r_{1,2} = .80$, $r_{2,3} = .81$, $r_{1,3} = .71$, and percentage of correct trial identifications were: 85.0% for Rater One, 86.1% for Rater Two, and 84.5% for Rater 3 (see Appendix H). Therefore Expressiveness scores were averaged across raters for each trial.

Compliance with E/H instructions is indicated, then, by a high Expressiveness score on 'E' trials and a low score on 'H' trials. Compliance with Att/Av instructions is indicated by a high Coco score on any trial. It is necessary therefore to derive from the variable Expressiveness a variable which, like Coco, indicates level of facial compliance irrespective of trial instructions. Since a high Expressiveness score can correspond to good compliance on any 'E' trial or poor compliance on any 'H' trial, scores on the new variable, which will be labelled *Faco* (Facial Compliance), will have to be derived separately from 'E' and 'H' trials. The mean Expressiveness score across all 'E' trials was found to be 43.9. Higher Expressiveness scores indicate better compliance and so this mean was subtracted from each trial score. Any negative scores on the resultant variable Faco thus corresponded to poor compliance. The mean Expressiveness score across all 'H' trials was 15.2. The subtraction was reversed here such that a score below this mean became a positive Faco score.

Dependent variables Anx, Shock, HRC1, HRC2, Resp C1, Resp C2, SCR1, and SCR2 were all derived in the same way as in Part One, except in using a 30 second, rather than 20 second, anticipation interval.

Unless otherwise specified, subsequent analyses used data averaged across the two trials performed under each instructional combination.

Results

The raw data upon which all analyses were performed may be found in Appendix I. All analysis of variance summary tables cited are presented in Appendix J.

Research Hypothesis 1

R.H.1 asserted that the natural tendencies to cognitively attend and facially express in response to threatening stimuli will coexist; and that cognitive avoidance and facial inhibition will also occur together. From each subject's self-report of direction of attention during the natural trials was derived a score on the variable Avcon. Rated facial expressivity during anticipation on these trials gave scores on Antex. A directly proportional relationship is therefore expected between Avcon and Antex.

The correlation between these two variables across 24 subjects was found to be significant, $r = +.40$, $p < .05$ (using directional 1-tailed test).

When subjects were divided into avoiders ($n = 7$), middle group ($n = 8$), and confronters ($n = 9$) according to Avcon, then mean Antex scores for these groups were 8.3, 10.9, and 19.8 respectively. Analysis of variance across these groups was hampered by the departure from normality of the distribution of the data. However, individual t-tests between each of the groups revealed that avoiders differed significantly from confronters on Antex, $t\ (14) = 2.27$,

$p < .05$, and the difference between confronters and the middle group approached significance, t (15) = 1.57, $.05 < p < .10$, but avoiders did not differ significantly from the middle group, t (13) = 1.25, $p > .05$.

One way to rephrase R.H.1 is to say that natural cognitive confronters tend to be facial expressers and cognitive avoiders to be facial inhibitors. To test this the frequency of subject allocation into the four possible combinations needs to be assessed. The relevant frequency table for χ^2 analysis is presented in Table 5. (See Appendix K for details of derivation of Table 5.)

Table 5

χ^2 Frequency Table for Avcon and Antex

	Inhibitors		Expressers		
Avoiders	8	(6)	3	(6)	11
Confronters	4	(6)	9	(6)	13
	12		12		

The χ^2 resulting from Table 5 is 4.33, $p < .05$. Therefore cognitive avoiders tend to be facial inhibitors and attenders tend to be expressers to a significant degree.

R.H.1 is therefore supported by both interval scores and frequency data.

Inasmuch as natural expressivity has been found to be a stable, generalized propensity, expressivity to shock itself (Shex) was expected to vary with anticipatory expressivity (Antex). This relationship was found to occur. Antex and Shex correlated very highly, $r = +.74$, $p < .0001$. Analysis of variance of Shex across Antex-groups confirmed this relationship, $F\ (2,21) = 22.26$, $p < .001$ (see Table J1).

However, Avcon did not correlate significantly with Shex, $r = +.26$, $p > .05$, and neither did analysis of variance reveal a significant Avcon-group effect on Shex, $F\ (2,20) = 1.51$, $p > .05$ (see Table J2) although mean Shex scores were in the expected direction: avoiders = 0.43, middle group = 1.55, confronters = 1.75.

Research Hypothesis 2

R.H.2 asserted a difference in the relative effectiveness of natural cognitive and expressive tendencies on the assumption that one of these has a direct link with concurrent autonomic and subjective emotion, while the other is only effective through the first (see Figure 1). For the sake of giving direction to hypotheses it was specifically suggested that cognitive tendencies would proportionately affect concurrent indices more than expressive tendencies would.

The corresponding determinant variables to be compared are Avcon and Antex. These are measures of activity during the 20 second anticipatory period before shock. The indicators of emotional reaction derived from this same period (and therefore 'concurrent') were Anx, HRCl, RespCl, and SCRl.

(It is arguable as to whether perception of shock intensity, 'Shock', is a concurrent or resultant variable as it does not directly refer to anticipatory or post-shock periods. The variable Shock was not found to relate significantly to any other concurrent, resultant, or determinant variable in the natural trials, and so discussion of its allocation and relationships will be held over until the manipulated trials are analyzed.)

Table 6 lists the comparable correlation coefficients of Avcon and Antex with the four concurrent indices. It may be noted that all relationships are in the expected direction. Both Avcon and Antex correlate significantly with Resp Cl. However the z test of differences between r's shows that the two correlations are not significantly different, $z - z = .092$, SE of difference = .309 (Guilford, 1956, p.194). On the other hand the significant correlation of Antex with Anx is significantly greater than the significant correlation of Avcon with Anx, $z - z = .319$, SE of difference = .309.

Table 6

Correlation of Natural Cognitive and Expressive Tendencies with Concurrent Indices

	Avcon	Antex
Anx [a]	+ .35*	+ .60**
HRCl	+ .02	+ .19
Resp Cl	+ .52**	+ .45*
SCRl	+ .02	+ .08

* $p < .05$ (1-tailed)
** $p < .01$ (1-tailed)
a Significant difference in correlation size

Table 7 presents the Avcon-group and Antex-group means for the four concurrent indices, along with the results of analyses of variance on this data. The pattern of means across groups in seven of the eight cases is confirmed by the corresponding group means on each variable found in the second part of the study if the involvement of instructed facial and cognitive strategies is ignored (see Appendix L).

Once again the comparison of Antex and Avcon as they relate to the concurrent indices does not clearly favour one or the other. Antex-groups differ significantly on Anx, $F\ (2,21) = 3.67$, $p < .05$, while Avcon-groups do not, $F\ (2,21) = 0.86$, $p > .05$. However, Avcon-groups differ significantly on Resp Cl, $F\ (2,21) = 4.11$, $p < .05$, while Antex-groups only approach a significant difference, $F\ (2,21) = 3.02$, $p = .07$. Finally, SCR1 does not relate significantly to Antex-groups, $F\ (2,20) = 0.33$, $p > .05$, and does relate significantly to Avcon-groups, $F\ (2,20) = 3.89$, $p < .05$, but in an unexpected way: the middle group reacted on SCR1 much more than either avoiders or confronters.

It must be remembered that all of these patterns are supported by parallels in Part Two results (see Appendix L).

The substance of R.H.2 is therefore not clearly supported. The relative merits of Avcon and Antex as predictors of concurrent autonomic and self-reported indices of emotional reaction depend upon the particular indices in question.

Table 7

Avcon- and Antex-group Means and Results of Analyses of Variance on Concurrent Indices [a]

	(n)[b]	Anx	HRCl	Resp Cl	SCRl
Avcon					
Avoiders	(7)	2.04	-3.81	-1.11	-19.6
Middle	(8)	2.71	+0.46	-0.47	+187.7
Confronters	(9)	2.92	-1.67	+1.30	-43.6
F Ratios		F=0.86	F=2.50	F=4.11*	F=3.89*
Antex					
Inhibitors	(8)	2.46	-2.79	-1.24 [c]	+36.3
Middle	(8)	1.82	-2.46	+0.22	- 8.0
Expressers	(8)	3.56	+0.25	+0.98	+74.2
F Ratios		F=3.67*	F=1.54	F=3.02	F=0.33

* $p < .05$

[a] Analysis of variance summary tables J3 to J10, Appendix J.

[b] SCRl data missing for one subject. 'n's are 7,7,9 and 7,8,8.

[c] Order of means not confirmed by Part Two data (see Appendix L).

Research Hypothesis 3

The tendency of subjects to facially express while cognitively attending and to inhibit while avoiding under natural conditions referred to in R.H.1 should be evident in some feature of the instructional conditions of Part Two. Specifically, compliance with cognitive and/or facial instructions in the inconsistent conditions 'express-avoid' and 'hide-attend' is expected to be less than compliance in consistent conditions 'express-attend' and 'hide-avoid'.

Table 8 shows the mean Coco and Faco scores and their standard deviations under each of the four combined instructional conditions.

Table 8

Means and Standard Deviations of Cognitive and Facial Compliance Under Four Instructional Conditions

	Coco			Faco	
	Express	Hide		Express	Hide
Avoid	2.15±.87	2.87±.63	Avoid	2.63±15.56	0.20±8.80
Attend	2.86±.82	2.77±.61	Attend	-2.13±18.02	-1.59±10.28

Analysis of variance of Coco across the four conditions revealed that a significant interaction between instructions occurred, F (3,90) = 3.12, $p < .05$ (see Appendix J, Table J11). Inspection of the means in Table 8 shows that subjects found it most difficult to cognitively avoid the situation while facially expressing distress. Some difficulty in cognitively attending while facially hiding any distress was also indicated.

Analysis of variance of Faco across the four conditions showed no significant interaction effect, F (3,90) = 0.90, $p > .05$ (see Appendix J, Table J12). It seems that compliance with instructions to facially express or hide was not consistently affected by simultaneous cognitive strategies.

One half of R.H.3 is therefore supported. While compliance with cognitive instructions is susceptible to expressive behaviour, facial expression compliance is not as easily affected by concurrent cognitive activity.

Research Hypothesis 4

The hypothesis that instructions for cognitive strategies have a greater effect on concurrent emotional indices than instructions for facial strategies can be assessed in this study by comparison of the effects of variables Att/Av and E/H on the four concurrent indices: Anx, HRC1, Resp C1, and SCR1.

Comparison of Att or E condition means with Av or H condition means and the corresponding analysis of variance results are given in Table 9. This shows that instructions to attend or express resulted in significantly greater self-reported anxiety (Anx) than instructions to cognitively avoid or facially hide. However, only instructed expressive behaviour significantly affected anticipatory heart rate change (HRC1), and only instructed cognitive behaviour significantly affected anticipatory respiration rate change (Resp C1). Skin conductance response to threat (SCR1) was not significantly affected by instructions in either mode.

Table 9

Effects of Att/Av versus E/H Instructions on Four Concurrent Indices

	E or Att Mean	H or Av Mean	Difference	F Ratio and p [a]
Anx				
Att/Av	3.25	2.76	0.49	F (1,147) = 11.93, $p < .001$
E/H	3.35	2.66	0.69	F (1,147) = 24.02, $p < .001$
HRC 1				
Att/Av	-1.06	-1.18	0.12	F (1,92) = 0.03, $p > .05$
E/H	0.08	-2.32	2.40	F (1,92) = 11.31, $p < .01$
Resp Cl				
Att/Av	1.57	-0.07	1.64	F (1,147) = 10.62, $p < .01$
E/H	1.00	0.50	0.50	F (1,147) = 0.96 $p > .05$
SCR 1				
Att/Av	42.5	32.8	9.7	F (1,147) = 0.11, $p > .05$
E/H	41.1	34.3	6.8	F (1,147) = 0.05, $p > .05$

[a] Analysis of variance summary tables J13 to J16 in Appendix J.

As was found under natural conditions (R.H.2), while both cognitive and expressive behaviour can affect concurrent emotional indices, neither emerges as a clearly dominant determinant. R.H.4 is therefore not supported.

Research Hypothesis 5

The claim here is that if natural expressivity is directly proportional to concurrent emotional indices, it is inversely proportional to resultant or post-shock indices. Natural expressivity in this study is represented by the variable Antex.

Table 10 shows the intercorrelations between Antex, Avcon, the four concurrent indices, and the three resultant emotional indices: HRC2, Resp C2, and SCR2.

The correlations between Antex and the four concurrent indices (Anx, $r = +.60$; HRC1, $r = +.19$; Resp C1, $r = +.45$; SCR1, $r = +.08$) repeat the evidence of R.H.2 for a directly proportional relationship. All are in the expected direction and two are significant.

At the same time the correlations between Antex and the three resultant indices are all negative (HRC2, $r = -.24$; Resp C2, $r = -.28$; SCR2, $r = -.17$), although none are significant. The data are therefore consistent with a positive relationship between facial expressivity and concurrent arousal, and a negative relationship between facial expressivity and resultant or post-shock arousal, though significance in this latter aspect was not achieved.

Weight is added to this picture, however, if it is also noted in Table 10 that the intercorrelations among the concurrent indices are overwhelmingly positive, those among the three resultant indices are similarly positive, and those between the concurrent and resultant indices are consistently negative, including two significantly so (Anx: HRC2, $r = -.41$, $p < .05$; Resp C1: Resp C2, $r = -.64$, $p < .01$).

Table 10

Intercorrelations Among Natural Expressivity, Cognitive Attention, and Concurrent and Resultant Indices

	SCR2	RespC2	HRC2	SCR1	RespC1	Hrc1	Anx	Avcon
Antex	-.17	-.28	-.24	+.08	+.45*	+.19	+.60**	+.40*
Avcon	-.46*	-.32	-.31	+.02	+.52**	+.02	+.35*	-
Anx	-.12	-.16	-.41*	+.11	+.28	-.01	-	
HRC1	.00	-.32	-.16	+.22	+.02	-		
RespC1	-.27	-.64**	-.17	+.04	-			
SCR1	-.31	-.15	-.08	-				
HRC2	+.17	+.19	-					
RespC2	+.05	-						
SCR2	-							

* $p < .05$ (1-tailed)

** $p < .01$ (1-tailed)

Therefore, results are overall consistent with R.H.5, but evidence for a significant relationship has emerged only for the positive relationship hypothesized between facial expressivity and concurrent arousal.

<u>Research Hypothesis 6</u>

The same positive relationship with concurrent indices and inverse relationship with resultant indices is here claimed for natural cognitive confronting versus avoiding tendencies (Avcon). The data relevant to R.H.2, repeated in Table 10, shows Avcon to be significantly positively related to two of the four concurrent indices, namely Resp Cl, $r = +.52$, $p < .01$, and Anx, $r = +.35$, $p < .05$.

Inspection of Table 10 further reveals that, with regard to the three resultant indices of arousal, Avcon relates significantly negatively to SCR2, $r = -.46$, $p < .05$, and negatively, though not significantly so, to HRC2, $r = -.31$, and Resp C2, $r = -.32$.

It seems that subjects who reported a tendency to cognitively confront the situation showed greater concurrent autonomic and self-reported arousal, but then showed less post-shock (resultant) autonomic arousal than subjects who reported a tendency to cognitively avoid the situation.

Although some support for some aspects of the hypothesis has emerged, R.H.6 has not been confirmed.

Research Hypothesis 7

With R.H.4 it was found that instructions to facially express versus hide (E/H) had a significant effect upon concurrent self-reported anxiety (Anx) and anticipatory heart rate change (HRCl). Inspection of the mean Anx and HRCl scores under conditions E and H reveals a positive relationship in that expressing increased both measures of concurrent arousal (see Table 9). The nonsignificantly affected concurrent measures, Resp Cl and SCRl, also show means in this direction.

The current hypothesis anticipates an *inverse* relationship between E/H and *resultant* measures, given the positive relationship with concurrent measures. That is, greater arousal is expected on post-shock measures after instructions to hide facial expression of distress during anticipation (i.e. condition H).

Table 11 lists the mean scores achieved on the three resultant indices under conditions E and H, together with results of analyses of variance on each measure. This shows that mean HRC2 and mean Resp C2 under condition H is significantly greater than under condition E. SCR2 does not significantly differ between conditions.

Table 11

Mean Scores and Analyses of Variance on Resultant Indices following Instructions to Express or Hide Anticipatory Distress

	E mean	H mean	F Ratios and p [a]
HRC2	2.05	3.64	F (1,92) = 5.50, $p < .05$
Resp C2	0.43	1.67	F (1,140) =7.13, $p < .01$
SCR2	659	636	F (1,92) = 0.02, $p > .05$

[a] Analysis of variance summary tables J17, 18, 19, in Appendix J.

Therefore, instructions to facially express during anticipation resulted in significantly greater concurrent arousal on two measures out of four, but also resulted in significantly less resultant arousal on two measures out of three than instructions to facially hide distress. Although some support for some aspects of the hypothesis has emerged, R.H.7 has not been confirmed.

Research Hypothesis 8

The data of R.H.4 also revealed a significant effect of instructions to cognitively attend versus avoid (Att/Av) on anticipatory anxiety (Anx) and concurrent respiration rate changes (Resp Cl). The relevant means showed significantly greater Anx and Resp Cl scores under Att conditions than under Av conditions. The direction of means for HRCl and SCRl are consistent with this, though not significantly (see Table 9).

R.H.8 hypothesizes that, given this directly proportional relationship between attending and concurrent indices, resultant measures will vary inversely.

The mean scores on these resultant measures under conditions Att and Av and their analyses of variance between the two conditions are presented in Table 12. Mean Resp C2 is shown to be significantly greater under condition Av. Differences between scores under Att and Av do not achieve significance for HRC2 or SCR2.

Table 12

Mean Scores and Analyses of Variance on Resultant Indices following Instructions to Cognitively Attend or Avoid in Anticipation

	Att Mean	Av Mean	*F* Ratios and *p* [a]
HRC2	2.76	2.93	F (1,92) = 0.07, $p > .05$
Resp C2	0.47	1.63	F (1,140) = 6.29, $p < .05$
SCR2	669	626	F (1,92) = 0.07, $p > .05$

[a] Analysis of variance summary tables J17, 18, 19 in Appendix J.

Therefore, instructions to cognitively attend to the threat during anticipation resulted in significantly greater concurrent arousal on two of four indices, and significantly less resultant arousal on one of three measures. Although some support for some aspects of the hypothesis has emerged, R.H.8 has not been confirmed.

Research Hypothesis 9

Hypotheses so far have been concerned with the effects of natural *or* imposed cognitive and facial strategies. It is suggested here that an interaction effect may also occur. That is, the effects of instructions to facially express will differ between subjects who have a natural tendency to do so and those who naturally inhibit expression.

These differences could occur due to differences in degree of compliance with instructions, or due to the fact that the behaviours requested are familiar or unfamiliar.

It has already been found that compliance with facial instructions (Faco) does not significantly vary among all subjects according to Att/Av and E/H (R.H.3). However, when subjects are divided into facial inhibitors, middle-group, and expressers (Antex-groups), then mean Faco scores under conditions Att/Av and E/H form a recognizable pattern. This is shown in Table 13. This pattern is clearer when Faco is averaged across Att/Av conditions (see Table 13).

Table 13

Mean Facial Compliance Under Conditions E/H and Att/Av for Natural Inhibitors, Middle-group, and Expressers

Individual Condition Means			Means Across Att/Av	
	E	H	E	H
Inhibitors				
Att	-16.68	+1.51		
Av	-11.28	+3.24	-13.97	+2.37
Middle group				
Att	+6.09	+2.21		
Av	+9.39	+3.81	+ 7.74	+3.01
Expressers				
Att	+4.20	-8.54		
Av	+9.76	-6.31	+ 6.98	-7.42

The interaction effect of Antex-groups and E/H conditions on Faco was found to be significant, F (2,90) = 7.70, $p < .05$ (Appendix J, Table J20). Inspection of the means under E and H in Table 13 shows that natural facial inhibitors were poor expressers under instruction, while natural facial expressers were poor hiders of distress when instructed to do so.

To find out whether this difference in facial compliance in turn produces a differential effect on autonomic and self-reported arousal between inhibitors and expressers under instructions, an analysis of covariance was performed on Anx scores with covariable Faco (Summary

Table J21). Faco was not found to add significantly to the relationship between Antex and Anx (Within-treatment regression, F (1,20) = 1.30, p = .27; Within- and between-treatment regression, F (1,22) = 1.20, p = .28).

A further check, which also assesses the possibility that grouping on Antex affects reactions under E and H conditions in ways other than via compliance differences (e.g. unfamiliar strategy causing arousal), can be undertaken. This involves inspection of the interaction effects of Antex and E/H on the emotional indices. Interaction effects were calculated for Anx, F (2,147) = 0.83, p > .05, Resp Cl, F (2,147) = 1.83, p > .05, and SCRl, F (2,147) = 0.26, p >.05 (Summary tables J22, J23, J24). None were significant.

Evidence has therefore emerged that natural facial expressers do not comply with instructions to hide distress as well as natural inhibitors; And these do not comply with instructions to express distress as well as the former. No evidence that this difference in turn affects patterns of autonomic and self-reported arousal under different instructions was found.

Therefore only that part of R.H.9 relating natural expressivity to facial instruction compliance was supported.

Research Hypothesis 10

It is here hypothesized that natural cognitive tendencies will alter the effect of instructed cognitive strategies on indices of arousal, or will at least be reflected in differing degrees of compliance with these instructions.

Under R.H.3 it was found that compliance with cognitive instructions (Coco) is greater in consistent instructional conditions 'express-altend' and 'hide-avoid' than in inconsistent conditions 'express-avoid' and 'hide-attend'. The four relative Coco means under these conditions are given for cognitive avoiders, middle-group, and confronters separately (Avcon-groups) in Table 14.

Table 14

Mean Cognitive Compliance Under Conditions Att/Av and E/H for Natural Avoiders, Middle-group, and Confronters

	Individual Condition Means		Means Across E/H	
	Att	Av	Att	Av
Avoiders				
E	2.91	2.54		
H	2.79	3.23	2.85	2.88
Middle group				
E	2.62	2.16		
H	2.62	2.87	2.62	2.51
Confronters				
E	3.03	1.83		
H	2.89	2.58	2.96	2.20

Inspection of these means shows that, while the overall significant picture referred to above holds for avoiders, cognitive confronters comply less under both of the 'avoid' conditions than both of the 'attend' conditions. This new pattern is clearer when Coco scores are averaged across E/H conditions, as done in Table 14.

The interaction between Avcon-groups and Att/Av conditions represented by these new means was found to be significant, F (2,90) = 28.05, $p < .05$ (Summary table J25). The direction of this effect is discernible from the means in Table 14. While cognitive avoiders were able to comply with attend and avoid instructions equally well, cognitive confronters found avoiding more difficult than attending.

To find out whether this difference in Coco in turn produces a differential effect of instructions on arousal between avoiders and confronters, an analysis of covariance was performed on Anx scores with covariable Coco (Summary table J26). Coco was not found to add significantly to the relationship between Avcon and Anx (Within-treatment regression F (1,20) = 0.04, $p = .83$; Within- and between-treatment regression, F (1,22) = 0.03, $p = .87$).

A further check, which also assesses the possibility that grouping on Avcon affects reactions under Att and Av conditions in ways other than via compliance differences (e.g. unfamiliar strategy causing arousal) can be undertaken. This involves inspection of the interaction effects of Avcon and Att/Av on the emotional indices themselves. Interaction effects were calculated for Anx, F (2,147) = 1.44, $p > .05$, Resp C1, F (2,147) = 0.39, $p > .05$, SCR1, F (2,140) = 0.93, $p > .05$, and Resp C2, F (2,140) = 0.74, $p > .05$ (summary tables J27 to J30). None were significant.

Evidence has therefore emerged that, while natural cognitive avoiders can comply adequately with instructions to cognitively attend to or avoid a threat, natural confronters find it hard to break their usual strategy and cognitively avoid the situation.

Therefore only that part of R.H.10 relating natural cognitive tendency to cognitive instructional compliance was supported.

Other Findings

Shock: Because the degree of distortion of perception of shock intensity (Shock) was not found to significantly relate to any other variable in Part One (see Appendix M), and also because it does not neatly allocate into concurrent or resultant indices, Shock was excluded from further hypothesis testing. Subsequent analysis of variance across instructional conditions in Part Two, however, revealed that instructions to cognitively attend to the situation resulted in significantly greater perceived Shock ($\bar{x} = +0.22$) than instructions to cognitively avoid ($\bar{x} = -0.33$), F (1,92) = 4.38, $p < .05$ (summary table

J31). To align this with other results Shock, then, should be regarded as a 'concurrent' index of arousal. However this assertion remains tenuous. Shock did not even relate significantly to Shex which is a measure of activity occurring at exactly the same time, $r = +.16$, $p > .05$.

Shex: was found to relate very closely with Antex, reflecting the generality of expressive tendencies. As could be expected from this, Shex was also found to vary proportionately with Anx, $r = +.42$, $p < .05$, and inversely with Resp C2, $r = -.44$, $p < .05$. That is, high anticipatory anxiety was followed by high facial response to shock, which in turn was followed by a slower 'resultant' respiration rate. Shex aligns well with Antex and the pattern of relationships which have emerged from the Research Hypotheses.

Sex: Relationships approaching significance were found between Sex and Antex, $r = -.39$, $.10 > p > .05$, and Sex and Shex, $r = -.35$, $.10 > p > .05$. There is the suggestion here, since females were scored one and males two, that females in the study tended to be more expressive during anticipation and shock periods. This is consistent with generally accepted sex differences in behaviour in Western culture.

Natural versus Conscious: Included in the questionnaire administered upon completion of the four natural trials was facility to indicate whether self-reported cognitive behaviour had been entirely natural or had been part of a consciously self-imposed strategy to cope with the situation (see Appendix C). No other variable in Part One related significantly to responses on this question. That this issue seemed to have little relevance is supported by the close parallels found between results in the 'natural' Part One and the 'manipulated' Part Two of this study.

Threshold: Each subject's Shock scores were calculated in relation to the actual level of shocks administered. These levels in turn were one unit on the machine less than the pre-determined maximum dictated by each subject (*Threshold*). This variable approached a significant relationship only with subjects' ages, $r = -.38$, $.10 > p > .05$. That is, there was some tendency for older subjects to assert lower thresholds at the start of the study.

Reappraisers: Self-report of cognitive activity during Part One had facility for reporting time spent attending to, avoiding, *and reappraising* the situation (see Appendix C). Avcon was derived from the first two of these scales. Reappraising has been discussed in terms of paralleling the effect of cognitive avoidance, but perhaps best applied to more ambiguous threats. Nine subjects however indicated reappraisal activity for "most" (4) or "all" (5) of the anticipation time on the third scale (*Reappraisers*). To assess the similarity of effects of this strategy with avoidance, the mean scores for this Reappraisers group on the key variables in Part One were compared to the corresponding means for the remaining 'pure' Avoiders, Middle-group, and Confronters. These comparisons are presented in Table 15.

Table 15

Comparable Means for Reappraisers and the 'Pure' Avcon-groups Left

	n	Antex	Shex	Anx	HRC1	RespC1	SCR1	HRC2	RespC2	SCR2
Reappraisers	9	13.2	0.93	2.93	-2.48	-0.86	- 51.2	4.41	2.77	645
Avoiders	4	10.3	0.55	1.98	-2.67	-1.08	179.2	7.33	3.52	514
Middle	5	13.2	1.97	2.36	1.07	0.14	787.5	4.26	-0.82	483
Confronters	6	19.9	2.14	2.56	-2.06	1.82	-187.7	2.89	-0.05	239

The low group numbers in Table 15 make formal analysis difficult. However, visual inspection of the means shows that Reappraisers align nearest to Avoiders in five cases (Shex, HRC1, Resp C1, Resp C2, SCR2), to middle-group in two cases (Antex, HRC2), and to Confronters in only two (Anx, SCR1).

These data are consistent with the previous assumptions of similarity between reappraisal and avoidance effects.

Discussion

Facial Expression vs Cognitive Attention

Comparing the reviews of research on the effects of facial expression and of cognitive attention upon emotional indices reveals many parallels in the respective findings. The work of Jones (1950, 1960), Block (1957), and Learmonth, Ackerly, and Kaplan (1959) linked high trait expressivity to low autonomic responding under stress. Studies using Byrne's (1961) MMPI R-S scale, cited earlier, have suggested an inverse relationship between trait repression or denial and autonomic reactions. With situational measures negative correlations have been found between expressiveness and autonomic measures (Buck et. al., 1972, 1974; Lanzetta & Kleck, 1970), and between attending to threat and autonomic measures (Averill & Rosenn, 1972; Barrell & Price, 1977; Hare, 1966).

It has already been pointed out that the results of correlational studies in the areas above have not been consistent, and that problems such as controlling for degree of perceived threat and timing of measurements make these findings somewhat dubious. However this insight only serves to parallel the problems in these fields as well as the findings.

Studies which have experimentally manipulated facial expressivity have found a directly proportional relationship with autonomic and self-reported arousal (Cartwright-Smith, 1975; Colby, Lanzetta, & Kleck, 1977;

Kleck et. al., 1976; Lanzetta, Cartwright-Smith, & Kleck, 1976; Notarius, 1977). Experimental manipulation of cognitive attention to threat has resulted in the same direction of relationship (Bloom, 1975; Bloom et. al., 1977; Chaves & Barber, 1974; Sparos, Horton, & Chaves, 1975).

Finally, it has been suggested that natural expressivity can affect compliance with expression instructions (Cunningham, 1977; Zuckerman et. al., 1977), and that a natural tendency to cognitively attend or avoid can affect compliance with cognitive instructions (Andrew, 1970; DeLong, 1971; Lazarus & Alfert, 1964; Speisman et. al., 1964).

These parallels serve to support the suggestion that one of the determinants of emotional reaction (facial or cognitive) is direct and primary while the other is effective only inasmuch as it affects or reflects the first, a possibility discussed by Cartwright-Smith (1975), Lanzetta, Cartwright-Smith, and Kleck (1976), and Notarius and Levenson (1979). Further support comes from those studies which report a cognitive/somatic correlation without acknowledging the alternative explanations for effects on autonomic indices that this correlation creates (Barber & Hahn, 1962; Barrell & Price, 1977; Buck et. al., 1974).

This study attempted to compare cognitive and expressive determinants for primacy of effect. It was first necessary to affirm that cognitive attending and facial expressivity correlate in natural circumstances

(R.H.1); that normally greater expressing occurs with greater attention to threat. Without this correlation it could not be suggested that, for instance, the effects on emotional indices of measured expressivity are really a result of concurrent, unmeasured cognitive activity.

In testing R.H.1 a significant positive relationship between natural expressivity (Antex) and attending (Avcon) was found. The possibility of inter-explainability was maintained.

If the results of studies which experimentally manipulate expressing, for instance, are to be explained by asserting that this affected concurrent cognitive activity and that emotional indices were only then affected, then some effect on compliance with cognitive instructions must be shown to occur when facial conditions differ. Specifically compliance with instructions in inconsistent conditions 'hide-attend' and 'express-avoid' should be lower than in the two consistent conditions (R.H.3).

When this hypothesis was tested it was found that instructed cognitive activity was significantly affected by concurrent instructed facial expression in the direction predicted. Compliance with facial instructions, on the other hand, was not significantly affected by concurrent cognitive instructions. Evidence therefore emerged that, in studies in which cognitive activity is manipulated, concurrent unmeasured facial expression may be significantly affected, and this in turn may affect emotional indices.

However, no significant trend was found to support the idea of experimentally manipulated facial activity affecting emotional indices only via concurrent unmeasured cognitive activity.

To determine whether facial expression or cognitive attention is more closely related in natural conditions to emotional indices (R.H.2), and which therefore is more likely to be a primary or direct determinant, the correlations between Avcon and Antex and the concurrent indices were compared. While both revealed significant relationships, neither emerged as a clearly superior predictor. The direct relevance of both facial expression and cognitive activity in emotional reactions was supported (see Model 3, Figure 1).

A qualification to this conclusion must be pointed out. Natural cognitive tendency (Avcon) was determined from a single questionnaire asking subjects to report on the four natural trials of Part One. If subjects had reported before the completion of all such trials then their direction of attention would have been affected by demand pressures, self-consciousness, etc., and would have no longer been natural. Antex on the other hand was derived from four separate trial scores given by three independent video raters, and may therefore be expected to have greater reliability than Avcon. If any bias exists therefore in the comparison of Avcon and Antex as predictors of concurrent emotional indices, it has favoured Antex.

However, no such bias should affect comparison of cognitive and facial activity as predictors when this activity is controlled by instructions to subjects. This comparison of their respective effects on concurrent indices (R.H.4) once again produced no clear indication that either is a more primary or direct determinant of emotional arousal.

In summary, then, facial expressivity and cognitive attention to threat have been shown to vary in direct proportion under natural conditions. Furthermore, it is harder for subjects to cognitively avoid a threat while facially expressing distress or to attend while facially hiding, than to cognitively avoid while hiding or attend while expressing.

These findings support especially the possibility that undetected concurrent facial activity can explain the results of studies on the effects of manipulated cognitive activity on emotional indices. That compliance with facial instructions is relatively independent of concurrent cognitive behaviour suggests that the finding of an effect of facial instructions is not as easily reinterpretable as due to undetected concurrent cognitive activity.

However, when it comes to testing directly the possibility that either facial or cognitive activity more directly affects emotional indices, no evidence for the supremacy or primacy of either emerged. It seems that both spheres of activity are potentially effective determinants in adults.

Further research using the same paradigm but with young children as subjects is necessary if it is to be discovered whether both facial and cognitive effects on emotional indices are a result of direct innate neural links, or whether facial effects, for instance, are a result of a long history of pairing of cognitive attention (UCS) and facial expression (CS).

Concurrent vs Resultant Effects

The concurrent effects on autonomic and self-reported indices of a particular coping strategy have been defined in this study as those effects measured soon after commencement of the strategy and before any possible discharge phenomena could be expected to have occurred. Resultant effects on indices have been clearly distinguished in this study by having subjects cease use of strategies at onset of shock. Thus resultant measures (those subject to possible discharge phenomena) are different from concurrent ones in being (a) post-strategy, (b) post-shock, and (c) taken at a time further removed from onset of stress.

The suggestion that discharge of emotional arousal may occur with time was represented in Research Hypotheses 5 to 8. It was hypothesized that if concurrent arousal relates proportionately to natural or manipulated cognitive or facial activity, then discharge will be greater where concurrent arousal is greater, and so an *inverse* relationship between these cognitive or facial behaviours and resultant arousal will be found.

The results of testing these hypotheses confirmed directly proportional relationships between concurrent arousal measures and natural facial expressivity (R.H.5), natural cognitive attention (R.H.6), instructed facial expressivity (R.H.7), and instructed cognitive attention (R.H.8). Resultant measures of arousal were found to relate inversely to these same anticipatory activities, although no significant relationships were found with natural facial expressivity (R.H.5). That is, subjects who attended to the situation and/or showed facial distress during anticipation, whether naturally or under instruction, showed greater autonomic and self-reported arousal during anticipation, but then showed less arousal once the shock had passed.

The reliability of this picture is strengthened by the finding that concurrent indices and resultant indices tended to relate proportionately among themselves, but inversely to each other (see Table 10).

Therefore the concept of discharge of emotional arousal over time has been supported, as has been the importance of specifying the exact time period that measured reactions are occurring in. Results are also consistent with the possibility that many of the studies reviewed in this paper obtained inconsistent results by not distinguishing concurrent and resultant indices of arousal.

A possible criticism of this conclusion deserves attention. It could be argued that a facially expressive subject, for instance, who is subsequently highly aroused during anticipation is less capable of experiencing further arousal with onset of shock than a facially-inhibiting subject who is marginally aroused during anticipation. A ceiling effect similar to the law of initial values may be operating.

Two indications that this does not explain the results adequately can be cited:

Firstly, the law of initial values was found not to operate significantly among resultant measures (see Table 4). That is, no significant relationships occurred between level of heart rate, respiration rate, or SC attained during anticipation and the change from this to post-shock levels. Inasmuch as reaction during anticipation is reflected in level of arousal attained (versus change from baseline), no "ceiling effect" occurred. In fact in the case of heart rate and SC the change from anticipation to post-shock was nonsignificantly directly proportional to initial level during anticipation, $r = +.13$ and $r = +.30$ respectively.

Secondly, if arousal increase with anticipation hinders any further increase with shock, then this phenomenon can be expected to be largely specific to each measure of arousal. For example, high HRC1 would be followed by low HRC2 rather than low RespC2 or SCR2. Inspection of the negative correlations between the concurrent and resultant indices in Table 10 showed that high Anx was followed by low HRC2, $r = -.41$, $p < .05$; that the nonsignificant negative correlations between HRC1 and RespC2, $r = -.32$, and RespC1 and SCR2, $r = -.27$, both approximated that between SCR1 and SCR2, $r = -.31$; and that HRC1 and HRC2 correlated only -.16. Therefore a high concurrent reaction on any measure did not specifically lead to a low resultant reaction on that measure. Only with respiration did such a situation exist (RespC1 : RespC2, $r = -.64$, $p < .01$).

Natural vs Manipulated Strategies

The results with natural and manipulated cognitive and facial strategies were found in all cases to be parallel. Natural attending tended to occur with natural expressing (R.H.1), and subjects found it hard to follow instructions contrary to this natural pairing (R.H.3). Under natural conditions neither facial nor cognitive activity related more closely to concurrent indices (R.H.2), and nor was one of these more effective when instructions were being followed (R.H.4). Concurrent indices related positively, and resultant indices inversely with facial expressivity and cognitive attention whether under natural circumstances (R.H.5, R.H.6) or when following instructions (R.H.7, R.H.8).

Furthermore, the patterns of means across Avcon-groups and Antex-groups on the concurrent indices in the naturalistic Part One (see Table 7) was paralleled by the respective patterns across the same groups in the instructional Part Two, if the involvement of activity under instructions is ignored (see Appendix L). This means that a cognitive confronter, for example, who reported high anticipatory anxiety (Anx) during the four natural trials of Part One also tended to report high anxiety levels if averaged across the eight trials under four conditions in Part Two.

Finally, feedback from subjects when asked whether cognitive strategies used in Part One were entirely natural or were subsequent to a conscious attempt to cope (see Appendix C) did not correlate with any other measure.

In all cases, therefore, the effects of natural cognitive or facial tendencies were the same as the effects of instructed or conscious strategies.

The reviewed literature on the relationship between facial expressivity and autonomic arousal, on the other hand, separated fairly clearly into correlational studies of natural responding indicating a negative relationship and experimental studies of manipulated responding indicating a positive relationship. Past attempts at explaining this involving conditioning histories and conditionability have been noted.

The explanation supported by the current findings suggests a methodological error in that the bulk of naturalistic studies have been confounded by resultant measures and unrecognized discharge effects. A greater interest in these resultant effects than in concurrent ones in studies of natural reaction could be justified, but their difference from concurrent effects must be acknowledged.

The corresponding reviewed literature on the relationship between cognitive attention and autonomic arousal separated also into correlational studies of natural tendencies giving a mixed and confused picture, and experimental studies of manipulated attending indicating a relatively clear positive relationship. Explanations for the unclear correlational data cite especially the possibility that the measures of attention used are really measures of subjective anxiety.

The present study was careful to objectify measures of attention by asking subjects to report *time spent* attending or avoiding, and separately taking self-reports of level of anxiety. When this was done a positive relationship between attending and arousal was found, aligning with experimental studies of instructed attention and other correlational studies which controlled for anxiety in measuring cognitive activity (Houston, 1971, 1972; Houston & Hodges, 1970; Lazarus & Alfert, 1964).

In summary, then, no evidence emerged in this study of a difference between the effects of natural and manipulated strategies on concurrent or resultant arousal, whether these be cognitive or facial in nature. Furthermore, results have offered support for methodological explanations of such differences found in the past; namely, anxiety as a confounding variable, and lack of distinction between concurrent and resultant indices.

Interaction of Natural Tendencies and Instructed Strategies

Since the natural facial expressivity of each subject was assessed in Part One (Antex) the effect of this tendency on the results of instructed facial behaviour (E/H) could be observed. Analysis of the effects of this interaction revealed that, as has been found in the past (Cunningham, 1977; Zuckerman et. al., 1977), highly expressive subjects complied well with 'express' instructions, but poorly with 'hide' instructions (R.H.9).

Further analyses failed to discover any differences in the effects of instructions on emotional indices that this disparity in compliance could have been responsible for. The use of only 24 subjects in this study means that failure to detect such relatively subtle secondary effects is not surprising. A larger sample may detect such an interaction effect, and so the question remains an open one.

Natural cognitive tendency to attend to or avoid threat (Avcon) was found to affect compliance with instructions to consciously adopt these respective strategies (Att/Av) (R.H.10). While natural avoiders could attend or avoid under instruction equally well, natural attenders found it harder to cognitively avoid.

Once again, however, any secondary effects of this compliance disparity on emotional indices was not found.

Theoretical Implications

The findings of this study do not support the concept of an inverse relationship between concurrent facets of emotional reactions. Inverse relationships over time have been indicated, however, suggesting the relevance of some form of 'discharge' phenomena.

Jones's (1950, 1960) allegation that individuals generally either react expressively *or* autonomically from the start is not supported (see Table 1). Neither is Block's (1957) opposition of expressive and cognitive reactivity. However, his notion of discharge over time, detectable by declining autonomic arousal, is supported.

The confusion among these theorists over whether discharge refers to concurrent inverse relationships or relationships over time is made less excusable if we note again Allport's (1924) original claim: "If the somatic responses are totally inhibited, the visceral energizing effects can be discharged only inwardly ... [causing] an extended, intensified and lasting state of unpleasant internal feeling" (p.98). Careful reading reveals that Allport is referring to a lack of discharge over time, not the concurrent inverse relationship between overt and autonomic reactivity that Jones would claim.

The present results are generally in accord with the models proposed by the Proprioceptive theorists (see Table 1). They all claim directly proportional relationships between the concurrent facets of emotional response. However, the findings also suggest that the theories of Jacobson (1967), James (1884), Tomkins (1962), Gellhorn (1964), and Izard (1977) are all incomplete in that they do not incorporate effects over time (discharge phenomena) or the effects of concurrent cognitive activity.

The cognitive theories of Schachter (Nisbett & Schachter, 1966) and Laird (1974) are also inadequate in explaining the present findings (see Table 2). Expressive behaviour has been found to affect autonomic and subjective arousal independent of the mediation of cognitive activity. There seem to be more causal links than either of these two theorists acknowledge.

The propositions that cognitive mediation can explain the results of studies of manipulation of facial expression, or that the facial effects of cognitive manipulations can explain all subsequent effects on emotional indices, are not supported.

Practical Implications

No preference for the modification of cognitive versus behavioural elements of stress reactions in the management of these reactions has emerged. Inasmuch as an individual's reaction comprises mainly one of these aspects (cognitive anxiety or behavioural disruption), selection of that mode of intervention may be preferred. However the present findings suggest that in most cases these aspects will occur in parallel, and intervention in one area will often affect the other.

The present findings are also in agreement with the principles behind exposure treatment of fear responses, the "work of worrying", discharge of anxiety, etc. Those subjects that inhibited expression of their distress or avoided cognitive confrontation with the situation reacted more extremely subsequent to shock administration, even though they remained less aroused during anticipation. The point made by Cohen and Lazarus (1973) must still be kept in mind, however. They added that cognitive avoidance may yet be the preferable strategy if the anticipated stressor is not very likely.

Finally, to the extent that success with exposure treatment depends upon compliance with exposure instructions (cognitive attention/facial expression), the findings suggest that the natural tendencies of an individual toward such behaviours can be a factor relevant to success.

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Appendix A

CONSENT FOR THE ADMINISTRATION OF ELECTRIC SHOCKS

I, ...

of ....

hereby consent to the administration of electric shocks, the effect and nature of which have been explained to me.

Dated this .... day of .... 19.....

Signed ....

Read over and explained to the signatory, who stated that he/she understood and affixed his/her signature in my presence.

Witness ....

Appendix B

Fear thermometer and shock level estimates for four natural trials:

(1) Before this shock I was:

Completely calm — Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

[TH-3] [TH-2] [Actual Level] [Threshold]

(2) Before this shock I was:

Completely calm — Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

(3) Before this shock I was:

Completely calm — Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

(4) Before this shock I was:

Completely calm — Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

Appendix C

Direction-of-attention questionnaire to derive Avcon from four natural trials:

Please circle 1,2,3,4,or 5 for each statement where:

1 = Not at all;
2 = Some of the time;
3 = Half of the time;
4 = Most of the time;
5 = All of the time.

In the time between the warning light coming on and each shock:

(a) I thought about the shock, how intense it would be, what it would feel like, and so on. 1 - 2 - 3 - 4 - 5

(b) I thought about things not related to the shock, like other equipment, things outside the window, memories,plans, etc. 1 - 2 - 3 - 4 - 5

(c) I thought about the shock, but tried to downplay it, put it into perspective, or see it as 'not all that bad'. 1 - 2 - 3 - 4 - 5

Please tick (a) or (b):

The direction of my thoughts

(a)was due to a conscious policy I decided on to help me cope with the situation.

(b)was just the natural direction I let them take.

Appendix D

Trial instructions, fear thermometer, shock level estimates, and cognitive compliance feedback for instructed trials:

(4)

FACIALLY HIDE + MENTALLY ATTEND

Before this shock I was:

Completely calm Absolutely terrifed

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

How successful were you at concentrating on the shock, how intense it would be, whereit would be, etc.?

not at all some 1/2 most all of the time

0 1 2 3 4

(2)

FACIALLY HIDE + MENTALLY AVOID

Before this shock I was:

Completely calm Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

How successful were you at keeping your mind off the situation, and the prospect of shock?

not at all some 1/2 most all of the time

0 1 2 3 4

(1)

FACIALLY EXPRESS+MENTALLY ATTEND

Before this shock I was:

Completely calm   Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

How successful were you at concentrating on the shock, how intense it would be, how it would feel, where it would be, etc.?

not at all   some   1/2   most   all of the time

0 1 2 3 4

(3)

FACIALLY EXPRESS + MENTALLY AVOID

Before this shock I was:

Completely calm   Absolutely terrified

0 1 2 3 4 5 6 7 8 9 10

The shock felt as though it was:

How successful were you at keeping your mind off the situation, and the prospect of shock?

not at all   some   1/2   most   all of the time

0 1 2 3 4

Appendix E

In Part Two the facial instructions 'express' or 'hide' and cognitive instructions 'attend' or 'avoid' were combined to produce four instructional conditions. Each subject completed eight trials, two under each condition. The order of trials was counterbalanced across the 24 subjects. Every possible order was administered once.

Where:		Facially	Cognitively
	condition 1 =	express	attend
	condition 2 =	hide	avoid
	condition 3 =	express	avoid
	condition 4 =	hide	attend

Each subject completed two sets of four trials according to the following table of orders:

Subject No.	Trial Order	Subject No.	Trial Order
1	1234	13	4132
2	3142	14	3421
3	2413	15	1243
4	4321	16	2314
5	3412	17	2341
6	1324	18	4213
7	4231	19	3124
8	2143	20	1432
9	1423	21	4123
10	2134	22	2431
11	4312	23	1342
12	3241	24	3214

Appendix F

Instructions to video raters for scoring to derive Antex and Shex:

Antex

"Distress", rated from 0 to 100, refers to the overall degree of distress at the prospect of a shock, revealed by the subject's facial expression and movement. You will be looking for slight frowns, biting of the lips, tense jaw, etc.

Shex

"Shock reaction" rated from 0, indicating you had no idea of when the shock occurred, through 1 and 2 indicating you suspect you saw a shock reaction, through 3 where you saw a reaction but it was not great, to 10 which indicates an extreme reaction. A reaction may be a facial grimace, closing eyes, a small leap, etc.

Appendix G

Instructions to video raters for scoring Expressiveness and guessing 'express' and 'hide' trials:

Expressiveness

"Expressiveness", rated 0 to 100, indicates either (a) how extreme the subject's facial contortion is in response to instructions to express, or (b) how blank they have been able to keep their face in response to instructions to hide. Most of your ratings should fall, therefore, at quite low or quite high.

E/H

"Express (E)/Hide (H)" asks you to guess whether on this trial the subject was asked to express distress (write 'E') or to hide distress (write 'H'). Your choice here should correlate, of course, with your rating under "Expressiveness" (0-100).

Appendix H

Number of correct identifications of 'express' and 'hide' trials by the video raters:

Subject No.	Rater No. 1	Rater No. 2	Rater No. 3	No. of Taped Trials
1	8	8	6	8
2	8	8	8	8
3	8	8	4	8
4	8	8	8	8
5	8	8	8	8
6	8	8	8	8
7	5	0	6	8
8	8	8	8	8
9	8	8	8	8
10	3	4	3	4
11	8	8	6	8
12	8	8	8	8
13	4	4	4	8
14	4	4	6	8
15	4	6	4	8
16	7	7	7	7
17	4	4	8	8
18	8	8	8	8
19	8	8	6	8
20	8	8	8	8
21	4	8	4	8
22	8	8	8	8
23	4	4	6	8
24	8	8	8	8
Totals	159	161	158	187
Percentage of possible	85.0%	86.1%	84.5%	
Mean Percentage Correct		85.2%		

Appendix I

General					Natural Trials										
								Antex				Shex			
S.No.	Sex[a]	Age	Threshold	Cogab[b]	Confront	Avoid	Avcon	T2	T3	T4	$\bar{x}$	T2	T3	T4	$\bar{x}$
1	1	24	5	1	3	2	1	32.7	31.7	27.3	30.6	5.67	4.67	4.00	4.78
2	1	26	5	1	2	2	0	26.7	26.7	22.7	25.3	6.67	5.67	5.00	5.78
3	1	33	2	2	3	2	1	42.7	41.3	38.3	40.8	3.33	1.67	2.17	2.39
4	2	24	5	1	2	1	1	10	11.7	11.7	11.1	0.00	0.00	0.00	0.00
5	1	34	3	1	3	1	2	15	10	11.7	12.2	2.00	1.67	2.33	2.00
6	1	38	3	1	3	2	1	20	21.7	16.7	19.4	3.67	3.00	2.67	3.11
7	2	23	6	1	2	3	-1	6.7	5.7	9.3	7.2	0.00	0.17	0.67	0.28
8	1	19	3	1	3	3	0	18.7	16.7	15	16.8	0.83	0.33	0.50	0.56
9	2	54	3	1	2	2	0	10.3	7.7	6.7	8.2	0.50	0.50	0.50	0.50
10	1	39	4	2	4	4	0	3.3	3.3	3.3	3.3	0.00	0.00	0.00	0.00
11	2	58	3	2	1	1	0	13.3	16.7	16.7	15.6	3.00	3.00	3.67	3.22
12	1	52	5	2	1	4	-3	10.7	8.3	7.3	8.8	1.67	0.83	0.33	0.94
13	1	24	5	2	3	4	-1	9.3	9.3	4.3	7.7	0.17	0.00	0.00	0.06
14	1	21	4	2	2	3	-1	2.7	3.3	1.7	2.6	0.00	0.17	0.33	0.17
15	1	23	5	1	3	3	0	—	29.7	37.3	33.5	—	4.33	3.00	3.66
16	1	22	6	2	3	1	2	11.7	10	12	11.2	0.67	0.00	0.17	0.28
17	2	36	5	2	2	1	1	13.3	10.3	5	9.6	0.17	0.00	0.00	0.06
18	2	32	6	1	3	3	0	3.3	4	7.3	4.9	0.83	0.00	0.00	0.28
19	2	47	3	2	3	3	0	2	2.3	2.7	2.3	1.00	0.50	0.00	0.50
20	2	33	6	2	1	4	-3	19	13	13	15.0	0.83	0.33	0.33	0.50
21	2	24	6	2	4	2	2	4	9.3	6.3	6.6	0.83	0.67	0.17	0.56
22	1	39	5	1	1	4	-3	10	5.3	3.7	6.3	0.50	0.67	0.50	0.56
23	1	57	2	2	5	1	4	35	31	43.7	36.6	2.67	2.67	2.50	2.61
24	1	28	2	2	1	2	-1	10	11.7	9.3	10.3	0.00	0.83	0.67	0.50

[a] Females = 1, Males = 2.

[b] Cognitive activity reported completely natural = 1; Conscious policy = 2.

Appendix I

	Natural Trials															
	Anx				HRC1				RespC1				SCR1			
S.No.	T2	T3	T4	$\bar{x}$	T2	T3	T4	$\bar{x}$	T2	T3	T4	$\bar{x}$	T2	T3	T4	$\bar{x}$
1	4	3	5	3.00	2	2	-1	1	-1.4	3.0	-0.6	0.3	60	-60	-29	-10
2	5	5	4	4.33	-6	1	1	-1.3	2.3	-2.6	3.1	0.9	0	202	0	67
3	6	3	2	3.67	0	0	3	1	-0.8	2.0	3.7	1.6	217	91	-22	95
4	4	2	2	2.67	-6	-6	-2	-4.7	-3.0	1.6	-1.0	-0.8	-308	-292	40	-187
5	2	2	1	1.67	-7	5	-1	-1	-2.1	6.2	-2.7	0.5	-342	-79	-76	-166
6	1	1	1	1.00	2	6	3	3.7	1.7	-0.3	0.5	0.6	-401	-105	-109	-205
7	3	3	2	2.67	-16	-3	-9	-9.3	-10.3	0.1	-4.2	-4.8	251	384	-348	96
8	3	2	2	2.33	-6	4	5	1	3.1	1.8	-1.7	1.1	-146	35	175	21
9	2	1	1	1.33	2	-1	2	1	-3.1	-1.6	-5.2	-3.3	45	142	149	112
10	1.5	0.5	0.5	0.83	0	0	4	1.3	-1.9	1.3	-4.0	-1.5	—	—	—	—
11	2	2	2	2.00	-1	6	-2	1	-0.2	-0.4	-0.2	-0.3	115	679	351	382
12	1	2	1	1.33	1	3	-4	0	0.4	-1.9	1.1	-0.1	0	741	-122	207
13	3	2	2	2.33	-7	-17	-11	-11.7	-2.5	3.0	2.7	1.1	84	-171	175	29
14	2	2	2	2.00	-1	1	0	0	-0.4	0.8	-7.3	-2.3	37	-216	0	-60
15	5	5	4.5	4.83	-4	2	-4	-2	-2.4	0.9	-1.6	-1.0	294	379	68	237
16	3	3	2	2.67	-10	-3	-6	-6.3	-7.9	6.5	5.3	1.3	159	-28	-26	35
17	1	1	1	1.00	-8	-11	-3	-7.3	5.1	5.1	0.9	3.7	-78	0	0	-26
18	1	3	3	2.33	8	2	0	3.3	0.6	0.4	0.4	0.5	732	135	872	580
19	4	3	3	3.33	1	-1	-2	-0.7	0.5	-0.6	-0.2	-0.1	-282	-131	127	-95
20	4.8	3.5	3.5	3.77	4	0	1	1.7	-4.3	0.8	4.7	0.4	-62	-13	-91	-55
21	4	3.5	5	4.17	0	0	-3	-1	-0.7	0.7	-0.3	-0.1	-243	-23	489	74
22	4	1	1	2.00	0	-8	-5	-4.3	-1.7	-1.6	-3.2	-2.8	-338	-397	-375	-373
23	6	6	6	6.00	-1	-5	-1	-2.3	4.1	2.5	7.0	4.5	-182	170	0	-4
24	0	0	0.5	0.17	-3	-2	-4	-3	-0.3	0.5	0.3	0.2	0	0	49	16

Appendix I

Natural Trials

S.No.	Shock T2	Shock T3	Shock T4	Shock $\bar{x}$	HRC2 T2	HRC2 T3	HRC2 T4	HRC2 $\bar{x}$	RespC2 T2	RespC2 T3	RespC2 T4	RespC2 $\bar{x}$	SCR2 T2	SCR2 T3	SCR2 T4	SCR2 $\bar{x}$
1	0	-.5	-1	-0.50	-2	2	5	1.7	0.6	-0.6	0.2	0.1	248	178	173	200
2	-1	-1	-1	-1.00	10	-1	9	6.0	-5.5	-4.2	-5.9	-5.2	425	408	800	544
3	0	-.5	0	-0.17	-4	4	1	0.3	4.0	1.6	-0.9	1.6	425	596	658	560
4	-1	1	0	0	10	10	12	10.7	3.0	6.4	3.4	4.3	604	534	803	647
5	-1	-1	-.5	-0.83	—	-1	3	0.7	0.9	-5.8	-2.5	-2.5	329	312	312	318
6	.5	-1	-2	-0.83	14	10	9	11.0	-0.9	3.1	3.5	1.9	1463	1160	444	1022
7	-1.5	-1	-1	-1.17	4	7	5	5.3	8.7	9.9	12.6	10.4	556	356	701	538
8	0	1	1	0.67	6	4	3	4.3	2.5	1.0	-4.7	-0.4	388	575	375	446
9	0	0	0	0	2	1	2	1.7	0.3	2.0	4.0	2.1	189	196	103	163
10	-1	-1	0	-0.67	0	0	0	0	4.7	-0.9	1.2	1.7	—	—	—	—
11	0	0	1	0.33	9	2	6	5.7	0.6	2.8	-0.6	0.9	473	122	253	283
12	-1	0	-1	-0.67	—	5	—	5.0	-1.6	-0.1	-3.1	-1.6	722	1778	1500	1250
13	0	0	1	0.33	3	9	7	6.3	0.1	1.4	1.3	0.9	512	346	712	523
14	1	1	0	0.67	1	3	0	1.3	4.0	3.6	9.7	5.8	462	432	424	439
15	0	1	0	0.33	6	4	4	4.7	6.0	3.9	3.2	4.4	710	154	567	477
16	-1	1	0	0	6	-1	6	3.7	3.5	-6.1	4.3	0.6	285	169	107	187
17	-2	0	1	-0.33	2	3	5	3.3	3.7	1.7	1.5	2.3	305	321	321	316
18	-2	-1	1	-0.67	8	0	8	5.3	-2.6	-0.8	0	-1.1	581	701	773	685
19	-1	-1	-1	-1.00	5	3	2	3.3	1.9	1.8	1.0	1.6	574	264	768	535
20	0	0	0	0	0	4	5	3.0	7.1	3.6	-1.1	3.2	220	279	305	268
21	0	0	1	0.33	8	2	5	5.0	2.3	0.5	1.1	1.3	376	504	459	446
22	1	0	0	0.33	8	4	7	6.3	-5.1	7.6	6.4	3.0	2582	1871	1592	2015
23	0	0	0	0	-3	-3	-3	-3.0	-2.9	-0.9	-4.2	-2.7	214	369	297	293
24	0	1	1	0.67	—	16	—	16.0	2.3	1.5	2.5	2.1	0	0	0	0

Appendix I

Express – Attend Condition

S.No	Faco T1	Faco T2	Faco x̄	Coco T1	Coco T2	Coco x̄	Anx T1	Anx T2	Anx x̄	HRC1 T1	HRC1 T2	HRC1 x̄	RespC1 T1	RespC1 T2	RespC1 x̄
1	9.1	9.4	9.2	3	3	3.5	6.5	5	5.75	6	2	4	7	6.8	6.9
2	-2.2	4.2	1.0	1	1	1	4	4	4.0	2	2	2	1.8	-1	0.4
3	12.8	24.4	18.6	3	4	3.5	4	1	2.5	-6	-2	-4	0.6	-2.2	-0.8
4	19.4	17.8	18.6	4	2	3	2	3	2.5	0	8	4	-2	3.2	0.6
5	17.1	13.1	15.1	2	4	3	3	4	3.5	6	12	9	-1.2	4.2	1.5
6	6.1	10.8	8.4	1	3	2	1	3	2.0	2	6	4	4.8	4.2	4.5
7	-28.9	-27.2	-28.0	4	3.5	3.75	5	4	4.5	6	-2	2	10.6	19	14.8
8	20.8	29.4	25.1	4	4	4	5	5	5.0	-4	10	3	2.6	7	4.8
9	9.8	-4.2	2.8	3	4	3.5	2	1	1.5	2	0	1	-2	1.8	-0.1
10	-33.9	-7.2	-20.5	2	3	2.5	4	4	4.0	0	-11	-5.5	-0.4	3	1.3
11	-13.9	-10.6	-12.2	2	2	2	2	2	2.0	-2	2	0	0.8	3.4	2.1
12	4.4	5.4	4.9	2	1	1.5	2	1	1.5	2	-2	0	1.2	-1.4	-0.1
13	-16.6	-15.6	-16.1	2	2	2	2	1	1.5	-4	-4	-4	1.6	-0.4	0.6
14	-37.2	-35.6	-36.4	3	3	3	3	3	3.0	0	0	0	0	-2.2	-1.1
15	-18.9	-17.6	-18.2	3	4	3.5	6	6	6.0	0	-11	-5.5	0.2	6	3.1
16	5.4	1.8	3.6	3	2	2.5	4	3	3.5	0	0	0	—	-2.8	-2.8
17	-25.9	-36.2	-31.0	4	4	4	1	1	1.0	-2	-5	-3.5	10.8	-0.4	5.2
18	-0.2	1.1	0.4	2	3	2.5	5	5	5.0	0	-3	-1.5	-1.8	0	-0.9
19	-23.6	6.1	-17.5	2	2	2	2	3	2.5	-4	-7	-5.5	-0.6	-1.2	-0.9
20	15.1	12.1	13.6	3.5	2.7	3.1	5.3	5.3	5.3	8	6	7	-3.2	-6.8	-5.0
21	-30.2	-26.6	-28.4	3	1.5	2.25	6.5	4	5.25	0	-1	-0.5	4.4	3.2	3.8
22	13.4	12.8	13.1	3	3	3	6	3	4.5	0	-3	-1.5	4	-4	0
23	-4.9	8.4	1.7	4	4	4	6	8	7.0	2	-2	0	7.2	-3	2.1
24	21.8	20.4	21.1	4	4	4	1	1	1.0	-3	-1	-2	2.2	1.4	1.8

Appendix I

Express-Attend Condition

	SCR1			Shock			HRC2			RespC2			SCR2		
S.No	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}^a$
1	93	104	98.5	-0.5	-1	-0.75	2	2	2	-10.6	-3.2	-6.9	126	35	80
2	133	-319	-93	-1	1	0	6	-2	2	3	-6.2	-1.6	274	838	460
3	127	-44	41.5	1	0	0.5	-2	4	1	—	—	—	450	132	290
4	-138	-82	-110	0	-1	-0.5	4	4	4	2.4	8	5.2	368	342	350
5	0	0	0	-0.5	0.5	0	-4	-6	-5	-5.6	-3.4	-4.5	277	166	220
6	109	60	84.5	0	-2	-1	6	6	6	-0.4	1.1	0.3	1160	726	940
7	424	514	469	1	0	0.5	2	2	2	-15.4	-5.1	-10.2	356	233	290
8	72	145	108.5	1	1	1	-4	-6	-5	-0.6	-7.4	-4.0	454	375	410
9	-57	126	34.5	1	1	1	-2	8	3	6.4	5	5.7	0	0	0
10	—	—	—	0	0	0	4	6	5	2	-3.8	-0.9	—	—	—
11	325	227	276	-1	1	0	6	2	4	1.2	1	1.1	567	321	440
12	0	-402	-201	0	-1	-0.5	6	10	8	-4	1.4	-1.3	3509	4849	4200
13	284	-107	88.5	1	0	0.5	8	4	6	-2	-1.6	-1.8	840	892	870
14	-200	85	-57.5	1	0	0.5	4	4	4	6.8	1.8	4.3	595	265	430
15	856	157	506.5	0	1	0.5	4	3	3.5	1	2.8	1.9	731	487	610
16	0	94	47	0	1	0.5	0	0	0	3.1	2.4	2.7	343	192	270
17	88	0	44	-1	-1	-1	4	5	4.5	1.4	4.8	3.1	366	375	370
18	-137	-137	-137	0	0	0	2	7	4.5	0.6	2.4	1.5	567	872	720
19	-147	0	-73.5	0	0	0	4	7	5.5	1.8	-0.4	0.7	877	556	720
20	250	69	159.5	1	0	0.5	-4	-4	-4	3.6	4.8	4.2	289	245	270
21	-268	-285	-276.5	0	1	0.5	-4	-3	-3.5	-8	-3.6	-5.8	684	752	720
22	-356	-855	-605.5	1	-1	0	4	1	2.5	1.2	2.8	2.0	2967	2941	3000
23	245	165	205	0	0	0	-2	6	2	-6.4	8.2	0.9	172	535	350
24	95	0	47.5	0	1	0.5	—	—	—	-0.2	2.6	1.2	111	80	95

[a] Rounded to two significant digits.

Appendix I

Express - Avoid Condition															
	Faco			Coco			Anx			HRC1			RespC1		
S. No	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$
1	30·1	27·8	28·9	2	3	2·5	4	4	4·0	-2	4	1	-1	1·6	0·3
2	5·8	0·8	3·3	2	1	1·5	4	5	4·5	0	-4	-2	0·6	-1·4	-0·4
3	9·4	17·8	13·6	1	2	1·5	3	2	2·5	2	-4	-1	3·6	1·6	2·6
4	16·1	20·1	18·1	2	3	2·5	4	3	3·5	2	2	2	-11·2	-1·6	-6·4
5	9·4	17·4	13·4	4	4	4	4	4	4·0	2	12	7	-2·2	2·8	0·3
6	15·4	-2·2	6·6	2	3	2·5	4	2	3·0	2	0	1	1·4	2·2	1·8
7	-24·2	-12·9	-18·5	2	3	2·5	3	2	2·5	2	-8	-3	13·8	13·2	13·5
8	31·8	22·8	27·3	0·5	2	1·25	5	5	5·0	8	6	7	11·8	7	9·4
9	4·4	13·8	9·1	2	3	2·5	1	1	1·0	-2	0	-1	-2·4	-6·6	-4·5
10	-5·9	-5·9	-5·9	1	1	1	1·5	3	2·25	8	2	5	4·6	-1·6	1·5
11	12·4	2·4	7·4	3	3	3	2	2	2·0	-4	-4	-4	1	2·4	1·7
12	5·8	4·4	5·1	3	3	3	2	1	1·5	4	-2	1	-0·2	2·6	1·2
13	-38·6	-37·6	-38·1	3	3	3	1	2	1·5	-8	0	-4	0·8	-4·2	-1·7
14	-13·6	-19·2	-16·4	3	2	2·5	3	2	2·5	0	4	2	0·2	-2·6	-1·2
15	10·8	-0·9	4·9	2	4	3	5	4	4·5	8	-4	2	4·8	-2·4	1·2
16	0·1	-3·6	-1·7	2	1	1·5	4	3	3·5	-4	-2	-3	-9·2	-5·4	-7·3
17	-3·2	-7·6	-5·4	1	1	1	2	1	1·5	7	0	3·5	-0·4	-2·8	-1·6
18	7·4	5·4	6·4	2	2	2	5	3	4·0	-2	-7	-4·5	-5·6	-9·8	-7·7
19	-0·2	0·8	0·3	3	3	3	3	2	2·5	-1	2	0·5	0·8	1·2	1·0
20	24·4	17·4	20·9	1	3·5	2·25	3·8	2	2·7	0	0	0	-12·6	-6·2	-9·4
21	-20·9	-15·6	-18·2	1·5	0·5	1	5·5	6	5·75	-1	1	0	3·4	4·6	4·0
22	-2·2	2·8	0·3	1	3	2	3	3	3·0	-4	-3	-3·5	5·4	3·4	4·4
23	-18·2	-11·6	-14·9	0	0	0	7	9	8·0	-2	-4	-3	0·6	3·2	1·9
24	15·4	15·8	15·6	2	3	2·5	1	1	1·0	-2	-1	-1·5	1	-1·2	-0·1

Appendix I

Express - Avoid Condition															
	SCR1			Shock			HRC2			RespC2			SCR2		
S.No.	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$ [a]
1	33	0	16.5	-1	-1	-1	2	0	1	1.8	-2.4	-0.3	65	38	51
2	0	595	297.5	0	0	0	-4	4	0	-2.2	1	-0.6	274	638	460
3	-44	22	-11	0	0	0	6	4	5	—	—	—	370	85	230
4	-67	39	-14	-1	1	0	2	-2	0	9.6	5.2	7.4	414	123	270
5	-135	142	3.5	0	0.5	0.25	-6	-4	-5	-1	-10	-5.5	271	305	290
6	-112	0	-56	-2	-2	-2	-2	8	3	7.4	-2.2	2.6	819	344	580
7	245	255	250	0	-1	-0.5	6	4	5	-7.8	-8	-7.9	512	541	530
8	325	111	218	0	1	0.5	0	-2	-1	-5.8	-3	-4.4	297	454	380
9	60	0	30	1	0	0.5	-2	0	-1	-0.4	4.6	2.1	122	143	130
10	—	—	—	0	-1	-0.5	-8	6	-1	2.2	1.2	1.7	—	—	—
11	348	399	373.5	-1	0	-0.5	8	4	6	1.4	0.4	0.9	290	337	310
12	420	-571	-75.5	-1	0	-0.5	8	14	11	-1	1.4	0.2	3247	3235	3200
13	420	-219	50.5	1	1	1	4	8	6	-0.8	0.2	-0.3	700	892	800
14	147	78	112.5	1	0	0.5	0	4	2	0.6	1.4	1.0	563	595	580
15	321	-78	121.5	0	1	0.5	4	10	7	0.4	2.8	1.6	512	753	630
16	-44	89	22.5	0	1	0.5	-4	-2	-3	2	7	4.5	260	377	320
17	166	87	39.5	-1	0	-0.5	-3	0	-1.5	1.2	6.4	3.8	356	541	450
18	134	344	239	-2	-1	-1.5	—	—	—	4.8	5	4.9	290	1030	660
19	0	0	0	0	-1	-0.5	3	2	2.5	2	1.2	1.6	595	556	580
20	160	-11	74.5	-1	0	-0.5	4	2	3	15	8.2	11.6	266	116	190
21	-297	124	-86.5	1	1	1	-5	-3	-4	-1.4	-2.6	-2.0	699	686	690
22	-902	-763	-832.5	0	1	0.5	2	1	1.5	-4.6	3.8	-0.4	2267	2765	2500
23	126	88	107	1	0	0.5	2	0	1	0.2	0.8	0.5	350	275	310
24	23	188	105.5	0	1	0.5	—	—	—	-1.8	1.2	-0.3	47	101	74

[a] Rounded to two significant digits.

Appendix I

Hide - Attend Condition

	Faco			Coco			Anx			HRC1			RespC1		
S.No	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$
1	-6.5	-3.1	-4.8	2	4	3	3	4	3.5	2	-4	-1	4.4	3	3.7
2	-3.1	-4.8	-3.9	1	3	2	5	4	4.5	0	-6	-3	1.4	-1	0.2
3	-13.1	-8.1	-10.6	4	3	3.5	3	3	3	-6	4	-1	6.8	6	6.4
4	1.9	7.9	4.9	3	2	2.5	6	3	4.5	-2	-4	-3	-4.2	0.6	-1.8
5	1.9	2.9	2.4	1	4	2.5	1	3	2	-2	-4	-3	4	1	2.5
6	-1.5	3.5	1.0	2	3	2.5	3	2	2.5	8	0	4	2.4	1.6	2.0
7	-16.5	3.2	-6.6	3	3.5	3.25	3	3	3	2	-16	-7	2.6	6.6	4.6
8	-1.8	-5.8	-3.8	2	4	3	4	3	3.5	8	-4	2	4.4	3	3.7
9	6.9	8.5	7.7	3	3	3	2	1	1.5	-4	-2	-3	-3.2	-4	-3.6
10	-7.8	-7.8	-7.8	2	3	2.5	0	0	0	-2	-6	-4	3.6	2.2	2.9
11	-1.5	0.9	-0.3	3	2	2.5	2	2	2	-6	2	-2	1.4	2.8	2.1
12	6.9	8.5	7.7	2	2	2	2	1	1.5	2	6	4	1	-0.6	0.2
13	5.2	6.9	6.0	3	2	2.5	3	2	2.5	-10	-4	-7	-1.4	2.6	0.6
14	9.2	5.2	7.2	3	4	3.5	3	3	3	0	4	2	2.4	1.8	2.1
15	-17.8	-4.8	-11.3	2	3	2.5	5	5	5	-8	-7	-7.5	3.8	3	3.4
16	3.2	7.2	5.2	4	2	3	2	2	2	-6	-8	-7	3.6	7.8	5.7
17	-17.8	-21.5	-19.6	4	3	3.5	1	1	1	-10	-8	-9	1.4	-2.8	-0.7
18	8.5	7.9	8.2	3	2	2.5	3	4	3.5	4	2	3	-3.6	-1.2	-2.4
19	10.9	11.5	11.2	3	3	3	3	2	2.5	2	-1	0.5	8.2	-0.2	4.0
20	3.9	7.5	5.7	1.5	2	1.75	3.8	2.2	3	-6	-1	-3.5	-5.8	-2	-3.9
21	-7.1	-12.8	-9.9	2	1	1.5	5	3.5	4.25	-2	3	0.5	0.4	5.8	3.1
22	0.2	7.5	3.8	3	3	3	5	2	3.5	-4	-5	-4.5	3.6	4	3.8
23	-38.5	-30.3	-34.6	4	4	4	9	9	9	-2	0	-1	-4.4	-2	-3.2
24	0.9	6.5	3.7	3	4	3.5	1	0.5	0.75	-4	-2	-3	-3	-3.2	-3.1

Appendix I

Hide - Attend Condition

	SCR1			Shock			HRC2			RespC2			SCR2[a]		
S.No.	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$
1	100	155	127.5	0	-1	-0.5	2	4	3	-4	-3.4	-3.7	34	39	36
2	274	0	137	0	0	0	4	2	3	-2.2	1.4	-0.4	282	638	460
3	64	-131	-33.5	0	0	0	-2	0	-1	—	—	—	450	257	350
4	158	-79	39.5	0	1	0.5	10	8	9	-0.2	7.8	3.8	575	368	470
5	-137	78	-29.5	0	1	0.5	6	4	5	-3.4	-1	-2.2	277	329	300
6	58	0	29	-1	-1	-1	-8	8	0	2	1.1	1.5	741	838	790
7	366	82	224	0	0	0	6	4	5	-2.2	-9	-5.6	556	346	500
8	178	71	124.5	1	1	1	-4	4	0	1.2	2.2	1.7	146	293	220
9	0	65	32.5	0	0	0	4	-2	1	6.8	6.8	6.8	115	0	57
10	—	—	—	1	0	0.5	6	6	6	-2.4	5.4	1.5	—	—	—
11	271	305	288	-1	0	-0.5	6	6	6	2.2	0.8	1.5	430	321	380
12	-178	0	-89	-1	-1	-1	6	8	7	1	1	1	2804	1984	2400
13	96	219	157.5	1	1	1	10	8	9	2.2	1	1.6	794	892	840
14	44	-41	1.5	1	1	1	8	0	4	-1.2	-1	-1.1	555	425	490
15	251	384	317.5	0	0	0	6	9	7.5	2.2	3	2.6	512	321	420
16	41	143	92	0	0	0	2	0	1	4	0.6	2.3	343	303	320
17	261	91	176	1	0	0.5	2	2	2	5	7.2	6.1	181	375	280
18	0	535	267.5	0	-1	-0.5	2	4	3	2.8	3.2	3.0	641	872	760
19	-278	-142	-210	0	0	0	-2	1	-0.5	0.2	0.6	0.4	556	574	560
20	-103	-11	-57	0	0	0	-2	3	0.5	1.8	4	2.9	181	190	190
21	98	-153	-27.5	0	1	0.5	—	—	—	-0.4	1.8	0.7	732	887	810
22	-284	-524	-404	1	-2	-0.5	2	1	1.5	-5.2	-0.4	-2.8	3052	3160	3100
23	43	0	21.5	0	0	0	6	4	5	0	0	0	433	275	350
24	177	-51	63	1	1	1	—	—	—	1.8	5.2	3.5	108	101	100

[a] Rounded to two significant digits.

Appendix I

Hide - Avoid Condition

	Faco			Coco			Anx			HRC1			Resp C1		
S.No.	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$
1	-24.8	-1.5	-13.1	1	4	2.5	5	3	4	-2	0	-1	0.4	0	0.2
2	-6.1	0.2	-2.9	2	3	2.5	5	4	4.5	-2	-2	-2	-8.2	-4.6	-6.4
3	-19.8	-4.8	-12.3	2	3	2.5	4	2	3	-6	-8	-7	-1	2	0.5
4	-19.8	-4.8	-12.3	3	3	3	3	3	3	4	-4	0	1.6	0.8	1.2
5	1.8	3.5	2.6	4	4	4	0.5	0	0.25	-10	-4	-7	2	4.8	3.4
6	4.9	5.5	5.2	1	3	2	1	1	1	2	-4	-1	0	-0.4	-0.2
7	6.2	3.2	4.7	3.5	3.2	3.35	2	2	2	-8	-8	-8	-6.4	3.8	-1.3
8	3.2	2.2	2.7	3	3	3	3	3	3	-2	6	2	-2.8	1.2	-0.8
9	6.9	10.2	8.5	2	3	2.5	1	1	1	-2	-2	-2	-1.6	-0.8	-1.2
10	6.9	6.9	6.9	3	3	3	1	0	0.5	-4	8	2	-1	0.6	-0.2
11	2.5	-4.8	-1.1	3	3	3	1	2	1.5	0	-4	-2	1	-1.4	-0.2
12	7.9	7.2	7.5	3	3	3	1	2	1.5	-2	-2	-2	-1.4	2	0.3
13	-9.5	-8.5	-9	4	4	4	1	1	1	8	-8	0	1	2.4	1.7
14	-11.1	-6.1	-8.6	3	4	3.5	2	1	1.5	-2	0	-1	0.8	1.4	1.1
15	-16.1	-29.1	-22.6	3	3	3	5	5	5	3	0	1.5	3	3	3
16	4.5	4.5	4.5	3	3	3	2	2	2	-6	-2	-4	0	-0.8	-0.4
17	9.2	5.2	7.2	2	4	3	1	1	1	-12	-2	-7	-4.6	-1	-2.8
18	8.2	7.2	7.7	3	3	3	2	2	2	-2	-5	-3.5	-7.6	-4.4	-6
19	11.9	11.5	11.7	3	3	3	2	2	2	2	-2	0	2	5	3.5
20	5.5	7.9	6.7	3	3.5	3.25	2.5	1.5	2	-1	-5	-3	-12.6	-9.6	-11.1
21	1.5	8.2	4.8	2	2.5	2.25	3.5	4	3.75	-9	-6	-7.5	0.4	-1.8	-0.7
22	6.9	8.5	7.7	1	3	2	4	2	3	-2	-6	-4	2.4	7.8	5.1
23	-4.8	-8.1	-6.4	2	0	1	4	9	6.5	0	4	2	-0.4	6.4	3
24	3.5	8.2	5.8	4	3	3.5	1	1	1	1	-8	-3.5	-5	0.4	-2.3

Appendix I

Hide – Avoid Condition															
	SCR1			Shock			HRC2			RespC2			SCR2		
S.No.	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$	T1	T2	$\bar{x}$[a]
1	-32	72	20	-1.5	0	-0.75	2	8	5	-1.2	-6	-3.6	63	0	31
2	278	-308	-15	0	0	0	2	4	3	4.6	1.8	3.2	574	941	760
3	82	-22	30	-0.5	-0.5	-0.5	6	8	7	—	—	—	257	132	190
4	-167	-43	-62	0	-1	-0.5	8	4	6	5.2	1.2	3.2	382	171	280
5	0	0	0	-1.5	-0.5	-1	6	8	7	2.8	-5.6	-1.4	277	527	400
6	113	0	56.5	-1	-2	-1.5	6	8	7	-1.2	1.1	-0.05	838	463	650
7	169	243	206	-1	-1	-1	8	4	6	2.8	4.2	3.5	346	181	260
8	69	0	34.5	1	1	1	2	-6	-2	3.6	4	3.8	432	146	290
9	0	132	66	0	0	0	2	2	2	3.2	6.4	4.8	117	277	200
10	—	—	—	-1	-1	-1	0	0	0	-0.2	3.4	1.6	—	—	—
11	0	0	0	-1	-1	-1	8	4	6	1.4	3	2.2	290	329	310
12	157	233	195	0	0	0	6	2	4	-0.6	2	0.7	3678	2316	3000
13	439	107	273	1	1	1	4	4	4	-0.6	-4	-2.3	948	700	820
14	126	0	63	0	1	0.5	6	4	5	5.2	1	3.1	642	255	450
15	251	0	125.5	-2	0	-1	5	8	6.5	-0.2	0.2	0	356	641	500
16	-101	131	15	0	-1	-0.5	2	2	2	0.8	5.2	3	400	269	330
17	166	87	126.5	1	0	0.5	0	4	2	6.6	-2.6	2	329	356	340
18	-726	-264	-495	-1	-2	-1.5	6	9	7.5	6.4	4	5.2	541	812	680
19	-287	0	-143.5	0	-1	-0.5	4	8	6	0.4	1.8	1.1	574	556	560
20	-48	153	52.5	0	0	0	3	3	3	7.8	8.8	8.3	144	74	110
21	33	-398	-182.5	1	0	0.5	-1	4	1.5	1.2	4	2.6	653	983	820
22	618	-899	-140.5	1	-1	0	4	4	4	-4.4	7.8	1.7	3962	2238	3100
23	82	0	41	0	1	0.5	0	0	0	6.8	1.2	4	425	458	440
24	64	51	57.5	0	1	0.5	—	—	—	7	4.4	5.7	66	26	46

[a] Rounded to two significant digits.

Appendix J

Table J1

Analysis of Variance for Antex-groups using Shex Scores

Source	SS	df	MS	*F*	*p*
Antex	128.68	2	64.34	22.26	<.01
Between Ss	60.66	21	2.89		
Trials	1.92	2	0.96	5.13	<.01
Antex x Trials	0.17	4	0.04	0.21	-
Within Ss	7.85	42	0.187		

Table J2

Analysis of Variance for Avcon-groups using Shex Scores

Source	SS	df	MS	*F*	*p*
Avcon	22.80	2	11.40	1.51	-
Between Ss	150.62	20	7.53		
Trials	1.70	2	0.85	5.55	<.01
Avcon x Trials	0.70	4	0.17	1.14	-
Within Ss	6.12	40	0.153		

Table J3

Analysis of Variance for Avcon-groups using Anx Scores

Source	SS	df	MS	*F*	*p*
Avcon	10.82	2	5.41	0.86	-
Between Ss	132.62	21	6.32		
Trials	5.90	2	2.95	4.91	<.05
Avcon x Trials	0.77	4	0.19	0.32	-
Within Ss	25.25	42	0.601		

Table J4

Analysis of Variance for Avcon-groups using HRCl Scores

Source	SS	df	MS	*F*	*p*
Avcon	204.30	2	102.15	2.50	-
Between Ss	858.53	21	40.88		
Trials	18.40	2	9.20	0.71	-
Avcon x Trials	40.88	4	10.22	0.79	-
Within Ss	545.46	42	12.99		

Table J5

Analysis of Variance for Avcon-groups using RespCl Scores

Source	SS	df	MS	*F*	*p*
Avcon	76.80	2	38.40	4.11	<.05
Between Ss	196.09	21	9.34		
Trials	57.83	2	28.91	3.40	<.05
Avcon x Trials	35.92	4	8.98	1.06	-
Within Ss	356.93	42	8.498		

Table J6

Analysis of Variance for Avcon-groups using SCRl Scores

Source	SS	df	MS	*F*	*p*
Avcon	718,813	2	359,406	3.89	<.05
Between Ss	1,848,842	20	92,442		
Trials	90,045	2	45,022	1.14	-
Avcon x Trials	462,813	4	115,703	2.92	<.05
Within Ss	1,586,593	40	39,665		

Table J7

Analysis of Variance for Antex-groups using Anx Scores

Source	SS	df	MS	*F*	*p*
Antex	37.11	2	18.56	3.67	<.05
Between Ss	106.33	21	5.06		
Trials	5.87	2	2.93	4.82	<.05
Antex x Trials	0.44	4	0.11	0.18	-
Within Ss	25.58	42	0.609		

Table J8

Analysis of Variance for Antex-groups using HRCl Scores

Source	SS	df	MS	*F*	*p*
Antex	133.58	2	66.79	1.54	-
Between Ss	909.75	21	43.32		
Trials	20.08	2	10.04	0.79	-
Antex x Trials	57.33	4	14.33	1.13	-
Within Ss	531.25	42	12.648		

Table J9

Analysis of Variance for Antex-groups using RespCl Scores

Source	SS	df	MS	*F*	*p*
Antex	61.22	2	30.61	3.02	<.07
Between Ss	212.60	21	10.12		
Trials	56.64	2	28.32	3.35	<.05
Antex x Trials	40.45	4	10.11	1.20	-
Within Ss	354.68	42	8.445		

Table J10

Analysis of Variance for Antex-groups using SCR1 Scores

Source	SS	df	MS	*F*	*p*
Antex	81,327	2	40,663	1.56	-
Between Ss	2,486,329	20	124,316		
Trials	90,045	2	45,022	1.73	-
Antex x Trials	1,008,557	4	252,139	9.69	<.01
Within Ss	1,040,850	40	26,021		

Table J11

Analysis of Variance of Coco across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
Att/Av	0.67	1	0.67	1.02	-
E/H	0.17	1	0.17	0.26	-
Att/Av x E/H	6.19	1	6.19	9.52	<.05
Within Ss	59.64	92	0.65		

Table J12

Analysis of Variance of Faco across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
Att/Av	259.16	1	259.16	1.33	-
E/H	22.10	1	22.10	0.11	-
Att/Av x E/H	51.78	1	51.78	0.26	-
Within Ss	17,989.21	92	195.53		

Table J13

Analysis of Variance of Anx Scores across Att/Av and E/H [a]

Source	SS	df	MS	*F*	*p*
Antex	123.63	2	61.82	4.15	<.05
Between Ss	312.59	21	14.89		
E/H	22.96	1	22.96	24.02	<.001
Att/Av	11.41	1	11.41	11.93	<.001
Trials	5.47	1	5.47	5.72	<.05
Within Ss	140.54	147	0.956		

[a] All interaction effects were nonsignificant and therefore omitted.

Table J14

Analysis of Variance of HRCl Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
E/H	138.96	1	138.96	11.31	<.01
Att/Av	0.32	1	0.32	0.03	-
E/H x Att/Av	0.12	1	0.12	0.01	-
Within Ss	1,130.47	92	12.288		

Table J15

Analysis of Variance of RespCl Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
Antex	157.96	2	78.98	1.11	-
Between Ss	1,499.61	21	71.41		
E/H	11.57	1	11.57	0.96	-
Att/Av	128.18	1	128.18	10.62	<.01
Trials	9.76	1	9.76	0.81	-
Within Ss	1,774.61	147	12.072		

Table J16

Analysis of Variance of SCR1 Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
Avcon	210,968	2	105,484	0.51	-
Between Ss	4,171,492	20	208,575		
E/H	2,092	1	2,092	0.05	-
Att/Av	4,278	1	4,278	0.11	-
Trials	171,120	1	171,120	4.43	<.05
Within Ss	5,404,644	140	38,605		

Table J17

Analysis of Variance of HRC2 Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
E/H	57.93	1	57.93	5.50	<.05
Att/Av	0.70	1	0.70	0.07	-
E/H x Att/Av	7.92	1	7.92	0.75	-
Within Ss	978.32	92	10.520		

Table J18

Analysis of Variance of RespC2 Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
Avcon	28.05	2	14.03	0.20	-
Between Ss	1,378.72	20	68.94		
E/H	70.44	1	70.44	7.13	<.01
Att/Av	62.08	1	62.08	6.29	<.05
Trials	15.64	1	15.64	1.58	-
Within Ss	1,382.23	140	9.873		

Table J19

Analysis of Variance of SCR2 Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
E/H	12,445	1	12,445	0.02	-
Att/Av	43,739	1	43,739	0.07	-
E/H x Att/Av	34,207	1	34,207	0.05	-
Within Ss	57,281,149	92	622,621		

Table J20

Analysis of Variance of Faco Scores across Antex-groups and E/H

Source	SS	df	MS	*F*	*p*
Antex	1,997	2	998.5	6.45	<.01
E/H	22	1	22	0.14	-
Antex x E/H	2,372	2	1186	7.70	<.01
Within Ss	13,931	90	154		

Table J21

Analysis of Covariance of Anx Scores across Antex-groups, Att/Av, and E/H with Covariable Faco [a]

Source	SS	df	MS	*F*	*p*
Antex	142.27	2	71.13	5.24	<.05
Between Ss	271.37	20	13.57		
E/H	24.61	1	24.61	25.98	<.001
Att/Av	11.77	1	11.77	12.43	<.001
Trials	5.98	1	5.98	6.32	<.05
Within Ss	138.27	146	0.947		

[a] Compare with Table J13.
Within-treatment regression, $F(1,20) = 1.30$, $p = .27$;
Within- and between-treatment regression, $F(1,22) = 1.20$, $p = .28$.

Table J22

Analysis of Variance of Anx Scores across Antex-groups and E/H [a]

Source	SS	df	MS	*F*	*p*
Antex	123.63	2	61.82	4.15	<.05
Between Ss	312.59	21	14.89		
E/H	22.96	1	22.96	24.02	<.001
Antex x E/H	3.14	2	1.57	0.83	-
Within Ss	140.54	147	0.956		

[a] Same analysis as reported in Table J13.

Table J23

Analysis of Variance of RespCl Scores across Antex-groups and E/H [a]

Source	SS	df	MS	*F*	*p*
Antex	157.96	2	78.98	1.11	-
Between Ss	1,499.61	21	71.41		
E/H	11.57	1	11.57	0.96	-
Antex x E/H	44.17	2	22.09	1.83	-
Within Ss	1,774.61	147	12.072		

[a] Same analysis as reported in Table J15.

Table J24

Analysis of Variance of SCR1 Scores across Antex-groups and E/H

Source	SS	df	MS	*F*	*p*
Antex	717,514	2	358,757	1.96	-
Between Ss	3,664,946	20	183,247		
E/H	13	1	13	0.00	-
Antex x E/H	117,861	2	58,930	1.37	-
Within Ss	6,032,711	140	43,091		

Table J25

Analysis of Variance of Coco Scores across Avcon-groups and Att/Av

Source	SS	df	MS	*F*	*p*
Avcon	0.04	2	0.02	0.05	-
Att/Av	0.67	1	0.67	1.63	-
Avcon x Att/Av	23.00	2	11.50	28.05	<.001
Within Ss	36.77	90	0.41		

Table J26

Analysis of Covariance of Anx Scores across Avcon-groups, Att/Av and E/H with Covariable Coco [a]

Source	SS	df	MS	*F*	*p*
Avcon	41.17	2	20.59	1.04	-
Between Ss	394.51	20	19.73		
Att/Av	10.98	1	10.98	11.67	<.001
E/H	22.87	1	22.87	24.31	<.001
Trials	6.68	1	6.68	7.10	<.01
Within Ss	137.36	146	0.941		

[a] Compare with Table J13.
Within-treatment regression, $F(1,20) = 0.04$, $p = .83$;
Within- and between-treatment regression, $F(1,22) = 0.03$, $p = .87$.

Table J27

Analysis of Variance of Anx Scores across Avcon-groups and Att/Av

Source	SS	df	MS	*F*	*p*
Avcon	40.82	2	20.41	1.08	-
Between Ss	395.39	21	18.82		
Att/Av	12.44	1	12.44	13.24	<.001
Avcon x Att/Av	2.70	2	1.35	1.44	-
Within Ss	138.06	147	0.939		

Table J28

Analysis of Variance of RespCl Scores across Avcon-groups and Att/Av

Source	SS	df	MS	*F*	*p*
Avcon	15.42	2	7.71	0.10	-
Between Ss	1,642.14	21	78.20		
Att/Av	125.54	1	125.54	10.69	<.01
Avcon x Att/Av	9.25	2	4.63	0.39	-
Within Ss	1,725.76	147	11.740		

Table J29

Analysis of Variance of SCRl Scores across Avcon-groups and Att/Av

Source	SS	df	MS	*F*	*p*
Avcon	210,968	2	105,484	0.51	-
Between Ss	4,171,492	20	208,575		
Att/Av	4,278	1	4,278	0.11	-
Avcon x Att/Av	71,765	2	35,882	0.03	-
Within Ss	5,404,644	140	38,605		

Table J30

Analysis of Variance of RespC2 Scores across Avcon-groups and Att/Av

Source	SS	df	MS	*F*	*p*
Avcon	28.05	2	14.03	0.20	-
Between Ss	1,378.72	20	68.94		
Att/Av	62.08	1	62.08	6.29	<.05
Avcon x Att/Av	14.69	2	7.35	0.74	-
Within Ss	1,382.23	140	9.87		

Table J31

Analysis of Variance of Shock Scores across Att/Av and E/H

Source	SS	df	MS	*F*	*p*
Att/Av	1.83	1	1.83	4.35	<.05
E/H	0.23	1	0.23	0.55	-
Att/Av x E/H	2.33	1	2.33	5.58	<.05
Within Ss	38.47	92	0.418		

Appendix K

Throughout the study scores on Avcon defined three Avcon-groups: avoiders, middle-group, and confronters. Likewise Antex-groups were inhibitors, middle-group, and expressers. The allocation frequencies for 24 subjects into these groups are:

	Inhibitors	Middle	Expressers	
Avoiders	4 (2.33)	3 (2.33)	0 (2.33)	7
Middle	3 (2.67)	1 (2.67)	4 (2.67)	8
Confronters	1 (3)	4 (3)	4 (3)	9
	8	8	8	

However, expected frequencies as shown in brackets are all too low for valid χ^2 analysis. Antex is a continuously varying measure. Thus the three Antex-groups can be turned to two:

	Inhibitors	Expressers	
Avoiders	6 (3.5)	1 (3.5)	7
Middle	4 (4)	4 (4)	8
Confronters	2 (4.5)	7 (4.5)	9
	12	12	

Although the resultant χ^2 is significant, $\chi^2 = 5.99$, $p < .05$, expected frequencies are still all below five. Even allocation of the Avcon middle-group (who all scored zero) into avoiders and confronters results in Table 5 with expected cell frequencies of six.

Appendix L

Avcon-group and Antex-group means on concurrent indices from Parts One and Two:

	Anx		HRCl		RespCl		SCRl	
	One	Two	One	Two	One	Two	One	Two
Avcon								
Avoiders	2.04	2.34[a]	-3.81	-1.71[a]	-1.11	+0.55[b]	-19.6	+8.5[c]
Middle	2.71	3.05	+0.46	-0.83	-0.47	+0.44	+187.7	+86.8
Confronters	2.98	3.47	-1.67	-0.90	+1.30	+1.07	- 43.6	+17.7
Antex								
Inhibitors	2.46	2.88[a]	-2.79	-1.95[a]	-1.24	-1.86	36.3	-43.6[b]
Middle	1.82	2.08	-2.46	-1.02	+0.22	-0.43	- 8.0	+25.0
Expressers	3.56	4.04	+0.25	-0.42	+0.98	0.82	74.2	+106.3

[a] Parts One and Two means in exactly the same order.

[b] Extreme-group means in same order in Parts One and Two.

[c] Middle-group much greater in both Parts One and Two.

Appendix M

Correlation coefficients of variable Shock averaged across natural trials 2,3, and 4 with other measures from these trials were:

Avcon	-.09
Antex	+.17
Shex	+.16
Sex	-.25
Age	-.26
Threshold	-.07
Anx	+.20
HRC1	-.08
RespC1	+.11
SCR1	-.00
HRC2	+.21
RespC2	-.17
SCR2	-.12

None approach significance. No clear pattern of relationships emerged.